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Nanotechnology: Synthesis to Applications

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Micro/Nanoelectromechanical Systems

Atanu Kundu

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15.1 Introduction

A nanoelectromechanical system (NEMS) is a nanoscale version of the microelectromechanical system (MEMS), which has both an electrical and a mechanical component [1]. One nanometer is a billionth of a meter, or 10^{-9} meter. To visualize the nanometer dimension, it can be compared with the human hair. Normally, the diameter of human hair is around 100 µm; it has to be divided 100 times equally to get 1 µm, and that 1 µm has to be further divided 1000 times equally to get 1 nm.

NEMS/MEMS are very small devices or group of devices that can integrate both mechanical and electrical components within a space of a few nano/micrometers. NEMS can be constructed on one chip that contains one or more mechanical components and electrical circuitry for inputs and

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Tuncay Ozcan, Tarik Küçükdeniz, Funda Hatice Sezgin

Electricity load forecasting is crucial for electricity generation companies, distributors and other electricity market participants. In

this study... Sample PDF (/viewtitlesample.aspx?id=161066&ptid=149824&t=Comparative Analysis of Statistical, Machine Learning, and Grey Methods for

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The traditional media has its own place and will always be there but the revolution in marketing era will change the thinking of the society as a	
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Seismic Analysis of RC Framed Tall Structures with Plan Irregularity



Saurav Kar and Tapas Sadhu

Abstract For the last few decades, architects, designers and structural engineers have focused on various advanced architectural aspects of reinforced concrete and steel structures. Regular plan buildings are quite commonly existent in India, while irregular plan buildings are in practice. These asymmetrical plan buildings, which are constructed in seismic prone areas, are most vulnerable and prone to subsequent damage during earthquakes. Seismic excitations generate the most destructive forces on structures. In accordance with newly revised Indian Code for Earthquake Provisons i.e. IS 1893:2016. In this present paper, high rise RC buildings have been modelled using a software package like STAAD.Pro V8i. Various models of irregular plans (e.g. U-, L-, T- and X-shaped) each of 25 storeyed (75 m each) have been taken into account. All the building models are located in high intensity seismic zone IV. As per IS 1893:2016, equivalent static analysis and dynamic response spectrum method have been conducted on all the building models. Even though various irregularities (such as torsional irregularity, stiffness irregularity) affect the seismic behaviour, this paper primarily concentrates on the effect of geometric irregularity on various RC structures. The paper also highlights both on which irregular shape of building plan gives the severe most response towards ground motion and also the accuracy of dynamic analysis conducted on high rise RC structures compared to static analysis.

Keywords Asymmetrical structures · Torsional irregularity · Plan irregularity · Oscillation · Floor displacement

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Dr. Siddhartha Bhattacharyya

Dedicated to all my students.

Dr. Indrajit Pan

Dedicated to my respected teachers.

Dr. Anirban Mukherjee

Dedicated to my parents, the late Arun Kanti Dutta and Mrs. Bandana Dutta. Dr. Paramartha Dutta

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Foreword

Image analysis and understanding have been daunting tasks in computer vision given the high level of uncertainty involved therein. At the same time, a proper analysis of images plays a key role in many real-life applications. Examples of applications include image processing, image mining, image inpainting, video surveillance, and intelligent transportation systems, to name a few. Albeit there exists a plethora of classical techniques for addressing the problem of image analysis, which include filtering, hierarchical morphologic algorithms, 2D histograms, mean shift clustering, and graph-based segmentation, most of these techniques often fall short owing to their incapability in handling inherent real-life uncertainties. In past decades, researchers have been able to address different types of uncertainties prevalent in real-world images, thanks to the evolving state of the art of intelligent tools and techniques such as convolutional neural networks (CNNs) and deep learning. In this direction, computational intelligence techniques deserve special mention owing to their flexibility, application-free usability, and adaptability. Of late, hybridization of different computational intelligence techniques has come up with promising avenues in that these are more robust and offer more efficient solutions in real time.

This book aims to introduce the readers with the basics of image analysis and understanding, with recourse to image thresholding, image segmentation, and image and multimedia data analysis. The book also focuses on the foundations of hybrid intelligence as it applies to image analysis and understanding. As a sequel to this, different state-of-the-art hybrid intelligent techniques for addressing the problem of image analysis will be illustrated to enlighten the readers of upcoming research trends.

As an example of the recent trends in image analysis and understanding, albeit aging mitigates the glamor in human beings, wrinkles in face images can often be used for estimation of age progression in human beings. This can be further utilized for tracing unknown or missing persons. Images exhibit varied uncertainty and ambiguity of information, and hence understanding an image scene is far from being a general procedure. The situation becomes even graver when the images become corrupt with noise artifacts.

In this book, the editors have attempted to deliver some of the recent trends in hybrid intelligence as it applies to image analysis and understanding. The book contains 17 well-versed chapters illustrating diversified areas of application of image analysis using hybrid intelligence. These include multilevel image segmentation, character recognition, image analysis, video image processing, hyperspectral image analysis, and medical image analysis.

The first chapter deals with multilevel image segmentation. The authors propose a modified genetic algorithm (MfGA) to generate the optimized class levels of the multilevel images, and those class levels are employed as the initial input in the fuzzy c-means (FCM) algorithm. A performance comparison is depicted between the MfGA-based FCM algorithm, the conventional genetic algorithm (GA)-based FCM algorithm, and the well-known FCM algorithm with the help of three real-life multilevel grayscale images. The comparison revealed the superiority of the proposed method over the other two image segmentation algorithms.

Chapters 2 to 5 address the issue of character recognition and soft biometrics. Chapter 2 shows pros and cons of an entropy-based FCM clustering technique to classify huge training data for English character recognition. In chapter 3, the authors propose a two-stage word-level script identification technique for eight handwritten popular scripts, namely, Bangla, Devanagari, Gurumukhi, Oriya, Malayalam, Telugu, Urdu, and Roman. Firstly, discrete wavelet transform (DWT) is applied on the input word images to extract the most representative information, whereas in the second stage, radon transform (RT) is applied to the output of the first stage to compute a set of 48 statistical features from each word image. Chapter 4 presents a skin color region segmentation method based on K-means clustering and Mahalanobis distance for static hand gesture recognition. The final chapter in this group deals with soft-biometrics prediction. There, three prediction systems are developed using a support vector machine (SVM) classifier associated to various gradient and textural features. Since different features yield different aspects of characterization, the authors investigate classifier combination in order to improve the prediction accuracy. As a matter of fact, the fuzzy integral is used to produce a robust soft-biometrics prediction.

Chapters 6 and 7 focus on image analysis applications. More specifically, in chapter 6, the authors draw an analogy and comparison between the working principle of CNNs and the human brain. In chapter 7, the authors propose a framework for human action recognition that is trained using evolutionary algorithms and deep learning. A CNN classifier designed to recognize human actions from action bank features is initialized by evolutionary algorithms and trained using back-propagation algorithms.

Chapter 8 is targeted to video image processing applications. The authors propose a technique using Haar-like simple features to describe object models in chapter 8. This technique is applied with Adaboost classifier for object detection on the video records. The tracking method is described and illustrated by fusing global and local features.

Chapter 9 deals with a GIS-based application. The proposed GIS-anchored system extends a helping hand toward common and innocent people and exposes the trails for releasing themselves from the clutches of criminals. The chief intent of the proposed work is to not only check out the hot-spot areas (the crime-prone areas), but also give a glance to the flourishing of criminal activities in future. The process of determination of hot-spots is carried out by associating rank (an integer value) to each ward/block on the digitized map. The process of hooking up rank to a specific region is carried out on the basis of criminal activity at that particular region.

Chapters 10 and 11 deal with hyperspectral image analysis. Chapter 10 covers the hyperspectral data analysis and processing algorithms organized into three topics: spectral unmixing, classification, and target identification. In chapter 11, the authors deal with the band selection problem. They use the fuzzy *k*-nearest neighbors (KNN)

technique to calculate the affinity of the band combination based on features extracted by 2D principal component analysis (PCA).

The remaining chapters deal with medical image analysis using different hybrid intelligent techniques. Chapter 12 aims to introduce several uncertainty-based hybrid clustering algorithms and their applications in medical image analysis. In chapter 13, the authors propose a diagnosis system for early detection of breast cancer tissues from digital mammographic breast images using a Cuckoo search optimization algorithm and SVM classifiers. In general, the complete diagnosis process involves various stages, such as preprocessing of images, segmentation of the breast cancer region from its surroundings, extracting tissues of interest and then determining the associated features that may be vital, and, finally, classifying the tissue into either benign or malignant. Chapter 14 proposes a new approach for biometric recognition, using dorsal, palm, finger, and wrist veins of the hand. The analysis of these vein modalities is done in both the spatial domain and frequency domain. In the spatial domain, a modified 2D Gabor filter is used for feature extraction, and these features are fused at both the feature level and score level for further analysis. Similarly in the frequency domain, a contourlet transform is used for feature extraction, a multiresolution singular value decomposition technique is utilized for fusing these features, and further classification is done with the help of an SVM classifier. An automated segmentation technique has been proposed in chapter 15 for digital mammograms to detect abnormal mass/masses [i.e., tumor(s)]. The accuracy of an automatic segmentation algorithm requires standardization (i.e., preparation of images and preprocessing of medical images that are mandatory, distinct, and sequential). The detection method is based on a modified seeded region growing algorithm (SRGA) followed by a step-by-step statistical elimination method. Finally a decision-making system is proposed to isolate mass/masses in mammograms. Chapter 16 presents a novel method for the automatic detection of coronary stenosis in X-ray angiograms. In the first stage, Gaussian matched filters (GMFs) are applied over the input angiograms for the detection of coronary arteries. The GMF method is tuned in a training step applying differential evolution (DE) for the optimization process, which is evaluated using the area under the receiver operating characteristic (ROC) curve. In the second stage, an iterative thresholding method is applied to extract vessel-like structures from the background of the Gaussian filter response. The authors of chapter 17 introduce an efficient CAD system, based on multiresolution texture descriptors using 2D wavelet transform, which has been implemented using a smooth SVM (SSVM) classifier. The standard Mammographic Image Analysis Society (MIAS) dataset has been used for classifying the breast tissue into one of three classes, namely, fatty (F), fatty-glandular (FG), and dense-glandular (DG). The performance of the SSVM-based CAD system has been compared with SVM-based CAD system design.

From the varied nature of the case studies treated within the book, I am fully confident and can state that the editors have done a splendid job in bringing forward the facets of hybrid intelligence to the scientific community. This book will, hence, not only serve as a good reference for senior researchers, but also stand in good stead for novice researchers and practitioners who have started working in this field. Moreover, the book will also serve as a reference book for some parts of the curriculum for postgraduate and undergraduate disciplines in computer science and engineering, electronics and communication engineering, and information technology.

xxx Foreword

I invite the readers to enjoy the book and take advantage of its benefits. One could join the team of computational intelligence designers and bring new insights into this developing and challenging enterprise.

Italy, November 2016

Cesare Alippi

Preface

Image processing happens to be a wide subject encompassing various problems therein. The very understanding of different image-processing applications is not an easy task considering the wide variety of contexts they represent. Naturally, the better the understanding, the better the analysis thereof is expected to be. The uncertainty and/or imprecision associated inherently in this field make the problem even more challenging. The last two decades have witnessed several soft computing techniques for addressing such issues. Each such soft computing method has strengths as well as shortcomings. As a result, no individual soft computing technique offers a solution to such problems in a comprehensive sense that is uniformly applicable. The concept of hybridization pervades from this situation, where more than one soft computing technique are subjected to coupling with the hope that the weakness of one may be overcome by the other. Present-time reporting is more oriented toward that. In fact, the present volume is also aimed at inviting the contributions toward adequate justification for hybrid methods in different aspects of image processing.

The authors of chapter 1 try to demonstrate the significance of using modified genetic algorithms in obtaining optimized class levels, which when subsequently applied as initial input in the fuzzy c-means (FCM) algorithm overcome the limitation of possible premature convergence in FCM-based clustering.

The authors justify through extensive experimentation in chapter 2 as to how FCM-based clustering may be effectively hybridized with entropy-based clustering for English character recognition. The main uniqueness of the contribution of chapter 3 is the development of a two-stage system capable of recognizing texts containing multilingual handwritten scripts comprising eight Indian languages. The authors substantiate the effectiveness of their method by evaluating an extensive database of 16,000 handwritten words with a reported achievement of 97.69%.

In chapter 4, the authors propose a robust technique based on K-means clustering using a Mahalanobis distance metric to achieve static hand gesture recognition. In their proposed method, they consider zoning-based shape feature extraction to overcome the problem of misclassification associated to other techniques for this purpose.

The use of a support vector machine (SVM) for classification and effective soft-biometric prediction on the basis of three gradient and texture features, and how these features are combined to attain higher prediction accuracy, are the cardinal contributions of chapter 5. The authors validate their results by extensive experimentation.

In chapter 6, the authors attempt to draw an effective comparison of the functioning of a convolutional neural network (CNN) with that of the human brain by highlighting the fundamental explanation for the functioning of CNNs.

In chapter 7, the authors demonstrate how hybridization of evolutionary optimized deep learning may be effective in human behavior analysis.

The authors in chapter 8 explore how effectively various feature extraction techniques may be used for vehicle tracking purposes with requisite validation by experimental results.

Chapter 9 reports a GIS-anchored system that offers a helping hand toward common and innocent people by identifying crime hotspot regions and thereby alerting them to criminals' possible whereabouts.

In chapter 10, authors offer hyper-spectral data analysis and processing algorithms consisting of spectral unmixing, classification, and target identification. The effective-ness is validated by adequate test results.

In chapter 11, the authors demonstrate the effectiveness of artificial immune systems (AISs) in identifying important bands in hyperspectral images. The affinity of band combination, derived based on 2D principal component analysis (2DPCA), is computed by fuzzy *k*-nearest neighbor (KNN), reporting convincing results.

In chapter 12, the authors aim to study several hybrid clustering algorithms capable of tackling uncertainties and their applications in medical image analysis.

In chapter 13, the authors hybridize Otsu thresholding and morphological segmentation algorithms to achieve accurate segmentation of breast cancer images. Subsequently, relevant features are optimized using Cuckoo search, which in turn equips SVMs to classify breast images into benign or malignant. Their finding has been substantiated by the accuracy reported.

Chapter 14 proposes a new approach for biometric recognition of a person, using dorsal, palm, finger, and wrist veins of the hand. The analysis of these vein modalities is done in both the spatial domain and frequency domain with encouraging results reported.

In chapter 15, the authors are able to achieve a convincing performance in terms of metrics like accuracy, sensitivity, and specificity of their proposed method, based on computer-aided automated segmentation of mammograms comprising a seeded region growing algorithm followed by statistical elimination and eventually decision making.

In chapter 16, authors provide a novel method for the automatic detection of coronary stenosis in X-ray angiograms, comprising three stages: (1) differential evolution-based optimization of Gaussian matching filters (GMFs), (2) application of iterative thresholding of the Gaussian filter response, followed by (3) naive Bayes classification for determining vessel stenosis. Their technique is justified by encouraging experimental results.

In the work reported in chapter 17, the authors substantiate the effectiveness of an efficient CAD system based on multiresolution texture descriptors (derived from ten different compact support wavelet filters) using 2D wavelet transform using a smooth SVM (SSVM) classifier. The proposed technique is validated with adequate experimentation reporting very encouraging results in the context of classification of mammogram images.

The chapters appearing in this volume show a wide spectrum of applications pertaining to image processing through which the use of hybrid techniques is vindicated. It is needless to mention that the reporting of various chapters in the present scope indicates very limited applicability of hybridization in the field of various image-processing

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problems. There are, of course, many more to come in days ahead. From that point of view, the editors of the present volume want to avail this opportunity to express their gratitude to the contributors of different chapters, without whose participation the present treatise would not have arrived in the present form. The editors feel encouraged to expect many more contributions from the present authors in this field in their future endeavours also. This is just a limited effort rendered by the editors to accommodate what the relevant research community is thinking today. In fact, from that perspective, it is just the beginning of such an endeavour and definitely not the end. Last but not the least, the editors also thank Wiley for all the cooperation they rendered as a professional publishing house toward making the present effort a success.

India, November 2016

Siddhartha Bhattacharyya Indrajit Pan Anirban Mukherjee Paramartha Dutta

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VECTOR CALCULUS

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Module I

Basics of Vector Calculus, Physical Significance of grad, div, curl, Line integral, Volume Integral, Surface Integral - examples in context of electricity and magnetism, Stokes theorem and Divergence theorem, Application of Stokes and Divergence theorem, Different coordinate system, Expression of grad, div, curl in different coordinate system, Laplacian operator in different coordinate system.

ELECTRICITY

Module 2.1

Coulomb's law, Electrostatics field, Gauss law: Gauss's law in differential form, Application of Gauss's law: Field due to uniformly charged wire, Field due to infinitely long hollow cylinder, Field due to solid charged cylinder, Field due to uniformly charged sphere, Field due to charged spherical shell, Field due to concentric spherical conductor, Field for infinitely long plane charged sheet, Field for infinitely long plane conducting plate, Field inside a parallel plate capacitor, Coulomb's theorem, Electrostatic potential: Relation between electric field and potential, Equipotential surface, Potential energy for a system of charges, Poisson's Equation & Laplace's Equation, Application to Laplace's equation in different : Potential between parallel plate capacitor, Potential between cylindrical plate capacitor, Potential between spherical plate capacitor, Electric current: Steady current, Current density, Drift velocity, Electrical conduction and current density, Equation of Continuity.

Module 2.2

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Module 3

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Module 5.2

Formulation of Quantum Mechanics: Concept of probability density, Operators, (Characteristics of operators and examples), Eigen function & Eigen Value: (Propertiesof Eigen Value & Eigen Function, Examples of Eigen function & Eigen Value), Commutator: (Some properties of Commutators, Some Examples of Commutators).

polarisation, Retardation Plates, Quarter Wave plates & Half Wave Plates, Dichroism, Polaroid. 258 - 288 268 - 288 Mistory of laser, Characteristic of laser, Working principle of laser. Stimulated Absorption, Basic Components of laser, Active medium, Pumping Scheme, Optical Resonator, Different kinds of laser, Einstein's A and B coefficient and their physical significance, Ruby Laser, He-Ne laser, Application of Laser. GUANTUM PHYBICS 289 - 360 7MT - Mass-Entergy relation in Relativity. Einstein's mass energy relation, Black holy radiation, Energy density and Intamity of radiation, Planck's taliation holy radiation, Derivation of different radiation laws from Planck's taliation law, Compton Effect, Compton shift celtized derivations, Failure of classical aw, Compton Effect, Explanation of Compton effect on the basis
of quantum theory. PART -2 Wave particle duality, de-Broglie Hypothesis, Experimental verification of matter wave, Heisenberg's uncertainty relation, Group velocity, phase velocity and their relation, Application of Heisenberg's uncertainty principle. CRYSTALLOGRAPHY 351 - 408 Space Lattice, Crystal lattice, Basis, Unit cell and cell parameters, Primitive cell, The seven crystal system and their symmetry elements, Bravais lattices, Space Lattices of cubic systems, Atoms per unit cell of a cubic crystal, Coordination Number, Packing fraction, Miller Indices, X-rays production on the basis of Quantum theory. Continuous spectrum and their origin, Characteristic spectrum and their origin, Absorption of X-rays, Bragg's law, Lattice constant measurement, Crystal density and lattice constant relation.
History of holography, Principle of Holography, Conditions for good recording of hologram, Population inversion, Mathematical theory of holography, Viewing the hologram, Requirements of Holography, Properties of hologram, Classification of Holograms, Application of Holography, Socurrion 2011(EVEN SEM), 2011 (ODD 8EM), 2012 (EVEN SEM), 2012 (ODD 8EM), 2013 (EVEN SEM), 2013 (ODD 8EM), 2014 (EVEN SEM), 2014 (ODD 8EM), 2015 (EVEN SEM), 2015 (ODD), 2016(EVEN SEM) PHYSICS PRACTICAL SAMPLE 682-696 QUESTIONS & ANSWERS

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Edit Delete [HTML] from bvsalud.org The Implementation of AI and AI-Empowered Imaging Systems Dr. Lopamudra Dey to Fight Against COVID-19—A Review Authors Sanjay Chakraborty, Lopamudra Dey Publication date 2021/8/3 Journal Smart Healthcare System Design: Security and Privacy Aspects Pages 301 Publisher John Wiley & Sons Description COVID-19 has already affected the world with this deadly virus, resulting in over 3.5 lakh deaths. The behavior of this virus is extraordinarily peculiar and mutates frequently. So, the scientific community faces the problems to analyze and forecast the virus's growth and transmission capability. The combined effort of powerful Artificial intelligence and Image processing techniques to predict the initial pattern of COVID-19 disease identifies the most affected areas in each country through social networking information and predicts drug-protein interactions for making new drugs vaccines. However, Alempowered X-Ray and computed tomography image acquisition and segmentation techniques help us identify and diagnose the COVID-19 affected patients with minimal contact. In this chapter, our primary motivation is to sum up the essential roles of some Al-driven techniques (Machine learning, Deep learning, etc.) and Al-empowered imaging techniques to analyze, predict, and diagnose against COVID-19 disease. An essential set of open challenges and future research issues on AI-empowered procedures for handling COVID-19 are also discussed in this chapter. The Implementation of AI and AI-Empowered Imaging Systems to Fight Against COVID-Scholar articles 19—A Review S Chakraborty, L Dey - Smart Healthcare System Design: Security and Privacy ..., 2021

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We would like to express our deep appreciation to the distinguished authors of the chapters. The book has taken an interesting shape with valuable content, due to the expertise, professionalism and kindness of the contributed authors of this book. We are expecting that the readers will find the book very interesting, informative and enriching.

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Lecture Notes in Networks and Systems

Volume 147

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Nikhil Ranjan Das · Santu Sarkar Editors

Computers and Devices for Communication

Proceedings of CODEC 2019



Editors Nikhil Ranjan Das Institute of Radio Physics and Electronics University of Calcutta Kolkata, India

Santu Sarkar Institute of Radio Physics and Electronics University of Calcutta Kolkata, India

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Preface

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Volume 147

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It was a hard task to arrange peer reviews and plagiarism checks for all the contributory papers to comply with the publication requirement of Springer LNNS. The editors are thankful to their colleagues and staff in the department, who made a meticulous effort to complete the task towards the final selection of papers for publication. The editors are grateful to the reviewers for their time and efforts towards critical review of the submitted contributory research papers. Full credit goes to them for their evaluation to ensure the high quality and standard of the papers for the Springer Lecture Notes. It is a pleasure to acknowledge the help received from the Springer publication/production team, including G. Ayyasamy, S. Ravivarman, P. Thirumani, to name a few, and especially, Mr. Aninda Bose, Senior Editor of Springer Nature (Research Publishing).

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Volume 219

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Blockchain Technology and Innovations in Business Processes



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Preface

Blockchain is one of the most important technical inventions in the recent years. It is a transparent money exchange system that has transformed the way a business is conducted. It not only reduces risk but also puts an end to fraud along with bringing transparency. Companies and tech giants have started investing significantly in the blockchain market, and it is expected to be net worth of more than 5 trillion dollars in the next 5 years. This distributed ledger technology has increased its prominence in various sectors such as financial services, health care and entertainment. This emerging technology has marked its presence in the government sectors too such as in voting, taxes, identity management and record management. The benefits such as traceability, transparency, reduced costs and increased security make its applications a popular and successful one. This book covers the theory of blockchain technology, its security issues and its application in different industries.

The authors in this volume are from diverse background and from different universities across the globe. The authors of the chapters have related the blockchain technology with energy, supply chain management, data protection and security issues.

I profusely thank all the authors for their valuable contribution without which this volume could not have been possible.

On behalf of the editors, let me thank the Publishing Editor and the team of Springer Nature Singapore for their approval of the book project and constant support and cooperation during the publication.

Last but not least, I would like to extend my heartfelt thanks to my coeditors—Prof. (Dr.) Tao Sheng Wang, Prof. (Dr.) Tao Shen and Dr. Sushanta Kumar Panigrahi—for their constant support in bringing out this volume in time.

I am sure the readers shall derive utmost benefit from this volume.

Bhubaneswar, India

Srikanta Patnaik

Editorial

The evolution of blockchain technology has been marked with bitcoins. Bitcoin is a new kind of money which is being used for innovative payments. However, bitcoin and blockchain are being interchangeably used since bitcoin is a cryptocurrency and blockchain is the underlying technology that has distributed database to empower bitcoin. Again, blockchain technology is considered to be beyond digital money and payments. This technology can change the way that ownership, privacy, uncertainty and collaboration are conceived of in the digital world. Moreover, in several disrupting sectors and diverse practices like financial markets, content distribution, supply chain management, dispersal of humanitarian aid and even for voting in a general election, blockchain technology has huge applicability.

Besides, it provides varied information to the public in general—which has many potential applications that require smart transactions and contracts. As we know, blockchain is said to be immutable since breaking its encryption and decentralized architecture is very complex. Thus, these special features of blockchain technology safeguard the data stored on the shared ledger. Also, with the emergence of blockchain technology, there is a paradigm shift in the way of doing core processes, even for the industries that have already seen significant transformation due to wide adoption of digital technologies. Now, this makes blockchain technology suitable for limitless range of applications across almost all industries. Further, the ledger technology can be applied to most of the sectors, may it be to track fraud in finance or to securely share patient medical records between healthcare professionals. It also acts as a better way to track intellectual property in business and music rights for artists. We have received a good number of chapters for this volume, out of which thirteen selective chapters have been considered for this book.

With blockchain technology, the businesses worldwide are adopting and building trust in every sphere. Chapter 1 entitled "A Systematic Study of Blockchain Evolution, Architecture, and Application with Use Cases" by Samanta et al. guides one to understand both non-technical and technical working principles, evolution, architecture, types, use cases, applications and tools for implementation of blockchain.

Despite the fact that blockchain technology is secured, still its wide applicability fails to gain popularity. Chapter 2 entitled "Blockchain: A Technology in Search

of Legitimacy" by Rosati et al. throws light on how the players in the blockchain ecosystem attempted to build legitimacy. Their findings illustrate how the key actors engage in the blockchain and bitcoin legitimation discourse to help interpret this complex innovation and mobilize the market to adopt.

We are aware that the present world has become completely dependent on Internet. However, with intermittently connected network, the blocks can be accessed without relying on the Internet. This is well proved in the next chapter on "Using Blockchain in Intermittently Connected Network Environments" by Basu et al. They have explored possible integration of blockchain technology with intermittently connected networks towards exploiting its utility and availability in DTN environment towards improving disaster management services in the absence of end-to-end connectivity to the Internet.

However, like every coin has two sides so is the use of technology. Even though blockchain technology is said to be secure, still there are some prevailing scams till date. In this context, Chap. 4 entitled "Slaying the Crypto Dragons: Towards a CryptoSure Trust Model for Crypto-economics Blockchain versus Trust: The Expert's View of the Crypto Scammers" by Dr. Stephen Castell highlights the General Data Protection Regulation (GDPR) and its importance in the blockchain system and provides a checklist giving practical, generally applicable wording for an effective Digital Asset Disclosure exercise.

The core technology that enables the socio-technical tool, smart contracts which are the distributed ledger, is blockchain. These smart contracts require a large range of commercial applications to be taken into account. Therefore, Chap. 5 in this volume by Deval et al. on smart contracts titled as "Decentralized Governance for Smart-Contract Platform Enabling Mobile Lite Wallets Using a Proof-of-Stake Consensus Algorithm" has done a comparative analysis with Ethereum Smart Contract and found that they are not scalable for large industrial application owing to not being able to change the blockchain parameters.

Again, blockchain is not only confined to cryptocurrency. In fact, the underlying technology that supports cryptocurrency is blockchain. It prevents data feed failure and corruption. It also creates mechanism that grants protection to distributed systems. Clark et al. in their chapter titled "Blockchain Technology: Security and Privacy Issues" discussed on the use of still developing technology and also concluded that blockchain application is not possible to all applications. However, according to the author, the centralized solutions are still applicable in many cases.

As we know, privacy issues are prevailing in all industries and technology. Blockchain is a tool for keeping the data anonymously. The authors, Capraz and Ozsoy, summarized proposed models by using zero-knowledge proof which is Zerocoin and Zerocash in the chapter entitled "Personal Data Protection in Blockchain with Zero-Knowledge Proof".

With the increase in the business processes, the data protection has become a greatest challenge for the developers. Blockchain and smart contract technologies have been identified as promising approaches for supporting compliance checking and trust. The upcoming chapter by Barati and Rana entitled "Design and Verification of Privacy Patterns for Business Process Models" describes how smart contracts can

be used to meet GDPR compliance verification using a number of privacy patterns for business process models.

Blockchain technology has marked its existence in almost all the sectors, and the recent one is in the field of energy. The concept of distributed renewable energy sources has grabbed attention now. The next chapter on "Blockchain Technology in Energy Field: Opportunities and Challenges" by Bai and Shen addresses the problem by proposing consensus mechanism to optimize energy transaction processing speed.

Again, energy sector is embracing the deployment of blockchain and smart contracts in a slower pace, may it be for the regulations or the complexity of the energy market. The chapter on "Blockchain Technology for Energy Transition" by Bürer et al. provides a framework for assessing the relevance and impact of blockchain technologies for enabling the energy transition from both the production and consumption sides of the equation.

Next, health care is one of the biggest sectors storing the data of the individuals. The advancements in the blockchain technology and the distributed ledger facilitate better storage of data. Chapter 11 entitled "The Feasibility and Significance of Employing Blockchain-Based Identity Solutions in Health care" by the Zhang and Kuo presents a systematic overview of the underlying motivations and principles of blockchain identities. Furthermore, they also introduced two of the popular blockchain-based identity frameworks.

Startups need funding for its survival, and initial coin offerings (ICO) are the strongest supporters of the startups now. The blockchain in health care and the relevance to raising finance with the help of ICO are trending in the market now. Thus, Chap. 12 entitled "Towards eHealth with Blockchain: Success Factors for Crowdfunding with ICOs" by Stefan Tönnissen investigates the successful initial coin offerings of eHealth startups in the field of blockchain and its impact.

Last but not least, Chap. 13 by Canbolat et al. titled "Blockchain Track and Trace System (BTTS) for Pharmaceutical Supply Chain" provide a BTTS for improving the management of pharmaceutical supply chain.

Since this volume provides a broad coverage of different aspects of blockchain technology ranging from fundamental concepts to privacy and security issues along with diverse applications, this volume can provide a strong base for naïve researchers as well as experts to explore new directions for carrying out their work further. I hope the reader gets immense benefit out of this volume.

Prof. Srikanta Patnaik

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Smart Innovation, Systems and Technologies

Volume 137

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Souvik Basu · Siuli Roy · Sipra Das Bit

Reliable Post Disaster Services over Smartphone Based DTN

An End-to-End Framework



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This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd. The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore The mediocre teacher tells. The good teacher explains. The great teacher inspires. —William Arthur Ward

Dedicated to our teachers

Foreword

The monograph on *Reliable Post Disaster Services over Smartphone Based DTN* is timely and addresses an important topic. In recent years, natural disasters such as wildfires, floods, earthquakes, landslides, hurricanes, tornadoes, tsunamis and volcanoes have impacted human lives, assets and infrastructures more than ever. Indeed, natural disasters have grown almost threefold between 1980 and 2017 compared to between 1940 and 1980. Natural disasters have also affected about 217 million people each year since 1990. It has been observed that India, China, Philippines, Nepal, Bangladesh and Thailand are among the most affected, disaster-prone countries since 1995. In terms of devastation, during April 2015 Nepal earthquake, nearly 9000 people were killed, more than 600,000 houses destroyed and more than 288,255 houses damaged. Devastating floods and landslides for multiple days in June 2013 in the North Indian state of Uttarakhand not only took away more than 5700 lives but also wiped out a huge number of localities, forcing hundreds of thousands of people homeless and causing severe infrastructure damages, such as roads, bridges, power lines, electricity poles and so on.

In the aftermath of large-scale calamities, among other losses and damages, severe disruption of communication infrastructures, particularly impairment of wireless cellular towers and Internet services, is a common phenomenon. Therefore, rapid deployment of post-disaster communication infrastructure, albeit ad hoc and temporary, is crucial without which it becomes extremely challenging, if not impossible, to facilitate life-saving rescue operations as well as adequate relief services in a timely manner. The goal is to establish reliable and seamless information exchange among all stakeholders—survivors, emergency and disaster management personnel, policemen, rescue and medical teams, volunteers, government and non-government organizations, etc. This well-motivated monograph addresses some of these challenges by proposing a framework for reliable end-to-end post-disaster services by exploiting smartphone-based delay-tolerant networks (DTNs) technology that can operate despite the breakdown of traditional communication infrastructure networks.

The authors have done a good job in exploring relevant issues and challenges related to post-disaster services by proposing models, protocols and solution methodologies for accurate assessment and accumulation of various service needs, efficient resource allocation and reliable data dissemination in the wake of natural disasters. The monograph is organized into six chapters. Chapter 1 introduces post-disaster management services and communication followed by DTN architecture, routing and security issues. Chapter 2 describes various methods for post-disaster need assessment and forecasting, while Chap. 3 deals with the analysis of need accumulation over DTNs. Chapter 4 presents resource planning with the help of case-based reasoning and utility-based optimal resource allocation model. Chapter 5 investigates reliable data dissemination over DTNs using multilayer hashed encryption and group-based distributed authentication, followed by secure routing protocols. The final chapter summarizes future research directions in wireless technologies applied to post-disaster management. The authors have provided data sets from real disaster scenarios, where possible, to allow researchers to validate smartphone-based DTN protocols for post-disaster services. The proposed framework, solutions and smartphone apps may help enhance emergency preparedness and personnel training. Thus, the monograph is expected to benefit not only researchers but also disaster management practitioners of government and non-government organizations, particularly in developing countries.

Rolla, USA December 2018 Sajal K. Das Professor and Daniel St. Clair Chair of Computer Science Missouri University of Science and Technology

Preface

According to the World Disasters Report, when disaster strikes, access to information is as important as access to food and water. Such information, like the status of victims and the requirement of emergency resources, is crucial for rendering timely and effective disaster relief. However, the availability of cellular and Internet connectivity in a post-disaster scenario is usually ruled out due to the failure of the supporting infrastructure. Therefore, the possibility of exchanging situational information using normal communication infrastructure gets almost restricted resulting in high perception deviation at the control station about the actual needs of the remote shelters. Under such circumstances, providing post-disaster services like *need assessment, need accumulation* and *resource planning* becomes truly challenging leading to futile disaster relief endeavours. Moreover, the presence of malicious entities in the network may affect the reliability of data, i.e. resource needs, at the control station. Thus, *reliable data dissemination* is another service that is to be rendered for effective disaster management.

This book deals with the problems in providing reliable post-disaster services in a challenged network environment. In particular, it proposes a framework for reliable post-disaster services over smartphone-based DTN. The components of this framework are the four services, namely need assessment, need accumulation, resource planning and finally reliable data dissemination.

The introductory chapter, i.e. Chap. 1, is dedicated to the background necessary to understand the remaining chapters of this book. It first gives an introduction to disaster management, its phases and the various post-disaster services. Next, it presents an overview of delay-tolerant networks (DTNs)—its features, architecture, routing and applications, with an emphasis on DTN security.

A principal component regression (PCR) model is derived for forecasting the exact demand for different emergency resources in a shelter, based on the dynamic influencing situational parameters, in Chap. 2. The derived model can be used to periodically forecast the ever-changing demand for different emergency resources at shelters with high precision. Next, a utility function is proposed that dynamically

and quantitatively enumerates the utility of each emergency resource at different shelters. The demand forecast model along with the utility function assists in accurate *need assessment* for emergency resources at different shelters.

Assuming an underlying DTN-leveraged smartphone (carried by volunteers and relief workers)-based communication network, Chap. 3 proposes an opportunistic knowledge sharing scheme for transmitting the assessed resource needs to the control station in the absence of normal communication facilities. The knowledge sharing scheme runs on the smartphones to collect and exchange emergency resource needs at different shelters to create a consistent global view of accumulated resource needs across the entire affected area. Thus, the scheme enables *need accumulation* which in turn reduces the gap in perception about the actual needs at different shelters.

A case-based reasoning (CBR)-driven need validation technique is proposed in Chap. 4, to validate the opportunistically received resource needs at the control station. Additionally, a utility-based integer programming model for optimal resource allocation is formulated using the opportunistically transmitted and CBR validated resource needs. The model minimizes the overall resource deficit and the total resource deployment time. The CBR-driven need validation technique along with the integer programming model brings about efficient *resource planning*.

Chapter 5 proposes a series of security protocols to meet the stringent security requirements of a DTN. First, a multilayer encryption and hashing-based scheme are proposed to protect the transmitted emergency resource needs against authenticity, eavesdropping and modification attacks. Subsequently, a security-aided and group encounter-based PRoPHET routing protocol is proposed, where security features are incorporated into PRoPHET to provide security against eavesdropping, blackhole, identity spoofing and bundle store overflow attacks. Finally, a trust-based Watchdog technique is proposed and seamlessly integrated with PRoPHET to provide security against packet drop, badmouthing and ballotstuffing attacks. These security protocols run on the smartphones, carried by the volunteers and contributed towards *reliable data dissemination* so that all other post-disaster services can be rendered reliably.

There is a tremendous scope for the research community to identify novel and challenging problems in the area of ICT-based disaster management and investigate innovative solution methodologies. This book demonstrates the usage of wireless technologies coupled with smart devices to improve disaster management endeavours, by improving communication and resource planning during the aftermath of a disaster. The solutions provided herein exploit, in particular the opportunity of fast penetration of smart devices in daily life in developing countries like India, and rightly use these hand-held devices in forming delay-tolerant networks. Research conducted in this book fosters interdisciplinary collaboration among engineers, industry professionals, scientists and disaster relief organizations for the effective handling of disasters in developing countries. On the other hand, different academic regulatory bodies of such countries have made courses on Preface

disaster management mandatory at graduate levels. This book can be used as a first-hand reference for these courses. Thus, the book serves the requirements of both research and teaching communities.

Kolkata, India Kolkata, India Howrah, India September 2018 Souvik Basu Siuli Roy Sipra Das Bit

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Kolkata, India December 2018 Souvik Basu Siuli Roy Sipra Das Bit

About the Book

The objective of the book is to present a framework for reliable end-to-end post-disaster services over smartphone-based delay-tolerant networks (DTNs), which can operate even in the absence of conventional network connectivity. History has shown that disasters like Chennai flood and Uttarakhand flash flood in India, earthquake in Nepal and tsunami in Japan severely impair Internet-based communication systems, jeopardizing people's lives-loss of life and property. Under such circumstances, providing essential post-disaster services becomes truly challenging. The book explores a number of different aspects of this challenge, ranging from accurate need assessment, to timely need accumulation, to efficient resource allocation and reliable data dissemination and presents strategies to deal with challenges. It demonstrates the usage of wireless technologies coupled with smart devices to improve disaster management endeavours, by improving communication and resource planning during the aftermath of a disaster. The primary audience of the book is technologists and researchers working in the domain of ICT-based disaster management who would find it useful in understanding the challenges of providing post-disaster services in a challenged network scenario and their possible solutions. Disaster management authorities, government agencies, NGOs and other stakeholders would also find it useful for enhancing the preparedness of volunteers and relief agencies through intelligent use of wireless technologies coupled with smart devices with the goal of better disaster management. Furthermore, the book can be used as a first-hand reference for courses on ICT-based disaster management at graduate and undergraduate levels.

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Abbreviations

ACF	Action Contre La Faim
AES	Advanced Encryption Standard
AF	Accuracy factor
ANN	Artificial neural network
ARD	Average resource deficit
BP	Back-propagation
BPNN	Back-propagation neural networks
CBR	Case-based reasoning
CID	Control node ID
CN	Control node
CPin	Control pin
CRL	Certificate Revocation List
DDH	Decisional Diffie-Hellman
DFY	Doctors For You
DOM	Disaster operations management
DoS	Denial of service
DP	Delivery predictability
DTN	Delay-tolerant network
EMD	Expected message delay
FC	Forwarding competency
FE	Forwarding evidence
FEMA	Federal Emergency Management Agency
FIFO	First in first out
FN	Forwarder node
GID	Group ID
GP	Group pin
GPRS	General Packet Radio Service
GSM	Global System for Mobile
IBC	Identity-based cryptography
IBE	Identity-based encryption

ION	Interplanetary Overlay Network
ISP	Influencing situational parameter
ITRM	Iterative Trust and Reputation Mechanism
LEO	Low Earth orbiting
MANET	Mobile ad hoc network
MCPin	Modified control pin
MGP	Modified group pin
MLCE	Multiple layer commutative encryption
MLR	Multiple linear regression
NSE	Nash–Sutcliffe efficiency
OppNet	Opportunistic network
PB	Percentage bias
PC	Principal component
PCA	Principal component analysis
PCR	Principal component regression
PCRA	Principal component regression analysis
PD	Perception deviation
PEKS	Public encryption with keyword search
PEON	Privacy-Enhanced Opportunistic Networking
PFM	Positive feedback message
PGP	Pretty Good Privacy
PKI	Public key infrastructure
PRoPHET	Probabilistic Routing Protocol using History of Encounters
	and Transitivity
QRC	Qatar Red Crescent
RMSE	Root mean squared error
RPGM	Reference point group mobility
RSA	Rivest–Shamir–Adleman
SA	Situational awareness
SAGE-PRoPHET	Security-aided and group encounter-based PRoPHET
SHA	Secure Hash Algorithm
SN	Shelter node
SnW	Spray and wait
SRD	Shelter-specific resource deficit
ТА	Trusted authority
TCP/IP	Transmission Control Protocol/Internet Protocol
T-PRoPHET	Trusted PRoPHET
TTP	Trusted third party
VANET	Vehicular ad hoc network
VDTN	Vehicular DTN
Wise-PRoPHET	Watchdog supervised PRoPHET
WLAN	Wireless local area network

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Volume I

Section 1 Fundamental Concepts and Theories

This section serves as a foundation for this exhaustive reference tool by addressing underlying principles essential to the understanding of Nature-Inspired Computing. Chapters found within these pages provide an excellent framework in which to position Nature-Inspired Computing within the field of information science and technology. Insight regarding the critical incorporation of global measures into Nature-Inspired Computing blocks of this field are explored. With 11 chapters comprising this foundational section, the reader can learn and chose from a compendium of expert research on the elemental theories underscoring the Nature-Inspired Computing discipline.

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Opportunistic Networks

Book

Fundamentals, Applications and Emerging Trends

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ABSTRACT

The opportunistic network is an emerging and recent area of research. To make this research area more adaptable for practical and industrial use, there is a need to further investigate several research challenges in all aspects of opportunistic networks. Therefore, Opportunistic Networks: Fundamentals, Applications and Emerging Trends provides theoretical, algorithmic, simulation, and implementation-based research developments related to fundamentals, applications, and emerging research trends in opportunistic networks.

The book follows a theoretical approach to describe fundamentals to beginners and incorporates a practical approach depicting the implementation of real-life applications to intermediate and advanced readers. This book is beneficial for academicians, researchers, developers, and engineers who work in or are interested in the fields related to opportunistic networks, delay tolerant networks, and intermittently connected ad hoc networks. This book also serves as a reference book for graduate and postgraduate courses in computer science, computer engineering, and information technology streams.

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Computers and Devices for Communication

Proceedings of CODEC 2019



Editors Nikhil Ranjan Das Institute of Radio Physics and Electronics University of Calcutta Kolkata, India

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OFDM-SIM with Adaptive Modulation Through Fuzzy Interface

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Abstract. OFDM-SIM offers the advantage of reduced peak-to-average power ratio (PAPR) and improved spectral efficiency in comparison with classic OFDM. Due to frequency selective channel fading, OFDM frames undergo non-uniform attenuation and this results in different SNR values for different frames. Consequently, BER of the system is degraded. This problem can be mitigated by using adaptive modulation scheme depending on SNR values estimated by channel estimator. In this paper, a simple model of OFDM-SIM with adaptive modulation is proposed. Switching decision is implemented by fuzzy interface system. The output BER performance of the OFDM-SIM has been investigated for two types of modulations: 8-PSK and 8-QAM with 10 dB SNR as threshold level.

Keywords: OFDM \cdot OFDM-SIM \cdot Adaptive modulation \cdot Fuzzy interface

1 Introduction

Orthogonal frequency division multiplexing (OFDM) with sub-carrier index modulation (OFDM-SIM) is a promising scheme for the high-speed wireless communication due to its high spectrum and energy efficiency [1, 2] along with the inherent ability of OFDM to combat inter-symbol interference caused by multipath effects. In OFDM, the total frequency bandwidth is split into many narrowband sub-channels to transmit parallel data streams. In OFDM-SIM, the information bits are also segregated into several sub-blocks. The bits in each sub-block are further split into two parts, i.e., the index bits and the symbol bits. The symbol bits are transmitted by M-ary signal constellations and the carriers are activated according to the index bits [3]. Effective selection of the number of active carriers results in improved spectral efficiency, compared to conventional OFDM [4]. Apart from this, OFDM-SIM also has many noteworthy features, including enhanced bit error rate (BER) performance, reduced peak-to-average power ratio (PAPR), relatively

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Reduced Subcarrier Index Modulation Scheme in OFDM System for Next-Gen Wireless Networks

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Abstract. Orthogonal frequency division multiplexing (OFDM) has proved itself as a proficient multicarrier transmission technique to be successfully utilized in 5G and next-generation wireless communication. However, conventional OFDM suffers from the limitation of high peak-to-average-power ratio (PAPR). Subcarrier index modulation (SIM) has already been established as one of the efficient techniques to mitigate this high PAPR problem. In this work, we have proposed a novel modulation algorithm named as reduced subcarrier index modulation-OFDM (RIM-OFDM), which offers further considerable reduction in PAPR value and improved bandwidth utilization. In this paper, this newly proposed scheme has been mathematically established and block diagram for its realistic implementation has been described in detail. PAPR performance along with improvement in spectral efficiency of this technique, over SIM, has been investigated. Bit error rate (BER) performance is also studied and compared with that of classical OFDM. The results reveal that RIM-OFDM has come up as an optimized scheme, in terms of PAPR mitigation, bandwidth efficiency enhancement and low BER, for future wireless communication.

Keywords: Orthogonal frequency division multiplexing (OFDM) · Subcarrier index modulation (SIM) · Reduced subcarrier index modulation (RIM) · Peak-to-average-power ratio (PAPR) · Bandwidth efficiency (BWE)

1 Introduction

Orthogonal frequency division multiplexing (OFDM) is used extensively in broadband wired and wireless communication systems as an effective solution to inter symbol interference (ISI), caused in a dispersive channel with multipath effect [1–3]. In OFDM, data is transmitted in parallel, on a number of different orthogonal frequencies, and as a result, the symbol period is much longer than for a serial system with the same total data rate. Because the symbol period is longer, ISI affects minimum number of bits and equalization becomes simplified. In OFDM, the spectra of individual subcarriers overlap,

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Monte-Carlo Simulation as a Defining Tool to Diagnose Timing and Spectral Properties of Flows Around Black Holes

Himadri Ghosh

Abstract In this chapter we discuss the development and application of a Monte-Carlo radiative transfer code. Monte-Carlo simulation has been proven to be very useful for cases where exact or near exact analytical solutions are impossible. Radiative processes occurring in case of advective accretion mechanism is a classic example where Monte-Carlo simulation has been found to be very useful. This Chapter deals with the schematics that have been utilized. Spectral variations with various parameters are shown.

1 Introduction

Monte-Carlo simulation is an essential tool to understand the formation of spectrum in compact bodies [17]. Sunyaev and Titarchuk ([19, 20]; hereafter ST80 and ST85) showed that the power-law component of a blackbody spectrum forms due to inverse Comptonization. Hua and Titarchuk [13] studied the Monte-Carlo simulation for various known geometries and temperatures of the electron clouds and confirmed the conclusions drawn in ST80, ST85 and Titarchuk [21] using a Monte-Carlo simulation. Laurent and Titarchuk [14, 15] showed the effects of the bulk motion Comptonization which was predicted to produce a power-law spectrum even in the soft states ([3]; hereafter CT95).

The two component advective model is around for over decades, and there are more and more evidences that the flows around the galactic black holes are of two components. In this chapter, we attempt to carry out Monte-Carlo simulations in such systems. In Sect. 2, we give a brief description of simulation procedure using the Monte-Carlo method. We have shown two applications of this Monte-Carlo code in Sects. 3 and 4. Mainly the spectral analysis is presented in this chapter. Temporal

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Volume 137

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Souvik Basu · Siuli Roy · Sipra Das Bit

Reliable Post Disaster Services over Smartphone Based DTN

An End-to-End Framework



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This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd. The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore The mediocre teacher tells. The good teacher explains. The great teacher inspires. —William Arthur Ward

Dedicated to our teachers

Foreword

The monograph on *Reliable Post Disaster Services over Smartphone Based DTN* is timely and addresses an important topic. In recent years, natural disasters such as wildfires, floods, earthquakes, landslides, hurricanes, tornadoes, tsunamis and volcanoes have impacted human lives, assets and infrastructures more than ever. Indeed, natural disasters have grown almost threefold between 1980 and 2017 compared to between 1940 and 1980. Natural disasters have also affected about 217 million people each year since 1990. It has been observed that India, China, Philippines, Nepal, Bangladesh and Thailand are among the most affected, disaster-prone countries since 1995. In terms of devastation, during April 2015 Nepal earthquake, nearly 9000 people were killed, more than 600,000 houses destroyed and more than 288,255 houses damaged. Devastating floods and landslides for multiple days in June 2013 in the North Indian state of Uttarakhand not only took away more than 5700 lives but also wiped out a huge number of localities, forcing hundreds of thousands of people homeless and causing severe infrastructure damages, such as roads, bridges, power lines, electricity poles and so on.

In the aftermath of large-scale calamities, among other losses and damages, severe disruption of communication infrastructures, particularly impairment of wireless cellular towers and Internet services, is a common phenomenon. Therefore, rapid deployment of post-disaster communication infrastructure, albeit ad hoc and temporary, is crucial without which it becomes extremely challenging, if not impossible, to facilitate life-saving rescue operations as well as adequate relief services in a timely manner. The goal is to establish reliable and seamless information exchange among all stakeholders—survivors, emergency and disaster management personnel, policemen, rescue and medical teams, volunteers, government and non-government organizations, etc. This well-motivated monograph addresses some of these challenges by proposing a framework for reliable end-to-end post-disaster services by exploiting smartphone-based delay-tolerant networks (DTNs) technology that can operate despite the breakdown of traditional communication infrastructure networks.

The authors have done a good job in exploring relevant issues and challenges related to post-disaster services by proposing models, protocols and solution methodologies for accurate assessment and accumulation of various service needs, efficient resource allocation and reliable data dissemination in the wake of natural disasters. The monograph is organized into six chapters. Chapter 1 introduces post-disaster management services and communication followed by DTN architecture, routing and security issues. Chapter 2 describes various methods for post-disaster need assessment and forecasting, while Chap. 3 deals with the analysis of need accumulation over DTNs. Chapter 4 presents resource planning with the help of case-based reasoning and utility-based optimal resource allocation model. Chapter 5 investigates reliable data dissemination over DTNs using multilayer hashed encryption and group-based distributed authentication, followed by secure routing protocols. The final chapter summarizes future research directions in wireless technologies applied to post-disaster management. The authors have provided data sets from real disaster scenarios, where possible, to allow researchers to validate smartphone-based DTN protocols for post-disaster services. The proposed framework, solutions and smartphone apps may help enhance emergency preparedness and personnel training. Thus, the monograph is expected to benefit not only researchers but also disaster management practitioners of government and non-government organizations, particularly in developing countries.

Rolla, USA December 2018 Sajal K. Das Professor and Daniel St. Clair Chair of Computer Science Missouri University of Science and Technology

Preface

According to the World Disasters Report, when disaster strikes, access to information is as important as access to food and water. Such information, like the status of victims and the requirement of emergency resources, is crucial for rendering timely and effective disaster relief. However, the availability of cellular and Internet connectivity in a post-disaster scenario is usually ruled out due to the failure of the supporting infrastructure. Therefore, the possibility of exchanging situational information using normal communication infrastructure gets almost restricted resulting in high perception deviation at the control station about the actual needs of the remote shelters. Under such circumstances, providing post-disaster services like *need assessment, need accumulation* and *resource planning* becomes truly challenging leading to futile disaster relief endeavours. Moreover, the presence of malicious entities in the network may affect the reliability of data, i.e. resource needs, at the control station. Thus, *reliable data dissemination* is another service that is to be rendered for effective disaster management.

This book deals with the problems in providing reliable post-disaster services in a challenged network environment. In particular, it proposes a framework for reliable post-disaster services over smartphone-based DTN. The components of this framework are the four services, namely need assessment, need accumulation, resource planning and finally reliable data dissemination.

The introductory chapter, i.e. Chap. 1, is dedicated to the background necessary to understand the remaining chapters of this book. It first gives an introduction to disaster management, its phases and the various post-disaster services. Next, it presents an overview of delay-tolerant networks (DTNs)—its features, architecture, routing and applications, with an emphasis on DTN security.

A principal component regression (PCR) model is derived for forecasting the exact demand for different emergency resources in a shelter, based on the dynamic influencing situational parameters, in Chap. 2. The derived model can be used to periodically forecast the ever-changing demand for different emergency resources at shelters with high precision. Next, a utility function is proposed that dynamically

and quantitatively enumerates the utility of each emergency resource at different shelters. The demand forecast model along with the utility function assists in accurate *need assessment* for emergency resources at different shelters.

Assuming an underlying DTN-leveraged smartphone (carried by volunteers and relief workers)-based communication network, Chap. 3 proposes an opportunistic knowledge sharing scheme for transmitting the assessed resource needs to the control station in the absence of normal communication facilities. The knowledge sharing scheme runs on the smartphones to collect and exchange emergency resource needs at different shelters to create a consistent global view of accumulated resource needs across the entire affected area. Thus, the scheme enables *need accumulation* which in turn reduces the gap in perception about the actual needs at different shelters.

A case-based reasoning (CBR)-driven need validation technique is proposed in Chap. 4, to validate the opportunistically received resource needs at the control station. Additionally, a utility-based integer programming model for optimal resource allocation is formulated using the opportunistically transmitted and CBR validated resource needs. The model minimizes the overall resource deficit and the total resource deployment time. The CBR-driven need validation technique along with the integer programming model brings about efficient *resource planning*.

Chapter 5 proposes a series of security protocols to meet the stringent security requirements of a DTN. First, a multilayer encryption and hashing-based scheme are proposed to protect the transmitted emergency resource needs against authenticity, eavesdropping and modification attacks. Subsequently, a security-aided and group encounter-based PRoPHET routing protocol is proposed, where security features are incorporated into PRoPHET to provide security against eavesdropping, blackhole, identity spoofing and bundle store overflow attacks. Finally, a trust-based Watchdog technique is proposed and seamlessly integrated with PRoPHET to provide security against packet drop, badmouthing and ballotstuffing attacks. These security protocols run on the smartphones, carried by the volunteers and contributed towards *reliable data dissemination* so that all other post-disaster services can be rendered reliably.

There is a tremendous scope for the research community to identify novel and challenging problems in the area of ICT-based disaster management and investigate innovative solution methodologies. This book demonstrates the usage of wireless technologies coupled with smart devices to improve disaster management endeavours, by improving communication and resource planning during the aftermath of a disaster. The solutions provided herein exploit, in particular the opportunity of fast penetration of smart devices in daily life in developing countries like India, and rightly use these hand-held devices in forming delay-tolerant networks. Research conducted in this book fosters interdisciplinary collaboration among engineers, industry professionals, scientists and disaster relief organizations for the effective handling of disasters in developing countries. On the other hand, different academic regulatory bodies of such countries have made courses on Preface

disaster management mandatory at graduate levels. This book can be used as a first-hand reference for these courses. Thus, the book serves the requirements of both research and teaching communities.

Kolkata, India Kolkata, India Howrah, India September 2018 Souvik Basu Siuli Roy Sipra Das Bit

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Kolkata, India December 2018 Souvik Basu Siuli Roy Sipra Das Bit

About the Book

The objective of the book is to present a framework for reliable end-to-end post-disaster services over smartphone-based delay-tolerant networks (DTNs), which can operate even in the absence of conventional network connectivity. History has shown that disasters like Chennai flood and Uttarakhand flash flood in India, earthquake in Nepal and tsunami in Japan severely impair Internet-based communication systems, jeopardizing people's lives-loss of life and property. Under such circumstances, providing essential post-disaster services becomes truly challenging. The book explores a number of different aspects of this challenge, ranging from accurate need assessment, to timely need accumulation, to efficient resource allocation and reliable data dissemination and presents strategies to deal with challenges. It demonstrates the usage of wireless technologies coupled with smart devices to improve disaster management endeavours, by improving communication and resource planning during the aftermath of a disaster. The primary audience of the book is technologists and researchers working in the domain of ICT-based disaster management who would find it useful in understanding the challenges of providing post-disaster services in a challenged network scenario and their possible solutions. Disaster management authorities, government agencies, NGOs and other stakeholders would also find it useful for enhancing the preparedness of volunteers and relief agencies through intelligent use of wireless technologies coupled with smart devices with the goal of better disaster management. Furthermore, the book can be used as a first-hand reference for courses on ICT-based disaster management at graduate and undergraduate levels.

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Abbreviations

ACF	Action Contre La Faim
AES	Advanced Encryption Standard
AF	Accuracy factor
ANN	Artificial neural network
ARD	Average resource deficit
BP	Back-propagation
BPNN	Back-propagation neural networks
CBR	Case-based reasoning
CID	Control node ID
CN	Control node
CPin	Control pin
CRL	Certificate Revocation List
DDH	Decisional Diffie-Hellman
DFY	Doctors For You
DOM	Disaster operations management
DoS	Denial of service
DP	Delivery predictability
DTN	Delay-tolerant network
EMD	Expected message delay
FC	Forwarding competency
FE	Forwarding evidence
FEMA	Federal Emergency Management Agency
FIFO	First in first out
FN	Forwarder node
GID	Group ID
GP	Group pin
GPRS	General Packet Radio Service
GSM	Global System for Mobile
IBC	Identity-based cryptography
IBE	Identity-based encryption

ION	Interplanetary Overlay Network
ISP	Influencing situational parameter
ITRM	Iterative Trust and Reputation Mechanism
LEO	Low Earth orbiting
MANET	Mobile ad hoc network
MCPin	Modified control pin
MGP	Modified group pin
MLCE	Multiple layer commutative encryption
MLR	Multiple linear regression
NSE	Nash–Sutcliffe efficiency
OppNet	Opportunistic network
PB	Percentage bias
PC	Principal component
PCA	Principal component analysis
PCR	Principal component regression
PCRA	Principal component regression analysis
PD	Perception deviation
PEKS	Public encryption with keyword search
PEON	Privacy-Enhanced Opportunistic Networking
PFM	Positive feedback message
PGP	Pretty Good Privacy
PKI	Public key infrastructure
PRoPHET	Probabilistic Routing Protocol using History of Encounters
	and Transitivity
QRC	Qatar Red Crescent
RMSE	Root mean squared error
RPGM	Reference point group mobility
RSA	Rivest–Shamir–Adleman
SA	Situational awareness
SAGE-PRoPHET	Security-aided and group encounter-based PRoPHET
SHA	Secure Hash Algorithm
SN	Shelter node
SnW	Spray and wait
SRD	Shelter-specific resource deficit
ТА	Trusted authority
TCP/IP	Transmission Control Protocol/Internet Protocol
T-PRoPHET	Trusted PRoPHET
TTP	Trusted third party
VANET	Vehicular ad hoc network
VDTN	Vehicular DTN
Wise-PRoPHET	Watchdog supervised PRoPHET
WLAN	Wireless local area network

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Post-disaster Navigation and Allied Services over Opportunistic Networks



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-Virginia Satir

Dedicated to our parents

Foreword by Prof. Sukumar Ghosh

Disasters of various types and scales frequently occur, and they torment human society in unpredictable ways. Each disaster has a unique footprint. While Covid-19 pandemic is once in a century event, the more common disasters are natural disasters triggered by earthquake, flood, tornado etc. The challenge is to maintain emergency services and supply lines so as to minimize the loss of life and property as much as possible. In today's digital society, a key component of all the essential services is communication. The lack of effective communication paralyzes essential services. Road networks become partially inaccessible. Our modern society takes phone and internet services for granted, but often they are the first ones to fall apart when disasters strike. Social media becomes unreachable. The first responders are adversely affected. Adequate preparedness for such disasters requires both proactive efforts and reactive steps.

This monograph proposes and documents a number of strategies to mitigate the impact of a disaster that disrupts electronic communication. These are based on extensive research conducted by the authors over the past few years. Maintaining electronic communication in the face of disasters has been emphasized. Of particular interest here is the study of various types of opportunistic and delay-tolerant networks and their performances in simulated environments. Both practitioners and networking researchers engaged in disaster mitigation will find them useful.

December 2020

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Foreword by Prof. Keiichi Yasumoto

The monograph on Post-disaster Navigation and Allied Services over Opportunistic Networks addresses an important and timely topic. In recent years, natural disasters such as earthquakes, tsunamis, landslides, volcanoes, wildfires, floods, hurricanes, tornadoes, etc. have occurred more frequently than ever. Within the recent 50 years from 1967 to 2016, about 8,000 natural disasters occurred in the world and caused huge loss of human (280 million deaths) and economic resources (about 730 billion dollars). The top three regions where natural disasters most frequently happened are South-East Asia, South Asia and Central America. In terms of devastation, in September 2018, Sulawesi earthquake and tsunami happened in Indonesia where more than 4,000 people were killed. In April 2015, the Nepal Earthquake killed nearly 9,000 people, in excess of 600,000 houses were destroyed and more than 288,255 houses were damaged. Due to global warming, the number of natural disasters caused by climate changes such as typhoon, hurricanes and floods is also growing worldwide.

In the aftermath of large-scale disasters, one of the biggest problems is the impairment of cellular communication and the unavailability of internet services caused by the failure of communication infrastructure, including cellular towers and base stations by the power outage, water leakage, etc. Therefore, rapid deployment of post-disaster communication infrastructure and provisioning of internet services, especially GIS service, are crucial. Without communication infrastructure or GIS service, it becomes extremely difficult to facilitate life-saving rescue operations as well as adequate relief services in a timely manner. It is important to establish reliable and seamless information exchange among all stakeholders-disaster victims, emergency and disaster management personnel, policemen, rescue and medical teams, volunteers, government and non-government organizations, etc. This monograph addresses some of these challenges by proposing a post-disaster map-based navigation service, post-disaster situational awareness and resource management, and ad hoc communication infrastructure based on opportunistic networks for realizing these challenges during disaster situations where communication infrastructure is destroyed.

The monograph is well exploring relevant issues and challenges related to postdisaster services in six chapters. Chapter 1 introduces disaster management cycle, post-disaster management services and challenges in post-disaster scenarios followed
by architecture, routing and applications of opportunistic networks. Chapter 2 describes the author's primary challenge, post-disaster map-based navigation service, while Chap. 3 deals with the two other important challenges, post-disaster situational awareness and resource management. Chapter 4 presents the opportunistic networks architecture for reliable and energy-efficient post-disaster management. Chapter 5 investigates the routing protocols for energy-efficient post-disaster management. The final chapter summarizes the future research scope in various technologies applied to post-disaster management. The proposed map-based navigation services, situational awareness and resource management services, opportunistic network architecture and routing protocols may help enhance emergency preparedness and personnel training. Thus the monograph is expected to benefit not only researchers and academicians but also disaster management practitioners of government and non-government organizations, particularly in developing countries.

January 2021

Keiichi Yasumoto Professor of Graduate School of Science and Technology Nara Institute of Science and Technology Ikoma, Japan

Preface

It was a nice afternoon of 25 April, 2015, and we were attending a meeting of our research team at an Engineering institute campus away from Kolkata, India. The topic of discussion in that meeting was the application of ICT in disaster management. Suddenly we felt a mild tremor and within a few hours, we got to know that the tremor was caused by a massive earthquake which hit Nepal. The severity of the disaster was enormous, and the whole country was partially disconnected from the rest of the world. After almost one and half months of the disaster, a small team of our research group visited Katmandu, Nepal. The visuals were horrifying at Katmandu, and the road conditions were terrible even after one and half months of the disaster. We observed uncleared debris was piled up at the middle of the roads. There was scarcity of food, drinking water and shelters. Those visuals have motivated us to conduct research so that the disaster-prone countries can equip themselves with appropriate measures to cope with the challenges associated with the disasters. Some of the serious challenges are incapacitated communication infrastructure, unstable power supply and inaccessible road networks. Out of these challenges, the destruction of road networks, especially in developing countries, acts as a major hindrance to effective disaster management. This monograph provides the details of developing a digital route map construction system over the opportunistic networks. The monograph also provides the solution of the two other important post-disaster management services such as situational awareness and resource allocation. Both of these services are invariably dependent on the existence of navigation support. Finally, in order to offer such services, the other challenge is to address the problem of incapacitated communication infrastructure. This monograph also deals with such challenges in post-disaster scenarios and develops automated post-disaster management services.

The monograph is primarily divided into two parts, such as developing postdisaster management services and designing a post-disaster opportunistic network framework underneath. The first three chapters of the monograph discuss the development aspects of numerous post-disaster management services, whereas Chaps. 4 and 5 deal with designing a post-disaster opportunistic network framework.

Chapter 1 of this monograph deals with the necessary background to understand the remaining chapters. Initially, this chapter provides an introduction to the overall disaster management process. The various post-disaster management services along with the challenges of disaster management are discussed in the later parts of the chapter. An overview of opportunistic networks including their features, architecture, routing protocols and applications is also discussed in this chapter.

A smartphone-based digital route map construction system (Post-disaster Map Builder) is discussed in Chap. 2 which offers map-based navigation service in postdisaster scenarios. The proposed system constructs digital route maps of the affected areas using mobile handheld devices such as smartphones.

In Chap. 3, two post-disaster management services, namely situational awareness and resource management are discussed. An Android application (Disaster-Messenger) is presented which allows the sharing of situational information (text, image, video, or voice recordings) without the help of conventional network infrastructure. The development of a decentralized scheme (DPDRM) is also presented in this chapter to automate post-disaster resource management. The proposed scheme allows periodic group-based sharing of resource inventories and supports the search and retrieval of queries within a restricted time period.

In Chap. 4, a reliable and energy-efficient post-disaster opportunistic network architecture is designed to support post-disaster communication. The proposed opportunistic network architecture includes suitable network architecture and node deployment plans. Thus, three-tier architecture is proposed to facilitate post-disaster communication. Suitable node deployment plans for both mobile and static nodes corresponding to tier-1 and tier-2, respectively, to enhance the network reliability are also described in Chap. 4.

Finally, three energy-efficient post-disaster opportunistic network routing protocols, viz., Priority-enhanced PRoPHET (Pen-PRoPHET), Group encounter-based PRoPHET (Ge-PRoPHET) and Trace Route supporting three different post-disaster management services, such as situational awareness, resource management and mapbased navigation, respectively, are described in Chap. 5. The aforesaid routing protocols along with the proposed post-disaster communication architecture satisfy the desired network reliability requirement for post-disaster communication.

The primary targeted readers of the monograph are technologists, disaster management agencies, practitioners and researchers working in the domain of ICT-based disaster management in developing countries. They would find it useful in understanding the challenges of providing low-cost post-disaster management services in the disaster aftermath in absence of traditional communication infrastructure. In addition to that, due to the sharp rise in the number of disasters in the recent past, academic institutions are introducing specialized courses on disaster management to enhance student awareness. This monograph can also be used as a reference book in such courses.

Kolkata, India Kolkata, India Howrah, India December 2020 Suman Bhattacharjee Siuli Roy Sipra Das Bit

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Writing a monograph is a project by itself, and just like any real-life project, publication of a monograph requires active cooperation from a large group of people apart from the authors. We would like to thank those people who are involved in the preparation of the manuscript and without whom the monograph could not have seen the light of the day.

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Abbreviations

AFW	Autonomous Flight Wireless Nodes
AODV	Ad hoc On-Demand Distant Vector
CAMR	Context-Aware Multicast Routing
DDDAS	Dynamic Data-Driven Application Systems
DM	Data Mules
DPD	Discover-Predict-Deliver
DSR	Dynamic Source Routing
DTN	Delay Tolerant Networks
EASDM	Energy-Aware Single-Data Multicast
GPS	Global Positioning System
ICMN	Intermittently Connected Mobile Network
ICT	Information and Communication Technology
MANET	Mobile Ad hoc Networks
MAP	Mobile Access Point
MCS	Master Control Station
NBC	Naïve Bayesian Classifier
NLOS	Non-line-of-sight
NLP	Natural Language Processing
OMN	Opportunistic Mobile Networks
PRoPHET	Probabilistic Routing Protocol using History of Encounters and Tran- sitivity
PSN	Pocket Switched Networks
RAPID	Resource Allocation Protocol for Intentional DTN
RMS	Root Mean Square
RPLM	Relay Placement Strategy for Latency Minimization
RW	Relief Workers
SDM	Single-Data Multicast
SnW	Spray and Wait
SP	Shelter Point
TB	Throwbox
UAV	Unmanned Arial Vehicles
WIPER	Wireless Phone-based Emergency Response System

REALIZING SRI JAGANNATH is a book of poem written by Sk REALIZING ON BY Sk Makbul Islam (Ph. D; D. Litt.) and translated into English from Bengal Makbul Islam ("Bengal by Dr. Madhumita Chanda. This is 'Professor Khageswar Mahapatra by Dr. Madhumita Chanda. This is 'Sri Jagannath Resourt Mahapatra by DL Management of the second (SJRC), St. Paul's Cathedral Mission College, Kolkata-700009, India Published by 'Khosra Khata' Kolkata. Published on 23rd June 2021 (Rathayatra).

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Burning Mountains Short Stories of Gayatri Saraf

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Blockchain Leveraged Node Incentivization in Cooperation-Based Delay Tolerant Networks

By Siuli Roy, Souvik Basu, Soumyadip Chowdhury

Book Opportunistic Networks

Chapter

Edition	1st Edition	
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ABSTRACT

Performance of cooperation-based networks, like delay tolerant networks (DTNs), are severely affected by selfish nodes that are not willing to participate in message forwarding due to resource constraints. Thus, nodes must receive satisfactory incentives to compensate their resource depletion for cooperation. The available incentive schemes for DTNs either rely on hypothetical central trusted authorities or do not use explicit digital currency that is provably secure. Biockchain, a decentralized and secure digital ledger of immutable transactions, is an attractive approach for addressing the incentive challenges in DTNs that lack central trusted authorities. Ethereum, the blockchain-based cryptocurrency, makes it possible to devise practical credit-based incentive schemes for such networks. However, the usage of blockchain is restricted by the availability of end-to-end internet connectivity, which restricts the use of blockchain in intermittently connected networks like DTNs and has prompted exploration of new mechanisms for using blockchain in such networks. This chapter first proposes a mechanism, based on the Ethereum platform using smart contracts in Solidity, for integrating blockchain technology with DTNs, towards exploiting the immutability and availability of blockchains in DTNs. It then develops BlockCent, a blockchain-based node incentivizing scheme for DTNs that runs on the blockchain-DTN integrated environment. The scheme uses a novel reward strategy to bring rationality to the incentivizing process. To add logic to the incentivizing method, the scheme uses a novel incentive strategy. The proposed incentivizing scheme is applied to the disaster management use case for fast transmission of relief shelter needs to the emergency operation center, thus leading to efficient disaster relief. Extensive security analysis justifies security of the proposed scheme. Exhaustive experiments conducted on the ONE simulator and the Ethereum platform substantiate the efficiency of the scheme in terms of design parameters like selfishness reduction and reward fairness, and network parameters like delivery ratio, average delay, and overhead ratio, while not compromising blockchain performance parameters like processing time and gas consumption.

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	Book	Nature-Inspired Computing: Concepts, Methodologies, Tools, and Applications		
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	Publisher	IGI Global		
	Description	Image processing on quantum platform is a hot topic for researchers now a day. Inspired from the idea of quantum physics, researchers are trying to shift their focus from classical image processing towards quantum image processing. Storing and representation of images in a binary and ternary quantum system is always one of the major issues in quantum image processing. This chapter mainly deals with several issues regarding various types of image representation and storage techniques in a binary as well as ternary quantum system. How image pixels can be organized and retrieved based on their positions and intensity values in 2-states and 3-states quantum systems is explained here in detail. Beside that it also deals with the topic that focuses on the clear filteration of images in quantum system to remove unwanted noises. This chapter also deals with those important applications (like Quantum image		
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10

AlGaN/GaN HEMT Modeling and Simulation

Binit Syamal and Atanu Kundu

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10.1 Introduction to the Compound Semiconductor

Silicon (Si), germanium (Ge), tin (Sn), and diamond (C) are the Group-IV elemental semiconductor materials. The band gaps of the elementary semiconductors are Si:1.12eV, Ge: 0.67 eV, Sn: 0.08 eV, C: 5.5 eV. Among these materials, silicon is the most popular semiconductor material in VLSI industry for manufacturing of discrete devices and integrated circuits due to its several inherent advantages, like more reliable, many ways easier to use and lower cost [1]. Silicon is prepared from raw materials S and or SiO₂ or silica or quartz. This is available in earth crust and foundries, extract pure Si (99.99) from the silica through several process. Silicon to silicon-dioxide formation is very essential as it is required as insulating material to prevent leakages, device isolation and thin gate oxide formation for MOS/CMOS architecture. Therefore, silicon is designated as the God's gift to the world of microelectronics. Si to SiO₂ formation is quite easy and less expensive compared to Ge. It is difficult to grow oxide on Ge, whereas, SiO₂ grows naturally on Si. Doping is Si is also a very easy process, and crystal property is very sensitive to dopant mount change. However, though silicon has important properties and advantages, it also has several limitations, like indirect band-gap material, not suitable for high-frequency applications (system operating at 40 GHz and above), difficult to design optical devices, not appropriate for high-voltage/temperature electronics applications where operable temperature goes above 200°C and not suitable for cryogenic electronics required for space instruments that ^{operate} at 4.2 K and below.

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Chapter 9

ETHNIC DIFFERENCES IN PROINFLAMMATORY STATE AND SYNDROME X: AN OVERVIEW

Plaban Chaudhury¹, Riddhi Goswami¹ and Mithun Das^{2,*}

¹Department of Biotechnology, Heritage Institute of Technology, Kolkata, India ²Department of Anthropology, Sidho-Kanho-Birsha University, Purulia, West Bengal, India

The most widely recognized of the metabolic risk factors are atherogenic dyslipidemia, elevated blood pressure, and elevated plasma glucose. Individuals with these characteristics commonly manifest a prothrombotic state and a proinflammatory state. Atherogenic dyslipidemia consists of an aggregation of lipoprotein abnormalities including elevated serum triglyceride and apolipoprotein B (apoB), increased small low density lipoprotein cholesterol (LDLc) particles, and a reduced level of high density

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Preparation and Characterisation of Solid Catalysts for Saccharification of Biomass

A. Mallick and M. Mukhopadhyay

Abstract Biomass saccharification has assumed a significant importance in the context of the modern-day energy crisis and climate change scenarios. Waste biomass, which can constitute a significant portion of solid wastes, can be converted into value-added chemicals like ethanol by this process. The present investigation deals with the development of a solid acid catalyst for biotnass saccharification using coconut shell, a cheap and abundant raw material, which has not been explored previously in this field. Coconut shell has been carbonised with zinc chloride at 723 K for 1 h to produce activated carbon which has been sulphonated with conc. H₂SO₄ (98%) at 403 K for 16 h to develop the solid acid catalyst. The catalyst has been characterised by scanning electron micrography, X-ray diffraction, FTIR spectroscopy and nitrogen adsorption. The X-ray diffraction studies have shown a graphene sheet content of 39% in the catalyst, while the FTIR spectra show the presence of SO₃H, phenolic OH and COOH groups. The specific surface area measured by nitrogen adsorption was 10.162 m²/g. The catalyst has been used to hydrolyse pretreated sawdust from Acacia nilotica heartwood as well as microcrystalline cellulose under experimental conditions specified by central composite design. The yields of total reducing sugars in the hydrolysates have been analysed by UV spectrophotometry, and the produced sugars were identified by HPLC. Glucose constituted almost all of the produced sugars with negligible amounts of galactose being formed. The maximum sugar yield was 91% for pretreated sawdust and 93% for microcrystalline cellulose, indicating the excellent catalytic property of the catalyst. The results indicate the suitability of coconut shell as a source for developing biomass saccharification catalysts, as well as the efficacy of such a catalyst in the saccharification process.

Keywords Lignocellulosic biomass • Biomass saccharification • Sulphonated activated carbon

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Souvik Basu · Siuli Roy · Sipra Das Bit

Reliable Post Disaster Services over Smartphone Based DTN

An End-to-End Framework



Souvik Basu Computer Application Centre Heritage Institute of Technology Kolkata, West Bengal, India

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This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd. The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore The mediocre teacher tells. The good teacher explains. The great teacher inspires. —William Arthur Ward

Dedicated to our teachers

Foreword

The monograph on *Reliable Post Disaster Services over Smartphone Based DTN* is timely and addresses an important topic. In recent years, natural disasters such as wildfires, floods, earthquakes, landslides, hurricanes, tornadoes, tsunamis and volcanoes have impacted human lives, assets and infrastructures more than ever. Indeed, natural disasters have grown almost threefold between 1980 and 2017 compared to between 1940 and 1980. Natural disasters have also affected about 217 million people each year since 1990. It has been observed that India, China, Philippines, Nepal, Bangladesh and Thailand are among the most affected, disaster-prone countries since 1995. In terms of devastation, during April 2015 Nepal earthquake, nearly 9000 people were killed, more than 600,000 houses destroyed and more than 288,255 houses damaged. Devastating floods and landslides for multiple days in June 2013 in the North Indian state of Uttarakhand not only took away more than 5700 lives but also wiped out a huge number of localities, forcing hundreds of thousands of people homeless and causing severe infrastructure damages, such as roads, bridges, power lines, electricity poles and so on.

In the aftermath of large-scale calamities, among other losses and damages, severe disruption of communication infrastructures, particularly impairment of wireless cellular towers and Internet services, is a common phenomenon. Therefore, rapid deployment of post-disaster communication infrastructure, albeit ad hoc and temporary, is crucial without which it becomes extremely challenging, if not impossible, to facilitate life-saving rescue operations as well as adequate relief services in a timely manner. The goal is to establish reliable and seamless information exchange among all stakeholders—survivors, emergency and disaster management personnel, policemen, rescue and medical teams, volunteers, government and non-government organizations, etc. This well-motivated monograph addresses some of these challenges by proposing a framework for reliable end-to-end post-disaster services by exploiting smartphone-based delay-tolerant networks (DTNs) technology that can operate despite the breakdown of traditional communication infrastructure networks.

The authors have done a good job in exploring relevant issues and challenges related to post-disaster services by proposing models, protocols and solution methodologies for accurate assessment and accumulation of various service needs, efficient resource allocation and reliable data dissemination in the wake of natural disasters. The monograph is organized into six chapters. Chapter 1 introduces post-disaster management services and communication followed by DTN architecture, routing and security issues. Chapter 2 describes various methods for post-disaster need assessment and forecasting, while Chap. 3 deals with the analysis of need accumulation over DTNs. Chapter 4 presents resource planning with the help of case-based reasoning and utility-based optimal resource allocation model. Chapter 5 investigates reliable data dissemination over DTNs using multilayer hashed encryption and group-based distributed authentication, followed by secure routing protocols. The final chapter summarizes future research directions in wireless technologies applied to post-disaster management. The authors have provided data sets from real disaster scenarios, where possible, to allow researchers to validate smartphone-based DTN protocols for post-disaster services. The proposed framework, solutions and smartphone apps may help enhance emergency preparedness and personnel training. Thus, the monograph is expected to benefit not only researchers but also disaster management practitioners of government and non-government organizations, particularly in developing countries.

Rolla, USA December 2018 Sajal K. Das Professor and Daniel St. Clair Chair of Computer Science Missouri University of Science and Technology

Preface

According to the World Disasters Report, when disaster strikes, access to information is as important as access to food and water. Such information, like the status of victims and the requirement of emergency resources, is crucial for rendering timely and effective disaster relief. However, the availability of cellular and Internet connectivity in a post-disaster scenario is usually ruled out due to the failure of the supporting infrastructure. Therefore, the possibility of exchanging situational information using normal communication infrastructure gets almost restricted resulting in high perception deviation at the control station about the actual needs of the remote shelters. Under such circumstances, providing post-disaster services like *need assessment, need accumulation* and *resource planning* becomes truly challenging leading to futile disaster relief endeavours. Moreover, the presence of malicious entities in the network may affect the reliability of data, i.e. resource needs, at the control station. Thus, *reliable data dissemination* is another service that is to be rendered for effective disaster management.

This book deals with the problems in providing reliable post-disaster services in a challenged network environment. In particular, it proposes a framework for reliable post-disaster services over smartphone-based DTN. The components of this framework are the four services, namely need assessment, need accumulation, resource planning and finally reliable data dissemination.

The introductory chapter, i.e. Chap. 1, is dedicated to the background necessary to understand the remaining chapters of this book. It first gives an introduction to disaster management, its phases and the various post-disaster services. Next, it presents an overview of delay-tolerant networks (DTNs)—its features, architecture, routing and applications, with an emphasis on DTN security.

A principal component regression (PCR) model is derived for forecasting the exact demand for different emergency resources in a shelter, based on the dynamic influencing situational parameters, in Chap. 2. The derived model can be used to periodically forecast the ever-changing demand for different emergency resources at shelters with high precision. Next, a utility function is proposed that dynamically

and quantitatively enumerates the utility of each emergency resource at different shelters. The demand forecast model along with the utility function assists in accurate *need assessment* for emergency resources at different shelters.

Assuming an underlying DTN-leveraged smartphone (carried by volunteers and relief workers)-based communication network, Chap. 3 proposes an opportunistic knowledge sharing scheme for transmitting the assessed resource needs to the control station in the absence of normal communication facilities. The knowledge sharing scheme runs on the smartphones to collect and exchange emergency resource needs at different shelters to create a consistent global view of accumulated resource needs across the entire affected area. Thus, the scheme enables *need accumulation* which in turn reduces the gap in perception about the actual needs at different shelters.

A case-based reasoning (CBR)-driven need validation technique is proposed in Chap. 4, to validate the opportunistically received resource needs at the control station. Additionally, a utility-based integer programming model for optimal resource allocation is formulated using the opportunistically transmitted and CBR validated resource needs. The model minimizes the overall resource deficit and the total resource deployment time. The CBR-driven need validation technique along with the integer programming model brings about efficient *resource planning*.

Chapter 5 proposes a series of security protocols to meet the stringent security requirements of a DTN. First, a multilayer encryption and hashing-based scheme are proposed to protect the transmitted emergency resource needs against authenticity, eavesdropping and modification attacks. Subsequently, a security-aided and group encounter-based PRoPHET routing protocol is proposed, where security features are incorporated into PRoPHET to provide security against eavesdropping, blackhole, identity spoofing and bundle store overflow attacks. Finally, a trust-based Watchdog technique is proposed and seamlessly integrated with PRoPHET to provide security against packet drop, badmouthing and ballotstuffing attacks. These security protocols run on the smartphones, carried by the volunteers and contributed towards *reliable data dissemination* so that all other post-disaster services can be rendered reliably.

There is a tremendous scope for the research community to identify novel and challenging problems in the area of ICT-based disaster management and investigate innovative solution methodologies. This book demonstrates the usage of wireless technologies coupled with smart devices to improve disaster management endeavours, by improving communication and resource planning during the aftermath of a disaster. The solutions provided herein exploit, in particular the opportunity of fast penetration of smart devices in daily life in developing countries like India, and rightly use these hand-held devices in forming delay-tolerant networks. Research conducted in this book fosters interdisciplinary collaboration among engineers, industry professionals, scientists and disaster relief organizations for the effective handling of disasters in developing countries. On the other hand, different academic regulatory bodies of such countries have made courses on Preface

disaster management mandatory at graduate levels. This book can be used as a first-hand reference for these courses. Thus, the book serves the requirements of both research and teaching communities.

Kolkata, India Kolkata, India Howrah, India September 2018 Souvik Basu Siuli Roy Sipra Das Bit

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Kolkata, India December 2018 Souvik Basu Siuli Roy Sipra Das Bit
About the Book

The objective of the book is to present a framework for reliable end-to-end post-disaster services over smartphone-based delay-tolerant networks (DTNs), which can operate even in the absence of conventional network connectivity. History has shown that disasters like Chennai flood and Uttarakhand flash flood in India, earthquake in Nepal and tsunami in Japan severely impair Internet-based communication systems, jeopardizing people's lives-loss of life and property. Under such circumstances, providing essential post-disaster services becomes truly challenging. The book explores a number of different aspects of this challenge, ranging from accurate need assessment, to timely need accumulation, to efficient resource allocation and reliable data dissemination and presents strategies to deal with challenges. It demonstrates the usage of wireless technologies coupled with smart devices to improve disaster management endeavours, by improving communication and resource planning during the aftermath of a disaster. The primary audience of the book is technologists and researchers working in the domain of ICT-based disaster management who would find it useful in understanding the challenges of providing post-disaster services in a challenged network scenario and their possible solutions. Disaster management authorities, government agencies, NGOs and other stakeholders would also find it useful for enhancing the preparedness of volunteers and relief agencies through intelligent use of wireless technologies coupled with smart devices with the goal of better disaster management. Furthermore, the book can be used as a first-hand reference for courses on ICT-based disaster management at graduate and undergraduate levels.

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processing over wireless networks, and low-overhead wireless network security. She has published extensively in these areas. Prof. Das Bit has handled several Government-funded research projects as Principal/Co-Principal investigator, including projects on Disaster Management.

Abbreviations

ACF	Action Contre La Faim
AES	Advanced Encryption Standard
AF	Accuracy factor
ANN	Artificial neural network
ARD	Average resource deficit
BP	Back-propagation
BPNN	Back-propagation neural networks
CBR	Case-based reasoning
CID	Control node ID
CN	Control node
CPin	Control pin
CRL	Certificate Revocation List
DDH	Decisional Diffie-Hellman
DFY	Doctors For You
DOM	Disaster operations management
DoS	Denial of service
DP	Delivery predictability
DTN	Delay-tolerant network
EMD	Expected message delay
FC	Forwarding competency
FE	Forwarding evidence
FEMA	Federal Emergency Management Agency
FIFO	First in first out
FN	Forwarder node
GID	Group ID
GP	Group pin
GPRS	General Packet Radio Service
GSM	Global System for Mobile
IBC	Identity-based cryptography
IBE	Identity-based encryption

ION	Interplanetary Overlay Network
ISP	Influencing situational parameter
ITRM	Iterative Trust and Reputation Mechanism
LEO	Low Earth orbiting
MANET	Mobile ad hoc network
MCPin	Modified control pin
MGP	Modified group pin
MLCE	Multiple layer commutative encryption
MLR	Multiple linear regression
NSE	Nash–Sutcliffe efficiency
OppNet	Opportunistic network
PB	Percentage bias
PC	Principal component
PCA	Principal component analysis
PCR	Principal component regression
PCRA	Principal component regression analysis
PD	Perception deviation
PEKS	Public encryption with keyword search
PEON	Privacy-Enhanced Opportunistic Networking
PFM	Positive feedback message
PGP	Pretty Good Privacy
PKI	Public key infrastructure
PRoPHET	Probabilistic Routing Protocol using History of Encounters
	and Transitivity
QRC	Qatar Red Crescent
RMSE	Root mean squared error
RPGM	Reference point group mobility
RSA	Rivest–Shamir–Adleman
SA	Situational awareness
SAGE-PRoPHET	Security-aided and group encounter-based PRoPHET
SHA	Secure Hash Algorithm
SN	Shelter node
SnW	Spray and wait
SRD	Shelter-specific resource deficit
ТА	Trusted authority
TCP/IP	Transmission Control Protocol/Internet Protocol
T-PRoPHET	Trusted PRoPHET
TTP	Trusted third party
VANET	Vehicular ad hoc network
VDTN	Vehicular DTN
Wise-PRoPHET	Watchdog supervised PRoPHET
WLAN	Wireless local area network

Ankita Mazumder, Dwaipayan Sen, and Chiranjib Bhattacharjee **11 Optimization of oily wastewater treatment** process using a neuro-fuzzy adaptive model

Abstract: In the recent era, accelerated expansion of industrialization and urbanization leads to the release of a large volume of effluent comprising of wide varieties of toxic pollutants. Amidst these components, oily hydrocarbon is one of the alarming toxic pollutants causing severe health hazards to ecological species. For the treatment of oily wastewater discharged from various sources, membrane technology is an established separation process to deliver clean water before disposal in accordance with government environmental regulations. However, one of the main limitations of membrane technology is its economic feasibility for the long-run of treating heavy pollution load because of membrane fouling, which gradually declines the permeate flux rate. Moreover, real difficulties lie in evaluating the foulants' interaction with the membrane material, and henceforth, parameter manipulation, which is highly dependent on the in-depth chemistry associated with different unforeseen real-life consequences. Therefore, conventional mathematical models are often considered unsuitable for membrane separation processes as it does not incorporate any randomness of the system, but only dealing with known mass, energy and momentum balance. But stochastic models can proficiently handle real, complex system with inherent uncertainties, where one fails to predict any relation between the outcome and the input. Among these stochastic models, pattern mapping models such as Artificial Neural Network (ANN) is one of the most significant approach, which mainly relies on the experimental data and their accuracy level rather than developing any correlation in between the process parameters and outcome. However, one of the main intricacies involved with ANN is the unexpected occurrences of errors that predict unreliable output of the process. To compensate this limitation, research efforts has been directed toward the development of neuro-fuzzy hybrid models such as Adaptive neuro-fuzzy inference system (ANFIS) for modeling membrane separation process efficiently.

Keywords: Oily wastewater, fuzzy logic, pattern mapping, artificial neural network, adaptive neuro-fuzzy inference system, membrane separation, fouling

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Chapter 11

Microbial Fuel Cell for the Treatment of Wastewater

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Abstract

A microbial fuel cell is a potential alternative for the treatment of wastewater. In this process of water treatment, a substantial amount of energy is produced. Microorganisms are explicitly used in microbial fuel cells to generate electrons and protons that are involved in electrochemical reactions for the treatment of wastewater for the generation of power. Moreover, the efficiency of the treatment process and also the generation of power largely depend on the nature of the substrates used as feed, types of the microorganism used and the configurations of the cells. In view of an effective treatment process, various types of wastewater originated from a number of different sources have extensively been treated in microbial fuel cells using electrogenic microorganisms. Environment-friendly features of microbial fuel cells result in a better technology compared to the existing ones for the purpose. The present chapter of this book comprehensively briefs on the reactions mechanisms involved in different aspects of the technique and discusses extensively the essential changes in the treatment techniques of wastewater from varied sources.

Keywords

Wastewater, Microbial Fuel Cell, Cathode, Anode, COD, Power Density

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Mass Transport through Composite Asymmetric Membranes

Ankita Mazumder^{1,a}, Dwaipayan Sen^{2,b} and Chiranjib Bhattacharjee^{1,c*}

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Keywords: Composite membrane, Interfacial polymerization, Solution-diffusion model, Knudsen diffusivity, Non-equilibrium thermodynamics.

Abstract. In recent years, membrane separation technology has emerged as efficient and promising separation process from laboratory scale applications to wide range of technical industrial applications. The development of composite asymmetric membrane is a major breakthrough in membrane research field, as this membrane offers significantly high selectivity without affecting the mechanical durability of the membranes. In this chapter, structural characteristics and different fabrication techniques of composite membranes are reviewed. Moreover the mass transfer mechanism through the composite asymmetric membrane is described in details following solution-diffusion theory, Knudsen diffusion, and series resistance model. Composite membranes are preferred over others because of the high flux and enhanced selectivity without disturbing the mechanical stability of the membranes. These membranes are now widely employed in the applications of reverse osmosis (RO), nanofiltration (NF), pervaporation, gas separation, hydrocarbon fractionations, etc. As composite asymmetric membranes are "tailor-made" in nature, membrane characteristics can be tuned accordingly depending on their end use. Therefore plentiful research opportunities still exist to elevate their performance ability in terms of stability, selectivity and fouling resistance, which will in turn augment its application domain.

1. Introduction

Over the last two decades, membrane separation technology has gradually evolved from the academic research topic to an accepted and well-established separation technology in the industrial and environmental field with its compelling technical benefits. With the growth of industrialization, the process industries were facing the major complications for the recovery of product and recycling of reactants. To account this industrial problem, extensive research in membrane technology has been undertaken to supplement the energy-intensive and expensive traditional separation methods such as distillation, solvent extraction, crystallization, etc,. Membrane operation endeavors significant potential in fractionation, clarification, and molecular separation in liquid and gas phases in terms of high selectivity, reduced energy demand, faster operation, higher efficiency and modest cost to performance ratio. Several membrane processes such as reverse osmosis (RO), nanofiltration (NF), ultrafiltration (UF), microfiltration (MF), electrodialysis (ED), dialysis, membrane distillation (MD) etc. are presently adopted in the chemical industry, food and beverage industry and pharmaceutical industry. Moreover, the enhanced industrialization and urbanization gears up the generation of large volume of wastewater, which in turn adversely affect the environment [1]. In recent years the stringent environmental regulations of Government authority demands efficient water treatment processes for removal of pollutants over a wide concentration range. In this context, the membrane technology emerges as a promising, competitive option in the purification of both drinking water and wastewater because of its substantial progress and advancement. Membrane operations are employed to generate potable water from the seawater [2]; to treat industrial wastewater and to recover value- added products [3]; and to remove toxic components (such as urea) from blood stream using dialysis [4]. Furthermore, the successful development of selective polymeric membranes also paves the way for the introduction of membrane technology in gas purification domain.

Bioremediation of Dye Using Mesophilic Bacteria: Mechanism and Parametric Influence



Souptik Bhattacharya, Ankita Mazumder, Dwaipayan Sen, and Chiranjib Bhattacharjee

Abstract For centuries, dyes have been utilized in the tannery, textile, food, paper, cosmetic, and plastic industries. As a consequence of the fast urbanization and industrialization, the uncontrolled release of dyeing agents in the effluent is increasing. Such a release causes toxicity and pollution to the whole environment. These concerns become more critical due to the biomagnification phenomenon through various trophic levels resulting in severe toxicity in higher animals and plants including aquatic flora and fauna. Mitigation of this nuisance can be achieved by the economic application of biotechnology using safe biological agents to decolorize and degrade the dye in water bodies.

In this chapter, we reviewed the toxicity and harmful effects of various dyes along with different mechanisms and strategies of dye decolorization and degradation by biological agents while giving ampule emphasis on the mesophilic type bacteria. Further, the effect of different physicochemical parameters on dye removal efficacy was explicitly discussed. Moreover, various techniques to investigate the harmful toxic effects of the produced post degradation metabolites were also enlightened. Thus, this present chapter will deliver a quintessential perception on the feasibility of the bioremediation technique using mesophilic bacterial strains to treat dye contaminated waste streams.

Keywords Mesophilic bacteria · Biodegradation · Wastewater · Dye · Aerobic bacteria · Anaerobic bacteria, · Biomagnification · Bioreactor · Biosorption · Enzymatic degradation

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Lecture Notes in Civil Engineering

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Recent Developments in Sustainable Infrastructure



Effect of Metabolic Risk Factors, Gene Polymorphisms and Family History Among T2DM Population in Asian Indians



Plaban Chaudhuri, Riju Ghosh, Mithun Das, Indrani Lodh, and Riddhi Goswami

Abstract Women with a family history of diabetes (FHD) are at significantly increased risk of developing gestational diabetes mellitus, which is itself an important risk factor of childhood obesity and type 2 diabetes mellitus (T2DM) in early age. Elevated C-reactive protein (CRP) is a marker of low-grade systemic inflammation and involved in the etiology of diabetes. Insulin receptor substrate (IRS) molecules are key mediators in insulin signaling and development of diabetes. The present study was conducted on 100 healthy (non-diabetic, normotensive) adult Asian Indian women, including 50 with and 50 without FHD, living in and around Kolkata, India. During the gestation period they were studied twice, and followed up till delivery. During delivery both mothers' venous blood and cord blood were collected to estimate serum CRP, glucose, and lipid profiles of the respective mothers and their newborns. Genotyping of IRS-1, IRS-2 and CRP polymorphisms was done from these blood samples. A comparison of the metabolic variables among the subjects with and without FHD revealed significant differences among them. We also found close association of several polymorphisms in case of all three genes for both mothers and their newborn babies. More specifically, genotyping results for mothers with FHD and their newborn babies show susceptibility to T2DM: (i) for IRS-1 via diseased A allele (57%) which is carried over to the newborn babies (43%), (ii) for IRS-2 via

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Handbook for III-V High Electron Mobility Transistor Technologies

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Science and Spirituality for a Sustainable World: Emerging Research and Opportunities

Deepanjali Mishra (Kalinga Institute of Industrial Technology, India)

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Spiritual masters through the ages have devised methods different than those of science for investigating the great mystery of nature by, for example, immersing themselves in it, making use of silence, stillness, and solitude. The scientific and spiritual quests have been the two great quests of humanity, but somehow a feeling has developed that science is antagonistic to spirituality. Since the whole of reality is built up of both matter and consciousness, why should the quest for the understanding of order in the external world be antagonistic to the quest for the understanding of order in the inner world of our consciousness?

Science and Spirituality for a Sustainable World: Emerging Research and Opportunities brings together theories, methodologies, new ideas, experiences, and applications emphasizing the importance of both spirituality and skill for leadership and sustainable management, sensitizing leaders and management practitioners toward the spirituality-skill paradigm, skill-based leadership, and highlighting the role of spiritual values for environmental sustainability. Featuring a wide range of topics that focus on the relationship between spirituality and science such as spiritual education, management practices, and traditional wisdom, this book is essential for researchers, academicians, administrators, managers, professionals, policymakers, and students.

A TSV Constrained Algorithm for Designing Balanced Wrapper Chains in 3D SoC



Sabyasachee Banerjee 💿, Soumendu Ghorui, and Subhashis Majumder 💿

Abstract Three-dimensional integrated circuit (3D-IC) has emerged as a saviour of failing Moore's law, where the reduced length of interconnects is guaranteed with some added advantages like heterogeneous integration, higher computation per volume, etc. These benefits are also exhibited in 3D SoCs (3D System on Chips) to use the already built cores. However, testing these large complex SoCs in lesser time has become a challenge. In this paper, we propose a simulated annealing based wrapper chain design algorithm that will balance the length of the wrapper chain. The number of TSVs (Through Silicon Vias) are also kept as a constraint so that the number of TSVs could also be reduced. Rigorous experiments were being conducted on several ITC'02 SoC benchmarks and the results when compared with a recent work showed that our proposed approach recorded better test lengths in more than 90% cases with an average reduction of 9.65% in test length. Our algorithms also used less number of TSVs, in comparable CPU time.

Keywords 3D SoC \cdot Wrapper design \cdot TAM \cdot TSV \cdot Entropy

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³⁵

Ear Based Biometric Analysis for Human Identification



Samik Chakraborty, Anumita Mitra, Sanhita Biswas and Saurabh Pal

1 Introduction

Human biometric recognition system has been a demanding subject of research for the few decades as secure surveillance received significant attention in the present days. Biometric system based on several physiological and behavioral characteristics of human being like fingerprint, face, iris etc. are more reliable system than the conventional identification systems such as passwords and PINs [1, 2]. In spite of remarkable advancement in biometric recognition system, identify of individuals in uncontrolled and unconstrained environments remains a challenging problem like face recognition system can be affected due to illumination variance at different parts of the face or under different expressions. A change in voice due to cold and cough or other pathological conditions will make the system difficult to recognize. Recognition using finger may not be effective if the subject has dirty, deformed or cut hand. In compare to other physiological biometric feature ear has certain advantage. Contour of an ear is unique over the years [3] and also remain unchanged with change in expression [4] even person's cooperation is not necessarily required to acquire an ear image. Anatomy of human ear is shown in Fig. 1.

Burge and Burger [5] first developed ear authentication based algorithm where a graph model is constructed from for each ear from its edges and curves and introduces a graph based matching algorithm. Chang et al. [6] used PCA based ear biometric system and received 72% accuracy and also showed that due to hair or jewellary occlusion with pose variation recognition rate drops into 30%. A multimatcher system for ear recognition is proposed by Nanni and Lumini [7] where sub window is created

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Chapter 3

BIOAUGMENTATION TECHNOLOGY TO REMOVE OIL FROM OILY WASTEWATER USING ISOLATED ACTINOBACTERIA

Souptik Bhattacharya¹, Ankita Mazumder¹, Dwaipayan Sen^{2,*} and Chiranjib Bhattacharjee¹ ¹Department of Chemical Engineering, Jadavpur University, Kolkata, India ²Department of Chemical Engineering, Heritage Institute of Technology, Kolkata, India

ABSTRACT

Bioremediation through both biostimulation (addition of essential nutrients) and bioaugmentation (amendment of microorganisms) is one of the most applied technologies worldwide for the treatment of oily wastewater. Bioaugmentation thus nowadays becomes much expected technology with enhanced ability of biodegrading a wide variety of toxic hydrocarbons present in the oily effluents. Conventional methods like activated sludge process (ASP) gains much attention in treating wastewater

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Chapter 9

C-REACTIVE PROTEIN AND FAMILY HISTORY: A FUTURE THREAT TOWARDS DIABETES AND SYNDROME X

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INTRODUCTION

Type II Diabetes: A Global Menace

Type II diabetes mellitus is a long term metabolic disorder that consists of an array of dysfunctions characterized by hyperglycemia and resulting from the combination of resistance to insulin action, inadequate insulin

^{*} Corresponding Author Email: rgoswami77@gmail.com.

Interfacing and Pre-processing Techniques with Olfactory and Taste Sensors

Rajib Bandyopadhyay and Anil Kumar Bag

Abstract In human beings, analytical conclusion about any object is governed by the brain from the sensual influences coming from visual, auditory, olfactory, taste and touch organs. However, these conclusions are purely subjective in nature and target specific and may widely vary due to different human factors due to variability in mood and health conditions. Scientists and engineers have been trying to mimic the sensory organs of the humans in order to provide sufficiently reliable and selective analysis on the object, and imitation of these sensual organs, nowadays, has advanced to a great extent due to the immense development in sensor technology and intelligent smart electronics. In this regard, the electronic gadgets for visual, audio, and touch system have traversed a long journey in terms of accuracy and resolution and these three sensual organs now can be faithfully reproduced with reasonable accuracy. However, the electronic gadgets like electronic nose for olfactory system and electronic tongue for taste system, till now, are under research to find a profile to be commercialized widely. There are many challenges in this regard; firstly the selection of right sensor or sensor array for the application in hand. Secondly, design of reliable signal conditioning and pre-processing. In this chapter, we present the different types of sensors used for electronic nose and electronic tongue systems and associated interfacing circuits and preprocessing techniques.

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Foreword

Anthropology, by definition, is the study of man. It does so by investigating both social and biological aspects of human variation and evolution. It deals with human populations. On the other hand, public health encompasses the investigation of factors associated with health of populations. Therein lies the confluence of anthropology and public health, i.e. the study of various factors associated with diseases in human populations.

This book titled *Anthropology in Public Health* explores the relationship of some important factors involved in the causation (as well as responses to) of both communicable and non-communicable diseases in various Indian populations. It deals with the biological and social determinants of these ailments. The book also investigates not only the awareness of these diseases but also the health seeking behaviours. In general, the emphasis of this book is the role anthropology plays in public health. This is highlighted with special reference to particular diseases.

In total, there are fifteen very well written and lucid chapters by various researchers from different institutions of East and North-East India. It is noteworthy, that this book will be very useful not only for students and researchers of anthropology, public health, epidemiology, medicine, but, also for all other professionals who are interested in the study of morbidity in Indian populations.

I congratulate the editors for their commendable effort. I look forward to more such publications from them in future.

Prof. Kaushik Bose, D.Sc.

Effect of Metabolic Risk Factors and Family History...

(Xu *et al.*, 2012). In the US population, FHD showed significant, independent, and graded association with the prevalence of T2DM. This association opens up the possibility of formally adding family history to public health strategies aimed at detecting and preventing the disease (Valdez *et al.*, 2007; Das *et al.*, 2012).

Insulin Receptor Substrate (IRS) molecules are key mediators in insulin signalling and play a central role in maintaining basic cellular functions such as growth, survival and metabolism. Polymorphisms in the IRS gene family are associated with insulin resistance. Of four genes in the IRS system (IRS1, IRS2, IRS3, and IRS4), IRS1 and IRS2 play important roles in glucose metabolism (Malik *et al.*, 2005). C-reactive protein (CRP) is widely known to be a sensitive circulating marker of inflammation and is associated with increased risk of CVD. Inflammation is also associated with insulin resistance and hence the development of diabetes (Sesti *et al.*, 2001; Dehghan *et al.*, 2007).

Pregnancy is characterized by peripheral insulin resistance and gestation diabetes mellitus develops if insulin secretion fails to overcome insulin resistance. It is assumed that intrauterine exposure to an excess of glucose causes permanent foetal changes. Although maternal glucose freely crosses the placenta, maternal insulin does not. In pregnancies complicated by diabetes, this would lead to greater birth weight and increased risk of development of T2DM in later life (Dabela, 2007; Tam *et al.*, 2014; Ayaz *et al.*, 2014).

Asian Indians are ethnically predisposed to diabetes and tend to develop the disease much earlier and have a pre-inflammatory state that may contribute to their increased risk. These factors when coupled with family history and genetic predisposition can shed important insights into the prevalence of type 2 diabetes and their inheritance to the next generation. The objective of our study includes determination of the prevalence of metabolic risk factors and genetic polymorphisms among the obstetric Asian Indian population, with respect to their family history. In this study, we have selected two candidate genes for studying their polymorphism status—IRS-1 (Insulin receptor substrate-1) and IRS-2 (Insulin receptor substrate-2).

The main objective of the study was to assess the role of family history as a risk factor in the prevalence of T2DM and their inheritance to the next generation with respect to biochemical and

5

Effect of Metabolic Risk Factors and Family History on Diabetes in Asian Indian Population

Riddhi Goswami, Indrani Lodh, and Mithun Das

Introduction

The prevalence of diabetes is rapidly increasing all over the world at an alarming rate. The major driver of the epidemic is the more common form of diabetes, namely type 2 diabetes mellitus (T2DM), which accounts for more than 90 per cent of all diabetes cases. India is the worst hit country with an estimated 32 million people with diabetes in the year 2000 and this number is steadily increasing and set to reach about 70 million by the year 2025. Asian Indians are ethnically predisposed to diabetes and tend to develop the disease much earlier and have a pre-inflammatory state that may contribute to their increased risk (Mohan *et al.*, 2007; Huizinga and Rothman, 2006; Wild *et al.*, 2004).

Metabolic risk factors such as dyslipidemia, hypertension, abdominal obesity and impaired blood glucose regulation when coupled with family history and genetic predisposition can provide important insights into the prevalence of T2DM and their inheritance to the next generation. Family history of diabetes (FHD) is not only a risk factor for the disease, but is also important for relevant awareness programmes to ensure risk-reducing behaviours for target population. It may be used as a screening tool for detection and/or prevention of diabetes (Hariri *et al.*, 2006). In a study among the adult Chinese, it was observed that sufficient physical activity and negative FHD might jointly reduce the risk of developing T2DM

THE MYSTICAL MIRA AND THE LANGUAGE OF HER LOVE Saptaparna Roy

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Mirabai stands unique and alone in the Bhakti tradition in her relentless ming an icon of divine love, yearning and emanci Mirabai stands unique and of divine love, yearning and emancipation search for love, becoming an icon of divine love, yearning and emancipation search for love, becoming an icon of divine love, yearning and emancipation search for love, becoming and religious genealogy. A study of the Indian in a strictly patriarchal Hindu religious genealogy. A study of the Indian in a strictly patriarchar findian Hindu mysticism in the 16th century and the social context in which Hindu mysticism in the 10 which Mira lived, reveals a non-inclusive male dominated religious authority Mira lived, reveals a non-debarring the participation of women, a gendered institutionalisation of debarring the participation of religion as a normative and women's association with the erotic. Little can religion as a normative united hagiography on Mira but the interest in be fathomed from documented hagiography on Mira but the interest in be fathomed from documents in history much genres, time and place. Shrouded as she is in history, myth and tradition, Mira has evoked a cross-disciplinary research space in the later decades of the 20th century. Feminist theorists, especially in America have looked up to her as a symbol iconising a non-institutionalised religion of love, liberation and libidinousness. The dialectical relation between gender and power impacts the appreciation of mysticism as a discourse in India and Mirabai stands as an exemplary figure questioning the very foundation of it. The paper will establish how she exerts agency and power in her claim to religion, the religion of love. Her performances through devotional songs and renunciant acts have earned her popularity in the Hindu tradition that helped affirm Bhakti as a gendered religious experience. She exemplified the kernel of mysticism through her visions, divine love, subjective union and deliverance. Interestingly, Mira captures an expression of mysticism that unfolds an ineffable state, an in-betweenness, between knowing and not knowing. From film to documentary to musical experimentation, Mira's songs have inspired a progressive tradition of compositions in her name. As she transcends the boundaries of class, caste, language and cultures, Mira transforms into a cultural enigma even beyond a religious concern.



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Smart Healthcare System Design: Security and Privacy Aspects

S. K. Hafizul Islam (Editor)(/en-us/search?pq=%7Crelevance%7Cauthor%3AS.+K.+Hafizul+Islam), Debabrata Samanta (Editor)(/en-us/search?pq=%7Crelevance%7Cauthor%3ADebabrata+Samanta)

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The purpose of this book is to help achieve a better integration between the work of researchers and practitioners in a single medium for capturing state-of-the-art IoT solutions in healthcare applications to address how to improve the proficiency of wireless sensor networks (WSNs) in healthcare. It explores possible automated solutions in everyday life, including the structures of healthcare systems built to handle large amounts of data, thereby improving clinical decisions; which is why this book will prove invaluable to professionals who want to increase their understanding of recent challenges in the IoT-enabled healthcare domain. The 14 chapters address various aspects of the IoT system, such as design challenges, theory, various protocols, and implementation issues, and also include several case studies.

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Chapter 3 Using Blockchain in Intermittently Connected Network Environments



Souvik Basu, Soumyadip Chowdhury, and Sipra Das Bit

Abstract This chapter explores the possible integration of blockchain technology with intermittently connected networks, towards exploiting the utility and availability of blockchain technology in intermittently connected network environments. It also identifies the challenges of such integration and possible solutions using off-the-shelf technology. Finally, the chapter identifies open research areas in the domain of using blockchain in intermittently connected network environments that would foster new research avenues in both industry and academia.

3.1 Introduction

Blockchain [1–3] technology represents a technological innovation that is supposed to alter our lives in several aspects like the way we conduct business, manage assets, use machines, visit hospitals, cast votes, rent cars and even prove our identity. Apart from these traditional and urban applications, other specialized blockchain use cases can be disaster management, remote healthcare in developing countries, vehicular communications or even deep-space communications. However, in one hand, these specialized use cases are characterized by absence of traditional communication infrastructure, intermittent connectivity and disconnection of devices due to limitations of power, node mobility and sparse node density. On the other hand, the usage of blockchain is restricted by the user's access to end-to-end internet connection. This limitation restricts the use cases to access blockchain and prevents its adoption in intermittently connected network environments. In fact, reliance on the internet is

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Advanced Application Based Simulation

Dwaipayan Sen

Department of Chemical Engineering Heritage Institute of Technology Kolkata, West Bengal

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Blockchain Leveraged Node Incentivization in Cooperation-Based Delay Tolerant Networks

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Discrimination of Rice Based on Alkali Spreading Value (ASV) by Machine Vision Technique

Amitava Akuli¹, Anil Kumar Bag^{2(⊠)}, Arindam Sarkar², Abhra Pal¹, Sabyasachi Majumdar¹, Tamal Dey¹, Gopinath Bej¹, Srimoyee Chaudhury², and Nabarun Bhattacharyya¹

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Abstract. Physical and biochemical attributes are commonly used for characterization of rice. The physical attributes are related to the quantification of size, shape, colour and texture of the rice grains. Biochemical attributes are assessed from cooking and eating characteristics of rice and are termed like alkali spreading value (ASV), amylose content (AC), gel consistency (GC), grain elongation etc. Estimation of biochemical attributes are often time consuming and require meticulous effort for sample preparation, storage and manual measurement. The gelatinization temperature (GT) is related to Alkali spreading value of rice and is partly associated with the amylose content of the starch. GT has a negative correlation with cooking temperature of rice. In this paper image analysis technique has been proposed for discrimination of rice. A portable flat bed scanner has been used as the imaging device and image analysis software has been developed to measure the rate of dispersion during ASV testing. This machine vision technique is a faster and effective way to determine the ASV. The results obtained are promising towards this new approach for objective estimation of ASV.

Keywords: Alkali spreading value · Gelatinization temperature · Spreading index · Digital image analysis

1 Introduction

Rice is a staple food of nearly one-half of world's population and occupies a pivotal role in Indian food and livelihood system. A trained human expert subjectively evaluates the physical attributes like size, shape, colour and texture of rice based on visual inspection and smelling sensation. The cooking and eating characteristics are assessed by biochemical attributes such as ASV, AC, GC, grain elongation etc. The export quality measures are driven by physical and biological attributes and are thus need to

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be measured or quantified efficiently. The process of evaluation of the said attributes by chemical means, visual inspection are subjective, time consuming, non-repeatable and depend on human perception. Alkali spreading value of whole kernel milled rice is the measure of volume expansion in contact with dilute alkali and also a measure of gelatinization temperature. Again gelatinization temperature is partly associated with the amylose content of the starch. Disintegration of different rice grain in contact with dilute alkali may vary from no apparent effect to a completely dispersed state. Degree of disintegration is evaluated using seven point scale (1 to 7). Computer vision system based on image processing techniques has been developed in order to quantitatively characterize complex size, shape, colour and texture properties of rice [1]. Little et al. [2] described in 1958 a rapid and easy method to evaluate the ASV of starch granules.

Conventional procedure for estimation of ASV is conducted in Petri plates containing six raw milled rice grains immersed in potassium hydroxide (1.7%) solution. The plates are incubated overnight at room temperature and the scores (1 to 7) are assigned based on degradation of rice grains. The degree of degradation is evaluated visually by human expert and is compared to that of samples of known behavior which is expressed by a numerical score ranging from 1 (kernels not affected by alkali) to 7 (kernels completely dispersed and intermingled). Though the decision making process is performed visually or manually by trained inspectors, which is important of course, but very often it is time consuming, laborious, monotonous and of subjective in nature. The increasing demand for objective, consistent and efficient evaluations led to the development of machine vision application.

In this paper a machine vision technique for analysis of Alkali Spreading Value is proposed. Calculation of the spreading index from image data is used to measure degree of disintegration area during treatment of rice kernel with KOH solution. It is also revealed that increasing the concentration from 1.7% (traditionally used) to 2.2% reduces the time of experiment. Finally, the method proposed though approximate, is faster and effective way to determine the ASV.

2 Materials and Methods

2.1 Sample Collection

In this experiment, a total of 8 varieties of rice samples each of 10 gm and three different ASV categories (High, intermediate and Low) are collected from "Indian Agriculture Research Institute", New Delhi in the form of paddy rice. Among these rice samples five varieties are with low category, two varieties are with intermediate category and one variety with high ASV rating. Details of rice sample are shown in the Table 1.
970 A. Akuli et al.

ASV rating	Category
6–7	High
1–2	Low
1–2	Low
1–2	Low
3–5	Intermediate
1–2	Low
1–2	Low
3–5	Intermediate
	ASV rating 6–7 1–2 1–2 1–2 3–5 1–2 1–2 1–2 3–5

Table 1. Details of rice sample with ASV rating.

2.2 Sample Preparation and Procedure for Manual Testing

The entire experiment is driven towards reducing the time for analyzing the quality of rice. Through various tests [2, 3, 4], it is observed that the quality analysis of a particular rice sample requires a day when the sample treated with 1.7% KOH solution. This method is tedious and requires manual intervention as well. Following steps are followed to perform the alkali test manually.

Five whole milled dehusked rice kernels are collected randomly from each variety of rice and placed on a Petri dish with sufficient gap between the grains so that the grains did not touch each other. 20 ml of 1.7% KOH solution is poured in the Petri dish carefully without disturbing the grain position. The Petri dishes are then covered and kept for 23 h of incubation at room temperature (25° –27 °C). After 23 h of incubation, each grain is visually examined for its level of intactness or degree of dispersion and 3 human experts assigned a numerical score (ASV) as described in Table 1. For each sample, the test is repeated 3 times on 5 grains.

Manual result is recorded for correlation with machine vision solution. In our experiment with machine vision application, same procedure is followed as stated above. But, the concentration of the KOH solution is varied from 1.7% to 2.5% in order to reduce the duration of experiment. Best result is found for 2.2% KOH concentration.

2.3 ASV Testing by Image Analysis

2.3.1 Image Capturing Setup

A customized image capturing setup has been developed. It is comprised of a portable flat bed image scanner (Make: Fujitsu, Model: fi-65F), commercially available Petri dish and a sample holder for proper positioning of the Petri dish on the scanner. The top cover of the scanner is covered with a black paper to capture images with a black background. Petri dish comprising of rice sample (randomly selected five whole rice grains) is positioned inside the sample holder as shown in the Fig. 1.

Discrimination of Rice Based on Alkali Spreading Value (ASV) 971



Fig. 1. Imaging setup for ASV measurement.

The steps of digital image analysis are described below.

- A. *Image Capturing*: The images of the rice sample on the Petri dish are captured using the flatbed scanner at 300 dpi of resolution.
- B. *Image conversion*: The 24 bit colour images are then converted to 8 bit gray scale images.
- C. *Image enhancement*: Histogram equalization technique is used to process the images in order to adjust the contrast of the input image by modifying the intensity distribution of the histogram.
- D. *Segmentation*: Output of histogram equalized images are comprised of white coloured rice grain with black background. An area threshold method is applied to eliminate very small objects with single pixel or few pixels area.
- E. *Noise cleaning*: Morphological image processing is used to remove imperfections caused by the form and structure of the image.
- F. *Component Labeling*: Component or particle labeling provides unique identification number to every particle offering the feature detection easier.
- G. *Particle analysis*: In this paper, only the area (A) of each rice kernel dipped in the alkali solution is considered. The calculation of particle area is done by counting the number of pixels within that particle. A new index, S_t (Spreading Index), has been proposed in this paper and described as the ratio of mean area of rice kernels at any point of time (t) and the mean area of rice kernels at the beginning of the test.

$$S_t = \frac{A_t - A_0}{A_0}$$

Where, A_t = mean area of rice kernels at any point of time (t)

 A_0 = mean area of rice kernels at the beginning of the test

 $S_t = Spreading Index$

The spreading of kernel relative to the initial area is used to eliminate the effect of the kernel dimensional variability and the average area of five rice kernel has been considered to eliminate the uncertainty in chemical reactions between KOH and rice kernels. For each sample, the test is repeated 4 times on 5 grains.

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3 Result and Discussion

Eight different rice variations as stated in Table 1 are considered for our research work. Earlier method of quality estimation through various tests with KOH solution requires a day to estimate the quality of a particular rice sample. Also the method is tedious and requires manual intervention as well. Our experiment conducts using KOH solutions with different concentration ranging from 1.7% to 2.5% and it is observed that the rice grains with intermediate and high value are generally dissolves in 6 h with 2.2% concentration. It is further observed that higher concentration beyond 2.2% is difficult for classification of high and intermediate rice gains as the higher concentration dissolves both varieties of rice samples quickly. The experimental results revealed that by increasing the concentration from 1.7% (traditionally used) to 2.2%, would reduce the experimentation time to few hours only (typically 2–3 h).

For each sample the ASV is computed from the initial and final kernel area produced by the image processing technique. Also each ASV value is also tagged with time. The Fig. 2 showing the variation of ASV in terms of spreading index against the number of iterations (interval of 5 min) for the rice varieties considered. The Table 2 below shows time at which Maximum ASV occurs.



Fig. 2. Plot showing variation of ASV for rice considered.

Sl. No.	Rice sample	Maximum ASV	Max ASV reached at time (Minutes)	Category
1	PB 1	1.64	32.52	Low
2	PB 1401	1.92	180.72	Low
3	P 834	1.85	144.23	Low
4	PS 5	3.48	164.60	High
5	P 44	1.78	114.60	Low
6	PUSA 1121	2.6	277.52	Medium
7	PS 3	2.34	250.10	Medium
8	PS 2	1.93	82.92	Low

Fable 2. Time at which maximum ASV occi
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4 Conclusions

A portable scanner based machine vision system for rapid estimation of alkali spreading value (ASV) is presented in this paper. The image processing technique is applied to calculate the spreading index which is a measure of degree of disintegration area during treatment of rice kernel with KOH solution. The entire experiment is driven towards reducing the time and the manpower for analyzing the ASV of rice. Through various tests, it is observed that the initial KOH concentration used earlier required a day to perform the quality analysis on a particular rice sample. Also the method is tedious and requires manual intervention as well. The present study proves that the duration of the experiment may be reduced by increasing the concentration from 1.7% (traditionally used) to 2.2%. The dataset considered is only for few varieties from one location do not possess wide variability. The solution, however, can be made versatile by building the models of different rice varieties from different geographical regions in India and other rice producing countries. Nevertheless, the machine vision solution described in this paper being low cost and portable, is affordable by the rice quality control laboratories and has the potential to be useful measurement tool for ASV.

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