International Conference

on

EMERGING TRENDS IN MATHEMATICAL SCIENCES & COMPUTING

(IEMSC-21)

Date: February 05-07, 2021

BOOK OF ABSTRACTS

Organized by

IEM
श्रद्धावान लभते ज्ञानम्
INSTITUTE OF ENGINEERING & MANAGEMENT
Good Education, Good Jobs

Department of Basic Science & Humanities

Institute of Engineering & Management,

KOLKATA, INDIA

In association with

Society for Data Science

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S4DS IEM Student chapter

Smart Society, USA

SMART.

Editors:

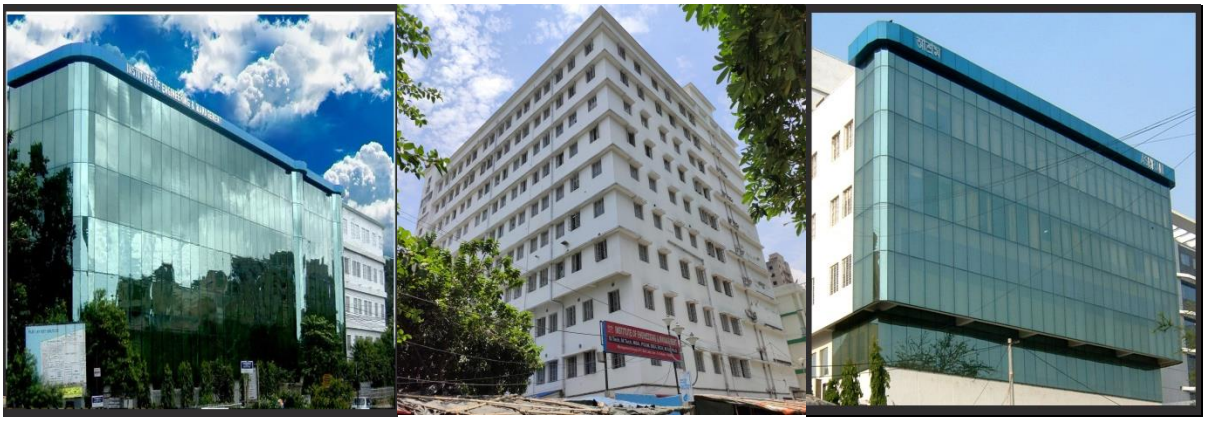
Prof. Dr. Sharmistha Ghosh
Prof. Dr. Krishanu Deyasi
Prof. Biswadip Basu Mallik
Prof. Santanu Das

About the Conference

IEMSC-21 aims to provide a premier platform for mathematicians, computer engineers, researchers, scientists and academicians from universities, research organizations and industries to present their work and to share experiences and ideas in the emerging areas of **Mathematics & Theoretical Computer Science.** The conference will primarily focus on the *amalgamation* of ***Mathematics*** for modern scientific investigations together with the technological innovations of ***Computing*** and dissemination of new technical ideas and features that can be incorporated in day-to-day life for the benefit of the society.

About the Organizer

Institute of Engineering & Management, Kolkata, INDIA



The Institute of Engineering & Management (IEM), Kolkata is one of the oldest premier technical institutes in West Bengal, India and had been providing quality education in the fields of technology and management since its inception in 1989. Being a **NAAC A** category institution and a **NIRF** rank holder, IEM continuously strives to reach out and add worth to people's lives, impart quality education for creating efficient manpower for the future, and promote a superior category of students and researchers who would apply knowledge for the advancement of society and meet the challenges of a rapidly changing world. It aims to spread and enhance education, collaborate with national and international institutions, promote interdisciplinary research work, upgrade educational standards and empower the youth with a holistic development.

PREFACE

We are pleased to present the ***Book of Abstracts*** for the 2nd International Conference on ***Emerging Trends in Mathematical Sciences & Computing*** **(IEMSC-21)**, organized by the **Institute of Engineering & Management, Kolkata, India**.

IEMSC-21 focuses on the recent advances in the field of Theoretical Computer Science as well as its blending with Mathematical techniques. It presents the current scientific as well as technological innovations by leading academicians, eminent researchers and experts throughout the globe. The conference aspires to exhibit scientific advancements in diversified spectrum that includes Differential as well as Integral Equations with applications, Computational Fluid Dynamics, Network Theory & Optimization, Control & Machine Learning, Big Data Analytics, IoT, Cryptography, Fuzzy Automata and many more. Even the challenges of the ongoing COVID-19 pandemic would be addressed and how Mathematics can shape the pandemic would be analyzed. We sincerely hope that this volume will serve as a valuable reference resource for researchers in academia and industry.

It is our pleasure to acknowledge the help we have received in finalizing the technical contents of this International Conference. We wish to thank all the Reviewers and Editorial Committee members who helped us in completing the review process in timely manner. We thank all the authors, co-authors, session chairs for enriching our International Conference through their valuable participation. Our deepest gratitude goes to the national and international experts who will deliver talks on various emerging domains during the keynote or plenary sessions of the conference and enlighten the gathering.

We are grateful to the Advisory Committee members of IEMSC-21 for their valuable suggestions and guidance. We are also thankful to all Organizing Committee members as well as student volunteers for their hard work for building up this exciting conference program.

We would like to thank Prof. Dr. Satyajit Chakrabarti, President, Prof. Dr. Satyajit Chakrabarti, Director, Prof. Dr. Arun Kr. Bar, Dean Engineering and Prof. Prabir Kr. Das, Head, Department of Basic Science & Humanities, IEM Kolkata for their constant support and valuable guidance for organizing this scientific meeting.

On this note, we heartily welcome all the delegates at this International Conference. We hope this academic forum will provide requisite intellectual stimulation for a healthy discussion, thus paving way to our own contribution towards an innovative society. It is our firm belief that the conference will fulfill all the objectives with which it is being organized.

Prof. Dr. Sharmistha Ghosh

Prof. Dr. Krishanu Deyasi

Prof. Dr. Soumen Nandi

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International Conference
on
EMERGING TRENDS IN MATHEMATICAL SCIENCES AND COMPUTING (IEMSC-21)

5^{th} - 7^{th} February, 2021

Programme Schedule

Venue: Online Platform

Zoom Link: https://zoom.us/j/7152617227 (Inaugural, Keynote/Plenary, Valedictory Sessions)		
Date	**Time**	**Programme**
5th February, 2021		***Inaugural Session***
	6.00 PM – 6.05 PM	**Speech** by **Prof. Dr. Satyajit Chakrabarti, President,** Institute of Engineering & Management, Kolkata, India
	6.05 PM – 6.10 PM	**Speech** by **Prof. Dr. Satyajit Chakrabarti, Director,** Institute of Engineering & Management, Kolkata, India
	6.10 PM – 6.15 PM	**Speech** by **Prof. Dr. Arun Kr. Bar, Dean Engineering,** Institute of Engineering & Management, Kolkata, India
	6.15 PM – 6.20 PM	**Speech** by **Prof. Prabir Kr. Das,** Head, Department of Basic Science & Humanities, Institute of Engineering & Management, Kolkata, India
	6.20 PM – 6.25 PM	**Speech** by **Prof. Dr. Sharmistha Ghosh**, **Convener**, IEMSC-21
	6.25 PM – 6.30 PM	**Opening** of **Book of Abstracts**
		Keynote/Plenary Session I **Session Chair**: **Prof. Dr. Saswati Barman**, Institute of Engineering & Management, Kolkata, India
	6.30 PM – 7.15 PM	**Keynote Address** by **Prof. Dr. Mark Levi**, Pennsylvania State University, USA
	7.15 PM – 8.00 PM	**Keynote Address** by **Prof. Dr. Enrique Zuazua**, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany
	8.00 PM – 8.45 PM	**Plenary talk** by **Prof. Dr. Leopoldo Eduardo Cárdenas-Barrón,** Tecnológico de Monterrey, Monterrey, México

6th February, 2021	***Plenary Session II*** **Session Chair**: **Prof. Dr. Saktipada Nanda**, Institute of Engineering & Management, Kolkata, India	
	2:30 PM - 3:15 PM	**Plenary talk** by **Prof. Dr. Tanka Nath Dhamala**, Tribhuvan University, Nepal
	3:15 PM – 4:00 PM	**Plenary talk** by **Prof. Dr. Defeng Sun**, The HongKong Polytechnic University, HongKong
	4:00 PM - 4:45 PM	**Plenary talk** by **Prof. Dr. Daniele Ritelli**, Università di Bologna, Italy
	4.45 PM - 5.00 PM	**BREAK**
	Technical Session I	
	5.00 PM - 6.00 PM	**Contributed Paper Presentation**
	Track – I	**Session Chair**: **Prof. Dr. Payel Mandal,** Jogamaya Devi College, Kolkata, India **Session Co-chair**: **Prof. Ranabir Banik**, Institute of Engineering & Management, Kolkata, India **Google meet link: https://meet.google.com/sqe-kovv-scg**
	Track – II	**Session Chair**: **Prof. Dr. Kalimuddin Ahmad**, Aligarh Muslim University, India **Session Co-chair**: **Prof. Dr. Satyasaran Changdar**, Institute of Engineering & Management, Kolkata, India **Google meet link: https://meet.google.com/hig-tcwb-ozi**
	Track – III	**Session Chair**: **Prof. Dr. Aradhana Dutt Jauhari**, Galgotias University, India **Session Co-chair**: **Prof. Dr. Soumyadipto Pal**, Institute of Engineering & Management, Kolkata, India **Google meet link: https://meet.google.com/baw-smcs-rjx**
	Track – IV	**Session Chair**: **Prof. Dr. Amol Goje,** President, Society for Data Science, India **Session Co-chair**: **Prof. Arnab Basu**, Institute of Engineering & Management, Kolkata, India **Google meet link: https://meet.google.com/ndc-hfwt-hoo**
	6.00 PM - 6.15 PM	**BREAK**

6th February, 2021	***Plenary Session III*** **Session Chair**: **Prof. Dr. Koyel Ganguly**, Institute of Engineering & Management, Kolkata, India	
	6.15 PM – 7.00 PM	**Plenary talk** by **Prof. Dr. Jens Struckmeier**, Universität Hamburg, Germany
	7.00 PM - 7.45 PM	**Plenary talk** by **Prof. Dr. Carla M.A. Pinto,** Instituto Superior de Engenharia do Porto, Portugal
	Plenary Session IV **Session Chair**: **Prof. Sandip Choudhury**, Institute of Engineering & Management, Kolkata, India	
	7.45 PM - 8.30 PM	**Plenary talk** by **Prof. Dr. Javed Mashregi**, Université Laval Québec, QC, Canada
	8.30 PM - 9.15 PM	**Plenary talk** by **Prof. Dr. Jerry L. Bona**, University of Illinois, Chicago, USA
7th February, 2021	***Plenary Session V*** **Session Chair**: **Prof. Dr. Kakoli Dutta**, Institute of Engineering & Management, Kolkata, India	
	2:30 PM - 3:15 PM	**Plenary talk** by **Prof. Dr. Gennaro Infante**, Universita' della Calabria, Italy
	3:15 PM - 4:00 PM	**Plenary talk** by **Prof. Dr. Ahmed A. Elngar**, Beni-Suef University, Egypt
	4:00 PM - 4:45 PM	**Plenary talk** by **Prof. Dr. Taraneh Eglidos**, Sharif University of Technology, Iran
	4.45 PM - 5.00 PM	**BREAK**
	Technical Session II	
	5.00 PM - 6.00 PM	**Contributed Paper presentation**
	Track –V	**Session Chair**: **Prof. Dr. Ihtiram Raza Khan**, Jamia Hamdard (Deemed University), New Delhi, India **Session Co-chair**: **Prof. Amartya Mukherjee**, Institute of Engineering & Management, Kolkata, India **Google meet link: https://meet.google.com/wom-oyht-zdu**

7th February, 2021	**Track –VI**	**Session Chair**: **Prof. Dr. Gopal Shit**, Jadavpur University, Kolkata, India **Session Co-chair**: **Prof. Dibyasree Guha**, Institute of Engineering & Management, Kolkata, India **Google meet link: https://meet.google.com/ebz-jhtg-oer**
	Track –VII	**Session Chair**: **Prof. Sabyasachi Mukhopadhyay,** Maulana Abdul Kalam Azad University of Technology, West Bengal, India **Session Co-chair**: **Prof. Triparna Dutta**, Institute of Engineering & Management, Kolkata, India **Google meet link: https://meet.google.com/thi-ijnm-vmx**
	Track –VIII	**Session Chair**: **Prof. Dr. Amol Goje,** President, Society for Data Science, India. **Session Co-chair**: **Prof. Ayan Panja**, Institute of Engineering & Management, Kolkata, India **Google meet link: http://meet.google.com/rms-bszv-rxd**
	6.00 PM - 6.15 PM	**BREAK**
	Valedictory Session	
	6.15 PM – 6.45 PM	**Speech** by **Prof. Dr. Soumen Nandi, Convener**, IEMSC-21 Distribution of Certificates **Vote of Thanks** by **Prof. Dr. Krishanu Deyasi, Convener**, IEMSC-21

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Keynote
and
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Keynote Address

Schroedinger's equation, tire tracks and rolling cones in the Minkowski space

Prof. Dr. Mark Levi

Professor of Mathematics

Pennsylvania State University

USA

I will describe a hidden but very close connection between the objects mentioned in the title. The tire track problem is a simple geometrical model suggested by the motion of a bike: a segment of fixed length with one end ("the front wheel") moves along a prescribed path in the plane, while the other end ("the rear wheel") tracks the front end: its velocity is constrained to the direction of the segment (no sideslip). I will describe the equivalence between this problem on the one hand and the stationary Schroedinger's equation on the other.

It turns out that the Schroedinger potential can be visualized as a path of the "front wheel"; and solutions of the equation can be viewed as paths of the rear wheel. Stationary Schroedinger's equation, also known as Hill's equation, is ubiquitous in mathematical, physical and engineering settings, and this equivalence opens a new "bicycle" interpretation of this basic system. In conclusion I will describe how all this (and some more general linear Hamiltonian systems) can be viewed as one cone rolling on another stationary cone, with the shapes of the cones determined by the potential in the Schroedinger's equation, or by the Hamiltonian in the more general case.

Keynote Address

Neural Differential Equations, Control and Machine Learning

Prof. Dr. Enrique Zuazua

Chair in Applied Analysis

Alexander von Humboldt-Professorship

Department of Mathematics

Friedrich-Alexander-Universität Erlangen-Nürnberg,

Erlangen, Germany

We discuss Neural Ordinary Differential Equations (NODEs) from a control theoretical perspective to address some of the main challenges in Machine Learning and, in particular, data classification and Universal Approximation. More precisely, we adopt the perspective of the simultaneous control of systems of NODEs. For instance, in the context of classification, each item to be classified corresponds to a different initial datum for the Cauchy problem of the NODE. And all the solutions corresponding the data under consideration need to be driven to the corresponding target by means of the same control. We present a genuinely nonlinear and constructive method, allowing to estimate the complexity of the control strategies we develop. The very nonlinear nature of the activation functions governing the nonlinear dynamics of NODEs under consideration plays a key role. It allows deforming half of the phase space while the other half remains invariant, a property that classical models in mechanics do not fulfill. This very property allows to build elementary controls inducing specific dynamics and transformations whose concatenation, along with properly chosen hyperplanes, allows achieving our goals in finitely many steps. We also present the counterparts in the context of the control of neural transport equations, establishing a link between optimal transport and deep neural networks.

Plenary Talk

Optimal inventory policy when the demand has a power pattern

Prof. Dr. Leopoldo Eduardo Cárdenas-Barrón

Professor

Department of Industrial and Systems Engineering

School of Engineering and Sciences

Tecnológico de Monterrey

Monterrey, México

The demand for goods depends on several factors, such as the price, time, and stock, among others. In some situations occurs shortages which must be handle in a proper manner. Furthermore, the holding cost for maintaining the goods in a warehouse varies over time; specifically it rises with time, as a long period of storing involves more expensive warehouse equipment and facilities. In this context, this talk presents an inventory model with price and time sensitive demand considering nonlinear holding cost and shortages. The demand for the goods conjointly combines the effect of the selling price and a time power function; the mixture of these two factors is done in an addition manner. The shortages are allowed and these are completely backordered. The holding cost is a power of the time that the item is maintained in the warehouse facility. For optimizing the inventory model, firstly some theoretical results are obtained to demonstrate that the total profit function is strictly pseudo concave with respect to the decision variables; secondly an algorithm that finds the optimal solution is developed. The proposed inventory determines the optimal inventory policy which maximizes the total profit.

Keywords: Pricing, order quantity; backordering level; nonlinear holding cost: power demand.

Plenary Talk

Flow Improvement Strategy using Lane Reversals on Evacuation Network

Prof. Dr. Tanka Nath Dhamala

Professor & Head

Central Department of Mathematics

Tribhuvan University

Kathmandu, Nepal

Dynamic flow problems have been emerging topic of research for emergency planning. They have been modeled and solved using various mathematical techniques like mathematical programming, fuzzy optimization, network flow theory, differential equations, variational inequalities and optimal control. We consider the flow over time problems where objectives are multiple; minimization of time and maximization of flow or a bi-objective one. We summarize various models addressing these objectives that are restricted by capacity and flow conservation constraints. The main focus of our presentation will be to establish the significance of network reconfiguration strategy in order to improve flow value and reduce the evacuation time. A number of applications will be highlighted.

Plenary Talk

Exploring the Data and Solution Sparsity in Large Scale Optimization Problems

Prof. Dr. Defeng Sun

Chair Professor

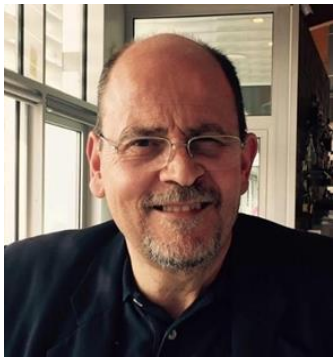
Applied Optimization and Operations Research

The Hong Kong Polytechnic University

It is widely believed by many researchers, in particular by those outside the traditional optimization community, that the second-order methods such as Newton's method are no longer applicable for solving large scale optimization problems. This is partially true for optimization models that neither need a good optimal solution nor need to be solved quickly. In this talk, we shall first use large scale statistical optimization problems arising from machine learning to explain why the second-order methods, in particular the proximal point dual Newton algorithms (PPDNA), if wisely used, can be much faster than the first-order methods. The key point is to make use of the second-order sparsity of the optimal solutions in addition to the data sparsity so that, at each iteration, the computational costs of the second-order methods can be comparable or even lower than those of the first-order methods. Equipped with the PPDNA, we shall then introduce adaptive dimension-reduction methodologies to generate solution paths of very large sparse statistical optimization problems of particular importance in applications. Finally, we shall illustrate the high efficiency of our approach with extensive numerical results.

Plenary Talk

Keplerian Trigonometry



Prof. Dr. Daniele Ritelli

Professor of Mathematical Analysis

Department of Statistical Sciences

University of Bologna, Italy

Taking the hint from usual parametrization of circle and hyperbola, and inspired by the pathwork initiated by Cayley and Dixon for the parametrization of the "Fermat" elliptic curve $x^3 + y^3 = 1$, we develop an axiomatic study of what we call "Keplerian maps", that is, functions $m(k)$ mapping a real interval to a planar curve, whose variable k measures twice the signed area swept out by the $O-$ray when moving from 0 to k. Then, given a characterization of k-curves, the images of such maps, we show how to recover the k-map of a given parametric or algebraic k-curve, by means of suitable differential problems.

Keywords: Generalized trigonometric functions, Keplerian maps, Eulerian functions, Elliptic integrals, Gauss Hypergeometric function.

Plenary Talk

Kinetic-Induced Moment Systems for Nonlinear Balance Laws

Prof. Dr. Jens Struckmeier

Professor

Department of Mathematics

Faculty of Mathematics, Informatics and Natural Sciences

University of Hamburg, Germany

Abstract: In my talk I will present a novel approach to relate Boltzmann-like kinetic transport equation to nonlinear hyperbolic balance laws via infinite moment systems. In particular I will show how to obtain finite moment systems by asymptotic motivated closure relations. For simplicity we will focus mainly on the classical Burger's equation, where the resulting moment equations may act as indicator functions to detect shock or rarefaction waves. The approach can be extended to more general balance laws and even hyperbolic systems, like the shallow water equations.

Plenary Talk

How can Mathematics help to shape the pandemic?

Prof. Dr. Carla M.A. Pinto

Adjunct Professor

Sub director of the Department of Mathematics

School of Engineering,

Polytechnic of Porto, Portugal

In the era of COVID-19, researchers and politics turn more and more to mathematical models, to gain insight and predict the course of epidemics. Politics search for epidemiologists, for guidance on what should be the best control practices to avoid a disaster in terms of human lives. In this talk, we will focus on the applicability of mathematical models of infectious diseases. We go from the usual and simple Susceptible-Infectious (SI) model to more realistic ones, which include variable transmission rate, treatment, intervention policies, non-integer order derivatives, amongst others.

Plenary Talk

The hidden component in signal approximation

Prof. Dr. Javad Mashreghi

Département de Mathématiques et de statistique

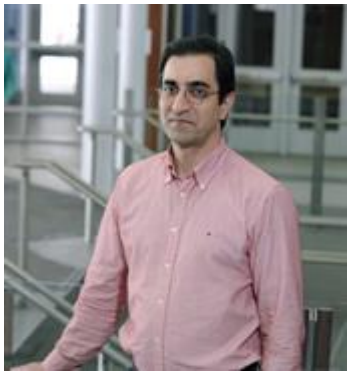
Université Laval

Québec, QC, Canada

President

Canadian Mathematical Society

Ottawa, ON, Canada.



Taylor (analytic) polynomials or (harmonic) trigonometric polynomials are not the most natural objects in approximation theory. However, in most cases Cesaro means help and the resulting sequence of Fejer polynomials are a good remedy. We study some function spaces on the open unit disc. In the context of Local Dirichlet Spaces, we show that the sequence of Taylor polynomials may (badly) diverge. However, and surprisingly enough, if we properly modify just the last harmonic, the new sequence becomes convergent. In the general setting of super-harmonically weighted Dirichlet spaces, we show that Fejer polynomials and de la Vallee Poussin polynomials are the proper objects for approximation. We end by presenting a rather strange Hilbert space in which odd functions cannot be approximated by odd polynomials. Hence, the traditional recovery methods fail to completely restore such signals.

Plenary Talk

Of what use is the mathematical theory of water waves?

Prof. Dr. Jerry L. Bona

Professor

Department of Mathematics, Statistics & Computer Science

University of Illinois

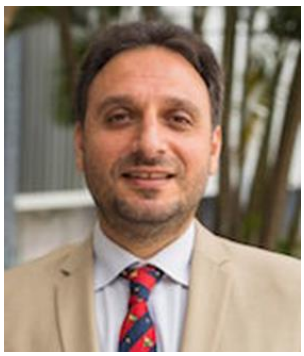
Chicago, USA

The mathematical theory of surface and internal water wave propagation goes back several hundred years. Despite its age and the many distinguished developments within its purview, it is still a very lively area. Mathematicians, physicists, engineers of many stripes and biologists all have their heroes in the area.

The subject is too large for a comprehensive review, so the lecture will focus on the nonlinear, dispersive theory that has blossomed in the last few decades and on a few of its applications. As time permits, we will discuss tsunami's, rogue waves, beach protection strategies and propagation in fiber optics cables.

Plenary Talk

Nontrivial solutions of systems of perturbed Hammerstein integral equations with functional terms



Prof. Dr. Gennaro Infante

Associate Professor of Mathematical Analysis

Dipartimento di Matematica e Informatica,

Universita' della Calabria, Italy

We discuss the solvability of a fairly general class of systems of perturbed Hammerstein integral equations with functional terms that depend on several parameters. The nonlinearities and the functionals are allowed to depend on the components of the system and their derivatives. The results are applicable to systems of nonlocal second order ordinary differential equations subject to functional boundary conditions, this is illustrated in an example. Our approach is based on the classical fixed point index.

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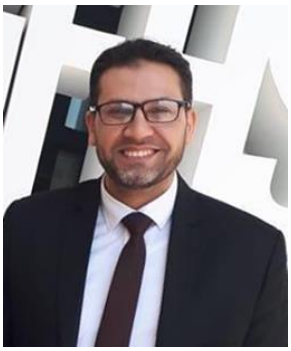
Plenary Talk

Pandemic Covid-19: Challenges and Future of New Technologies



Prof. Dr. Ahmed Elngar

Assistant Professor

Faculty of Computers & Artificial Intelligence

Beni-Suef University

Beni Suef City, Egypt

As we know, the (Covid-19) pandemic spreads, technological applications are multiplying in an attempt to control the situation, treat patients in an effective way and facilitate the efforts of overworked healthcare workers, while developing new, effective vaccines. So, what we need to know is: how different technological domains are helping to fight against this pandemic disease by means of innovative applications. Also, we will highlight on the main legal and regulatory challenges, but also on the key ethical dilemmas that the various uses of these technologies pose when applied in a public-health emergency context such as the current one.

In addition, scan of the technological horizon in the context of Covid-19 indicates that technology in itself cannot replace or make up for other public policy measures. But it does have an increasingly critical role to play in emergency responses.

Plenary Talk

Lattices in Post-Quantum Cryptography

Prof. Dr. Taraneh Eghlidos

Associate Professor

Electronics Research Institute,

Sharif University of Technology

Tehran, Iran

In this talk, I will first give a brief description of cryptography and its classification, in general, and then explain the motivation for migrating to post-quantum cryptography. In the second part, I am going to review some basic concepts of lattices and introduce lattice codes as the (finite) set of lattice points within a certain region which plays an important role in real world applications. Finally, I will put forward some ideas from a joint work with my colleagues, Dr. Khadijeh Bagheri and Dr. Mohammadreza Sadeghi from Amir Kabir University of Technology. In this work, we have introduced a new family of lattices, namely QuasiCyclic Moderate-Density Parity-Check (QC-MDPC) lattices, which are a special case of Low-Density Parity-Check (LDPC) lattices, and an improved Bit Flipping Algorithm (BFA) for decoding of these lattices. Encoding and decoding implementations of QC-MDPC lattices are practical in high dimensions. Indeed, to take advantage of practical decoding, we use the so-called "Construction-A lattices" which makes a tight connection between the structure of lattices and codes. Using these features, we have designed the first latticebased public-key encryption scheme enjoying linear time and space complexities of encryption and decryption in terms of the corresponding lattice dimension, reasonable key size, and small message expansion. On the other hand, we have shown that the cryptosystem is resistant against all known attacks both on lattice-based and code-based cryptosystems for different levels of security.

Abstract

of

Selected Papers

Track
of
Applied Mathematics

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper2***

Calculus and Roller Coasters

Surupi Nandi

Department of Basic Science and Humanities

Institute of Engineering and Management, Kolkata, India

Email: surupi.nandi@gmail.com

Abstract: In this paper, we will use limits, derivatives and integrals to derive kinematic equations which will relate to motion of real life roller coasters. Further, with the help of those derivations, we will solve questions that arise from working in this field, similar to how engines face them to make these rides more fun and safe as well.

Keywords: Differential Equations, Kinematics, Roller Coasters.

Track: ***Applied Mathematics***

Paper ID: *IEMSC-21_paper7*

Quadrology: The Logical Paradigm to solve the Millennium Prize Problems

John Austin Mendoza

Department of Education – Philippines, Philippines

Email: johnaustin.mendoza@gmail.com

Abstract: This research aims to conceptualize the idea of the annexed or sequel of the author's inventorship: the Quadronometry. And this sequel will be discussed here as the proposed application to solve the unsolved word problems as per the mandate of Clay Mathematics Institute. The sequel called by the author as the Quadrology, or the Quadronometric Logic. This is a descriptive qualitative research through the use of documentary and literary review analysis based from the descriptions of the remaining unsolved mathematical problems, how the Quadrology be applied to these word problems and on how to be recommended to all mathematics enthusiasts especially for the society of mathematics around the world. These are the unsolved word problems in mathematics. There were seven, but there was one considered a solved word problem:

1. P vs. NP Problem
2. Yang – Mills and Mass Gap
3. Riemann Hypothesis
4. Navier – Stokes Equation
5. Hodge Conjecture
6. Birch and Swinnerton – Dyer Conjecture
7. Poincare's Conjecture (Solved!)

You will soon notice why the author – researcher put the P vs. NP Problem be on the top list.

Keywords: Quadrology, Quadronometry, Millennium Prize Problems.

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper8***

Quadronometry as a Reconciling Tool for Newton and Einstein Theories

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Abstract: The law of universal gravitation, according to Sir Isaac Newton (1642 – 1727), states that the gravitational force between any two objects is directly proportional to the product of their masses, and inversely proportional to the square of their distance between their centers. This shows up that as per the claim of Newton, there is always an imaginary string to represent a gravitational force between two objects, just as the Earth revolves around the Sun. But after more than two hundred years have passed, another great genius of Science was born, Albert Einstein who attempted to contradict what Newton had claimed. And one of the greatest principles of modern physics as we are currently studying today, the General Theory of Relativity that suggestively governing the theory of gravitation formulated by Albert Einstein.

The development of general relativity began with the equivalence principle, under which the states of accelerated motion and being at rest in a gravitational field (for example, when standing on the surface of the Earth) are physically identical. The upshot of this is that free fall is inertial motion: an object in free fall is falling because that is how objects move when there is no force being exerted on them, instead of this being due to the force of gravity as is the case in classical mechanics. This is incompatible with classical mechanics and special relativity because in those theories inertially moving objects cannot accelerate with respect to each other, but objects in free fall do so. To resolve this difficulty Einstein first proposed that space time is curved. In 1915, he devised the Einstein field equations which relate the curvature of space time with the mass, energy, and any momentum within it.

General relativity explains the law of gravitation and its relation to other forces of nature. It applies to the cosmological and astrophysical realm, including astronomy. The theory transformed theoretical physics and astronomy during the 20th century, superseding a 200-year-old theory of mechanics created primarily by Isaac Newton. It introduced concepts including space time as a unified entity of space and time, relativity of simultaneity,

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kinematic and gravitational time dilation, and length contraction. In the field of physics, relativity improved the science of elementary particles and their fundamental interactions, along with ushering in the nuclear age. With relativity, cosmology and astrophysics predicted extraordinary astronomical phenomena such as neutron stars, black holes, and gravitational waves, and these gravitational waves are the proposed counterintuitive consequence of General Relativity pertaining to the further explanation for the gravitation theory, by which it is very contradicting to Newtonian Physics under classical mechanics. The two contradictory principles, the Newtonian Physics which is under the classical mechanics and the Einstein's General Theory of Relativity which is under the Modern Physics, will be now to be attempted by the author – researcher through the use of descriptive qualitative research, with the aid of documentary and literary review analysis, that would definitely soon to help all physicists to explain further the reconciliation of two contradicting principles in the world of Physics.

Keywords: Newton, Einstein, Gravitation.

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper9***

The Quadronometric Relationship of Force and Density of a Matter in Space: The Derivation of Mendozan Quadronometric Equation

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Abstract: General relativity is a theory of gravitation developed by Einstein in the years 1907–1915. The development of general relativity began with the equivalence principle, under which the states of accelerated motion and being at rest in a gravitational field (for example, when standing on the surface of the Earth) are physically identical. The upshot of this is that free fall is inertial motion: an object in free fall is falling because that is how objects move when there is no force being exerted on them, instead of this being due to the force of gravity as is the case in classical mechanics. This is incompatible with classical mechanics and special relativity because in those theories inertially moving objects cannot accelerate with respect to each other, but objects in free fall do so. To resolve this difficulty Einstein first proposed that space time is curved. In 1915, he devised the Einstein field equations which relate the curvature of space time with the mass, energy, and any momentum within it. Some of the consequences of general relativity are:

• Gravitational time dilation: Clocks run slower in deeper gravitational wells.
• Precession: Orbits precess in a way unexpected in Newton's theory of gravity. (This has been observed in the orbit of Mercury and in binary pulsars).
• Light deflection: Rays of light bend in the presence of a gravitational field.
• Frame-dragging: Rotating masses "drag along" the space time around them.
• Metric expansion of space: The universe is expanding, and the far parts of it are moving away from us faster than the speed of light. Technically, general relativity is a theory of gravitation whose defining feature is its use of the Einstein field equations. The solutions of the field equations are metric tensors which define the topology of the space time and how objects move inertially.

Around 1960, general relativity became central to physics and astronomy. New mathematical techniques to apply to general relativity streamlined calculations and made its concepts more easily visualized. As astronomical phenomena were discovered, such as quasars (1963), the

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3-kelvin microwave background radiation (1965), pulsars (1967), and the first black hole candidates (1981), the theory explained their attributes, and measurement of them further confirmed the theory. From the abovementioned documentary and literary reviews, we are going to use those principles made by Einstein in order to analyze and logically and systematically resolve the black hole candidacy, and on how to make the environment of a certain matter in space to be escaped in a possible event horizon locus, and that is on how to give specific relationship between the gravitational net force of a matter and its density. Through these logical bases between the force and density relationship, we are going to discuss the invented term to be known here as the quadronometric index as an indication if there is a candidate black hole and taking care of the certain environment will lead us to sustain the planet's density in order to escape from the apocalyptic danger to be fallen into the black hole.

Keywords: Mendozan Quadronometric Equation, Force, Density, Quadronometric Index.

Track: ***Applied Mathematics***

Paper ID: *IEMSC-21_paper10*

Developing a Dark Energy Model from Modified Gravity Theory

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Abstract: Dark energy, characterized by a huge negative pressure, has become a topic of paramount importance in the field of cosmology. It is considered responsible for the late time expansion of the universe at an accelerated rate. A spherically symmetric space-time in 5D is investigated within the framework of Scale Covariant Theory. The model turns out to be a phantom dark energy dominated model. The model tends to the de-Sitter phase in the future avoiding the finite time big rip singularity. The variation of gravitational constant G is estimated to be -7.2×10^{-11} yr^{-1} whereas that of Hubble's parameter is obtained as H = 68, aligning with $H_0 = 67.4 \pm 0.5$ kms^{-1} Mpc^{-1} of the latest Planck 2018 result.

Keywords: Phantom energy, Dark energy, spherically symmetric, higher dimension, Scale Covariant Theory.

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper17***

Generalized Multi-Commodity Contraflow Problem on Lossy Network

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Abstract: When we transship commodities from one place to another, there are chances of loss due to leakage, or evaporation, or damage. The maximum generalized multi-commodity flow problem on a lossy network deals with the transshipment of different commodities from the origin nodes to the destination nodes obeying the capacity constraints on each arc with the minimum loss. The contraflow strategy makes traffic smooth by reverting the orientation of necessary road segments, which improves both flow value and also minimize the loss (time) significantly. In this work, we investigate the analytical solution of the maximum generalized dynamic multi-commodity contraflow (GDMCCF) problem on a lossy network and present an algorithm to solve the problem in pseudo-polynomial time complexity.

Keywords: Network flow, Generalized multi-commodity, Lossy network, Contraflow.

Track: ***Applied Mathematics***

Paper ID: *IEMSC-21_paper18*

Numerical Simulation of Stepped Spillways Using Computational Fluid Dynamics

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Abstract: The aim of this paper is to investigate capability of numerical models to address the complex turbulent fluid flows. Water flow over the stepped spillway models is significantly complex as it exhibits turbulence due to the air water interactions. Model geometric parameters of stepped spillway as well as experimental results were taken from a previous study. The same model was inculcated in a commercially available computational fluid dynamics software FLOW 3D®, which uses the Navier-Stokes equations along with volume of fluid method to track the location of air water interface of a complex fluid flow. Different sub grid models like air entrainment to address water air interaction, density evaluation to counter the change in water density, and drift flux to capture the free surface flow over the stepped spillway were used. RNG k-ε Turbulence Model was selected to account for turbulent flow over the stepped spillway. A good agreement between experimented and simulated results were found.

Keywords: Computational fluid dynamics, Stepped Spillways, FLOW 3D®, Navier Stokes Equation.

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper23***

A Brief Survey on Dynamic Network Flows in Continuous-time Model

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Abstract: In dynamic network flows, when some commodities move from one place to another, time taken by them to traverse the path are taken into account, unlike the static flows. Time being continuous entity, network flow problems are modeled in its continuous setting to get more realistic solution to the optimization problems. Rather, it can also be discretized to get more computational results. In this paper, insight is given to the models formulated by the researchers in dynamic network flows along with some practical applications regarding the triple optimization problem in continuous time setting mainly focusing on cost minimization problems, since the shortest path problem and the maximum flow problem are considered as two important special cases of the minimum cost flow problem. Different solution strategies and their efficiencies carried out by them are also observed. Further possible modification in the existing formulations and algorithms for better solution of problems are suggested as research endeavour.

Keywords: Network optimization, Dynamic flows, Continuous-time model, Discretization.

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper24***

The Method of Lines for Solution of One-Dimensional Diffusion Reaction Equation describing Concentration of Dissolved Oxygen in a Polluted River

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Abstract: The present paper addresses a diffusion-reaction equation describing the dynamics of dissolved oxygen in a polluted stream of a river. The diffusion-reaction equation is a mass-balanced partial differential equation which relates the concentration of dissolved oxygen with the effect of other natural processes, viz. diffusion, natural aeration and reaction with pollutants. The well-known method of lines is used to solve the one-dimensional nonsteady state case with Dirichlet boundary conditions. The study is motivated by the miserable condition of most of the rivers in India. Water pollution has now become a global concern and this study furnishes a better apprehension of complex phenomenon of maintaining desired level of oxygen and will aid water resource management.

Keywords: Diffusion-Reaction equation, method of lines, river-pollution, aeration.

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper26***

Effects on porous nanofluid with internal heat generation and homogeneous chemical reaction

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Abstract: This paper reports a detailed numerical investigation on mixed convection flow of a nanofluid through a porous medium due to the combined effects of thermal and mass diffusion. The energy equation accounts for heat generation or absorption, while the nth order homogeneous chemical reaction between the fluid and the diffusing species is included in the mass diffusion equation. The governing equations of the linear momentum, energy and concentration are obtained into a dimensionless form by introducing a suitable group of similarity transformations. The transformed coupled non-linear ordinary differential equations are solved numerically by applying a fifth-order Runge-Kutta-Fehlberg scheme with shooting technique using appropriate boundary conditions for the various values of physical parameters. The effects of various physical parameters on the dimensionless velocity, temperature and concentration profiles are investigated through graphs. Numerical results for the skin friction coefficient, Nusselt number and Sherwood number are also presented and analyzed in details.

Keywords: Mixed convection, Nanofluids, Porous Medium, Heat generation, Chemical Reaction.

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper28***

Time Minimization Aspect on the Transit-based Evacuation System

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Abstract: The evacuation planning problem deals with sending the maximum number of evacuees from the danger zones to the safe zones in minimum time, as efficiently as possible. The optimal use of the vehicles and their assignments are highly complicated in emergencies. Their effectiveness depends upon the evacuee arrival patterns at the pickup locations and their appropriate assignment to the transit-vehicles in the system of the available evacuation network. In this work, we consider an integrated system having two sub-networks as the primary and the secondary sub-networks. For the time minimization aspect, evacuees are collected in the earliest arrival flow pattern at zero transit times at the primary sub-network and are assigned in the secondary sub-network in the dominant approach.Transit-vehicles are provided from the bus depot to the embedding. The arrival pattern of the evacuees respects the partial lane reversal strategy, whereas the better assignments are based on the dominance relations concerning the evacuation duration. Such a problem on an integrated network for the transit-based evacuation system is also solved on a prioritized embedding. We use the lexicographically maximum flow approach with partial arc reversal strategy to collect the evacuees in minimum time at the primary sub-network. By treating such supplies as the demands, the available set of transit-buses is assigned simultaneously in the secondary sub-network to shift the evacuees finally to the sinks. The lane reversal strategy significantly reduces the evacuation time, whereas reversing them only partially has an additional benefit that the unused road capacities can be used for emergency logistics.

Keywords: Transit-based network, arrival pattern, vehicle assignment, partial lane reversals.

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper29***

Algorithms for Quickest Flow Problem on Time-Dependent Network

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Abstract: In real world situation, there are numerous network optimization problems where the attributes are of time-varying nature. In this paper, we review algorithms for discrete-time quickest flow problem with time-varying attributes to determine the earliest arrival time paths along which given amount of flow can be sent so that the last unit of flow can reach to the sink node in minimum time. The time-dependent quickest flow model and its algorithms can be applied to determine the earliest arrival time in an evacuation network.

Keywords: Dynamic network, quickest flow, time-varying, earliest arrival time.

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper31***

B-Spline Collocation Solution for Burgers' equation arising in Longitudinal Dispersion Phenomena in Fluid Flow through Porous Media

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Abstract: This paper investigates B-Spline Collocation Solution for Burgers' equation arising in longitudinal dispersion phenomenon in the fluid flow through porous media. In the porous medium clean water, saltwater or tainted water disperse longitudinal way offers to increase to a non-linear partial differential condition as Burgers' equation. The equation is solved by utilizing the B-Spline Collocation method with suitable initial and boundary conditions. The issue of miscible displacement can be found in the seaside territories, where new water beds are step by step uprooted via ocean water. An unequivocally steady B-spline Collocation method has been utilized to discover the concentration $C(X,T)$ of salty or polluted water dispersion in uni-direction. It is completed, that the concentration $C(X,T)$ reduce as distance X just as time T increments. The tables and figures are created by utilizing MATLAB coding.

Keywords: Longitudinal dispersion, Burgers' Equation, B-Spline Collocation Method.

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper36***

Blow up of Solutions for a Klein-Gordon Equation with Delay and Variable-Exponents

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Abstract: This work deals with a Klein-Gordon equation with delay term and variable exponents. Under suitable conditions, we prove the blow up of solutions in a finite time. Our results are more general than the earlier results.

Keywords: Blow up, Delay term, Klein-Gordon equation, Variable exponent.

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper42***

Blow up of the high-order Kirchhoff-type system with logarithmic nonlinearities

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Abstract: This work investigates the solution of high-order Kirchhoff-type system with logarithmic nonlinearities. Under the appropriate assumptions, we prove the blow up of the solution at initial energy levels, i.e. E (0) < d.

Keywords: Blow up, System of higher-order Kirchhoff type equation.

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper48***

Bio-convection in Buoyancy Induced flow of Williamson Nanofluid over a Riga Plate-DTM-Pad´e Approach

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Abstract: The buoyancy induced flow of Williamson nanofluid containing Gyrotactic microorganisms along a vertical riga plate has been investigated. The Gyrotactic microorganisms act as active mixers that help in stabilising the nanoparticles in the suspension. Also, the movement of these cells gives rise to a macro phenomena called bioconvection that helps in preventing the agglomeration of nanoparticles. Furthermore, the magnetic field generated due to the flow of nanofluid is considered in addition to Thermophoresis and Brownian Motion to make the results more appropriate. The Buongiorno's Model has been incorporated to frame the system of equations that govern the fluid flow. Later, lie group analysis is performed to transform these equations into ordinary differential equations that are further solved using differential transform method with Pad´e approximant. It is observed that the Lorentz force generated by Riga plate in parallel to the flow helps in increasing the velocity of the nanofluid. It has also been observed that the bio-convection reduces the flow speed and enhances the heat transfer rate.

Keywords: Williamson Nanofluid, Gyrotactic Microorganisms, Riga Plate, Lie Group Analysis, Differential Transformation Method, Pade Approximant.

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper86***

Solution of Matrix Games with Pay-offs of Single-Valued Neutrosophic Numbers and its Application in the Market Share Problem

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Abstract: Neutrosophic sets (NSs) are portrayed by three independent membership dimensions (truth, indeterminacy, and falsity). NS can be utilized to display circumstances described by complex uncertainty and has not been applied to matrix game problems yet. The objective of this paper is to explore matrix games in which pay-offs are represented by single-valued neutrosophic numbers. The concepts of the solutions for matrix games with payoffs of NSs are defined based on the degree of membership, the degree of indeterminacy, and the degree of non-membership. To solve such games, a methodology has been derived based on the notion of the score function of single-valued neutrosophic numbers. Firstly, we formulate two neutrosophic mathematical programming problems and then these two problems are transformed into two crisp equivalent mathematical programming problems using the score function of single-valued neutrosophic numbers. Reduced problems are subsequently solved to get the optimal strategies and the expected value of the players by using the simplex method on the LINGO platform. Finally, we consider one numerical example to illustrate the methodology. A market share problem is illustrated to show the validity and applicability of the proposed approach. A comparative study implies the fact that the proposed approach is an extension of existing work.

Keywords: Matrix game, single valued neutrosophic numbers, score function.

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper88***

A novel score function based EDAS method for multi-attribute decision making with q-rung orthopair fuzzy data

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Abstract: In this paper, we propose an improved score function for the ranking order of the qrung orthopair fuzzy set and discuss some of its suitable properties. Then, to verify the validity and superiority of the proposed score function we compare it with some existing score functions. Based on the proposed score function, we develop a q-rung orthopair fuzzy evaluation based on the distance from the average solution (EDAS) method to deal with multi-attribute decision making (MADM) problem. The positive distance from average and the negative distance from average have been computed utilizing the proposed score function to determine integrative appraisal score and hence to select the most suitable one(s). Further, the proposed method is demonstrated through a numerical example for the selection of the vacant post of a company. Finally, a comparison analysis of the proposed method is performed to show the validity of the existing method.

Keywords: q-rung orthopair fuzzy sets, Score function, EDAS method, MADM.

Track: ***Applied Mathematics***

Paper ID: ***IEMSC-21_paper91***

Mathematical Models studying Crime Dynamics: A Review on Adopted Approaches

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Abstract: As crime is becoming a major issue over the last few decades in India, mathematical models came as a rescue to study and understand the dynamics of crime and to analyse the effect of control and preventive measures. This review aims at discussing several approaches to formulate such mathematical models, namely, economical approach, epidemic approach, predator-prey modelling approach and spatio-temporal approach. Strategies for combating financial crime are also examined. Through this review, it has been observed that study on the dynamics of crime against women is less considered. Such gap could be analysed with the help of information obtained through the approaches discussed. The work of this paper could help crime analysts to predict the trends in the crime against women and prepare the optimal control and prevention policies.

Keywords**:** Mathematical Modelling, Crime against women, Epidemic Approach, Economical Approach, Prey Predator Approach, Spatio-temporal Approach.

Track
of
Pure Mathematics

Track: ***Pure Mathematics***

Paper ID: ***IEMSC-21_paper5***

Coincidence Point and Common Fixed Point Results in G- Fuzzy Metric Spaces for G_f-type Weakly Commuting Mappings

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Abstract: In recent times G-metric spaces appeared in the literature as a generalization of D-metric spaces, 2-metric spaces and metric spaces. G-fuzzy metric spaces are generalization and fuzzy version of G-metric spaces. Commuting mappings and weakly commuting mappings are very much important for the study of fixed point theorems. In this paper we have established some coincidence point result and common fixed point result in G-fuzzy metric spaces. Here we have used G_f-type weakly commuting mappings and the altering distance functions. We have deduced some corollaries to our theorems and our theorems are also supported by examples.

Keywords: G-Fuzzy metric space, G-Cauchy sequence, coincidence point, common fixed point, altering distance function and Ψ-function.

Track: ***Pure Mathematics***

Paper ID: *IEMSC-21_paper6*

Proving the Reflection Formula of Gamma Function

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Abstract:

Objective:- To prove the reflection formula of Gamma Function using two methods

1) Euler's definition of Gamma Function (as infinite product)

2) Weierstrass definition of Gamma Function.

Methods:- In Euler's definition of Gamma Function we come across $\Gamma(-z)$. Manipulating the definition, we arrive at Reflection formula. In Weierstrass definition, we assume the value of γ (Euler-Mascheroni constant) and manipulate in same way as before to find the reflection formula. Basic thing which is used in both cases is $\Gamma(z+1) = z\Gamma(z)$.

Results:- In all 2 cases, we get the proof of same formula of Euler Reflection formula which is $\Gamma(z)\Gamma(1-z)= \pi/\sin(z\pi)$.

Keywords: Weierstrass, Euler, Gamma function.

Track: ***Pure Mathematics***

Paper ID: ***IEMSC-21_paper14***

An algorithm for semitotal domination problem in proper interval graphs

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Abstract: Let G = (V, E) be a simple and undirected graph without isolated vertices. A set D of vertices of a graph G = (V, E) is a dominating set of G if every vertex outside D is adjacent to some vertex in D. A set D ⊆ V is called a semitotal dominating set of G if D is a dominating set of G and every vertex in D is within distance 2 from another vertex of D. Given a graph G, the semitotal domination problem is to find a semitotal dominating set of G with minimum cardinality. The semitotal domination problem is known to be NP-complete for chordal graphs.We present an algorithm to compute a minimum semitotal dominating set in proper interval graphs which is a subclass of chordal graphs.

Keywords: Domination, semitotal domination, proper interval graphs, polynomial time algorithm.

Track: ***Pure Mathematics***

Paper ID: ***IEMSC-21_paper19***

Some New Inequalities using Extended Generalized Fractional Integral Operator for Chebyshev Functional

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Abstract: In this paper, we establish some new integral inequalities for Chebyshev functional using extended generalized fractional operator. The result obtained in the case of differentiable as well as Lipschitz functions.

Keywords: Chebyshev functional, Integral inequalities, Extended generalized fractional integral operator.

Track: ***Pure Mathematics***

Paper ID: ***IEMSC-21_paper37***

On the Hermitian positive definite solution of $X_i^{\delta_i} = Q_i - \sum_{j=1}^{m}\left(A_j^* F_{ij}(X_j) A_j\right)^{r_{ij}}$

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Abstract: We study a system of nonlinear matrix equations of the form

$$X_i^{\delta_i} = Q_i - \sum_{j=1}^{m}\left(A_j^* F_{ij}(X_j) A_j\right)^{r_{ij}}, \quad i = 1, 2, \ldots, m \qquad (1)$$

We find some necessary and sufficient conditions for the existence of Hermitian positive definite solution of our system of nonlinear matrix equations. We also provide some iterative methods and numerical examples to illustrate our results.

Keywords: Matrix equation, Fixed point, Partially ordered set.

Track: ***Pure Mathematics***

Paper ID: ***IEMSC-21_paper40***

Fixed point theorems for G-contraction mappings on partial metric spaces

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Abstract: The purpose of this paper is to introduce a new type of mapping called the G-contraction mapping. Fixed point theorems for such mappings in partial metric spaces are established. Then we show that our theorem generalizes and complements many well-known fixed point results in metric spaces. Moreover, we present a numerical example for the main result. By that example it is shown that our main result is a real generalization of the fixed point results of several mathematicians in the literature.

Keywords: F weak contraction, G contraction, Fixed point theorem, Partial metric space.

Track: ***Pure Mathematics***

Paper ID: ***IEMSC-21_paper44***

Error Estimation of the Function by Generalized Zygmund Class using $(E, s)(\bar{N}, p_n, q_n)$ Summability Means of Conjugate Fourier Series

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Abstract: The aim of the present paper is to approach a new result on the new best approximations of the function of different classes have been considered by various researchers under different summability means. In the paper presented a new theorem established under $(E, s)(\bar{N}, p_n, q_n)$ product summability mean of conjugate fourier series of function belonging to the generalized Zygmund class $(Z_\mu^r, r \geq 1)$. Many mathematicians have proved some known and unknown results. But this is a unique approach to prove a new theorem.

Keywords: Degree of Approximation, generalised Zygmund class, Conjugate Fourier series, product mean.

Track: ***Pure Mathematics***

Paper ID: ***IEMSC-21_paper47***

Number theory: Polynomials which are near to k-th powers

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Abstract: The main purpose of the paper is to prove that if we suppose only that $f(x) = y^k + o(z)$ as $x \to \infty$ through the integral values, where y^k denotes for each x the integral k-th power nearest to $f(x)$, then $f(x) = (g[x])^k + A$ identically, where A is a constant integer. It is not necessary to suppose that the hypothesis applies for all large integers x. Let's consider a sequence $x_1 < x_2 < x_3 < \cdots$ of positive integers is thin if, for some integer $M > 0$ and some $\propto > 0$, we have $x_{j+M} - x_j > x_j^{\propto}$ for all sufficiently large j. Then for the first result it suffices if the positive integers x for which $f(x) = y^k$ do not form a thin sequence, relative to certain values of M and $\propto$ which depend only on n and k. This is an easy deduction from the work of Dorge, and occurs later as Lemma 2. For the second result we have to make a somewhat stronger hypothesis, namely that the first equation holds for all x except for a set whose number up to X, say $N(X)$, satisfies $N(X) = o(X^{\frac{1}{k}})$.

Keywords: Number theory, polynomials near to k-th power.

Track: ***Pure Mathematics***

Paper ID: ***IEMSC-21_paper61***

Complete gs-Lattice and some of its properties

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Abstract: A soft set is a parametrized family of subsets of an initial universal set. This universal set may be an ordinary set or an abstract one such as group, ring, field, lattice, vector space, topological space and so on. Complete lattices are used in many applications of Mathematics and Computer Science. In this paper we introduced the concept of complete gs-lattice, s-closure system, s-Moore family and discuss their properties. Fixed point theory is a useful tool in applied mathematics. We conclude this paper with another form of Tarski's fixed point theorem in gs-lattice.

Keywords: Complete gs-lattice, s-closure system, s-Moore family.

Track: ***Pure Mathematics***

Paper ID: ***IEMSC-21_paper63***

A Review on the Generation of Pythagorean Triplets and Representing an Integer as a Difference of Two Squares

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Abstract: In this paper, we have reviewed the proposition for generalization of formulae that finds the primitive and non-primitive Pythagorean triplets generated by a given integer. Besides, the procedure for finding complete representations of the integers as a difference of two squares has been formularized. Finally, the Pythagorean triplets are generated in a range from x to y, programmed with the proposed formulae, which thereby validates them.

Keywords: Pythagorean triplets, primitive and non-primitive, generalization, formularized, difference of two squares.

Track: ***Pure Mathematics***

Paper ID: ***IEMSC-21_paper84***

Survey on Convex Equilateral Pentagonal Tiling of the Plane

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Abstract: Tiling a plane by various types of polygons is been established and among these pentagons, in particular equilateral pentagons that tile a plane is also probed in multiple research work. In this article we provide a survey on the detailed proof of equilateral pentagons that tile a plane.

Keyword: Tiling, convex, equilateral, monohedral.

Track of Statistics

Track: ***Statistics***

Paper ID: ***IEMSC-21_paper16***

A Statistical Characterization of MCX Crude Oil price with regard to Persistence Behaviour and Seasonal Anomaly

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Abstract: The paper aims at investigating long term persistence behaviour followed by seasonal anomaly in MCX crude oil returns. Daily return data for the period of 2009-2018 is considered for this study. Hurst exponent is computed and used as an indicator of persistence behaviour. The data is found to have long range correlation. Return distribution of asset price is leptokurtic which recovers Gaussianity with a lag of 550 days. Additionally, on analysing the cumulative monthly returns, distinct seasonal patterns were observed for summer and winter months indicating seasonal anomaly that contradicts efficient market hypothesis. This finding has been further utilized to devise suitable investment strategies that may guide investors to gain better return in the crude oil market.

Keywords: Persistence, MCX crude oil, Hurst Exponent, Power Law, Seasonal Anomaly, Efficient Market Hypothesis.

Track: ***Statistics***

Paper ID: ***IEMSC-21_paper25***

Data representation and performance in a prediction model

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Abstract: Data is the key element of future prediction in several disciplines like numerical method, data science, machine learning, etc. The data must be in a specific format such that it is fitted in a specific predictive model. But in real-life data are available in different forms and formats. Sometimes data may not be fitted into the various mathematical models directly or sometimes gives poor performance. This manuscript gives a comparative study of a predictive model with a different representation of the same data from which it can be chosen the better one. In this experiment, we have considered the COVID-19 data set of India with the linear regression model as the predictive model.

Keywords: Numerical methods, COVID-19, Linear regression.

Track: ***Statistics***

Paper ID: ***IEMSC-21_paper77***

Credits and Recovery Analysis of Chhattisgarh State Agricultural Cooperative Bank

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Abstract: One of the leading partners in Indian banking is the Cooperative Bank market. Through its broad credit-based network, cooperative banks have more access to rural India. The cooperative industry has been an important part of the country's economy and is still remembered as an integral part of our national economy. Cooperatives have an ethical basis, an economic intent and a social viewpoint. Agricultural credit for all agricultural production projects is one of the most significant contributions. Rural loan access in India has remained scarce. Agriculture Primary Loans companies (PACS) are operating at the grassroots level with direct communication and financial criteria with rural communities. In various areas, the issue of loans overdue is a serious problem because it impacts on the recycling of funds as a credit institution and loses its financial viability. The result shows that the performance of credit recovery was small in the north-eastern and northern and southern states. The credit recovery output is proportional to agricultural loans, training untrained employee ratio and average member per business and is reversed to the proportion of government capital at a constant price with working capital and real growth rates. The success of the credit union movement in a district depends primarily on its financial power. The DCC Bank is a large district financing organisation responsible for meeting the credit criteria of various types of district co-operatives. Currently, the Credit Co-operative is the only major institutional lending scheme in the district. It credit rates fair interest rates especially in rural areas reducing farmers' ability to rely on informal credit sources and usurious interest rates.

Key words: Cooperative bank, Credit analysis, Farmers, Recovery, Productivity, Utilization.

Track: ***Statistics***

Paper ID: ***IEMSC-21_paper90***

A Comparative Analysis of Principal Component Analysis on HIV-Infected/Non-Infected Patients Measurement Variables

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Abstract: This research is on the comparative analysis of principal component analysis on the data set extracted from HIV-infected patients and data of those not infected. The data were collected from the University of Port Harcourt Teaching Hospital, departments of Chemical Pathology and Hematology. The data consists of results for Hemoglobin (HB), White Blood Cells (WBC), Creatinine, Calcium, Aspartate Aminotransferase (AST) and Alanine Aminotransferase (ALT) tests for the HIV-positive cases and HIV-negative cases as the components. The statistical software of Minitab 18 and R-software was employed to examine and summary statistics are as follows: covariance matrix, correlation matrix, standard deviation, Eigenvalues, Eigenvectors, transformation of the sample onto new subsample, computing the principal components and finally plotting the graphs. The result of the principal components comparison showed Creatinine and AST are important indications of health status for both HIV positive patients and those without HIV.

Keywords: Infected/Non-Infected, Covariance and Correlation Matrix, Eigenvalues, Eigenvectors, Principal Components.

Track: ***Statistics***

Paper ID: ***IEMSC-21_paper92***

Estimating Maternal Mortality Rate in Nigeria using Zero Inflated Count Regression Models

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Abstract: The risk of pregnancy is very high in our society today and this has been a great challenge to health care service providers (centres), hospitals, clinics and the world at large. As a result, this has drawn the attention of researchers, medical practitioners, government, families, friends and even the pregnant women in question. Hence, this has drawn our attention to undertake the modeling of data on Maternal Mortality Rate in Rivers State Hospital Management Board records using Zero Inflated Poisson Regression and Zero Inflated Negative Binomial Regression models. Our main aim was to analyze data of Maternal Mortality using variables such as: stillbirth, infant-death, neonatal and number of causes using R software.

The result obtained showed a high rate of still-birth, followed by neonatal and infant death. However, the analysis and results were also considered using the Zero Inflated Poisson Regression Model with a very small value of AIC as the best to model count data of this form.

Keywords: Maternal Mortality Rate, Poisson Regression Model, Binomial Regression Model.

Track: ***Statistics***

Paper ID: ***IEMSC-21_paper93***

Multivariate Modeling of the Impact of Unemployment on Nigeria Economic Growth Using Markov Switching Regression

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Abstract: In this research we considered the relationship between unemployment and economic growth in Nigeria. We also analyzed the effect of unemployment on economic growth in Nigeria. These were with the aim to analyze the impact of unemployment on economic growth and reducing unemployment in Nigeria, in this present times economic challenges.

Secondary data was gotten from International Monetary Fund (IMF) from 1980 to 2016 and the macroeconomic indicators used include: unemployment, gross domestic product (GDP) and inflation. The data were analyzed using STATA software version 15.

Keywords: Multivariate modeling, Markov Switching Regression.

Track
of
Computer Science

Track: ***Computer Science***

Paper ID: ***IEMSC-21_paper3***

Grobner Basis and its application in Motion of Robot Arm

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Abstract: We are going to introduce Grobner basis, a particular kind of generating set of an ideal in a polynomial ring $k[x_1, \ldots, x_n]$ over field k, which is one of the main practical tools for solving system of polynomial equations. The upcoming discussion will focus on an application of Grobner basis in the field of Computer Science - Motion of Robot Arm.

Keywords: Grobner Basis, Buchberger's Algorithm, Macaulay2, Robot Arm, Forward Kinematic problem, Inverse Kinematic Problem.

Track: ***Computer Science***

Paper ID: ***IEMSC-21_paper4***

An Approach towards the Development of an Alternative Data Encryption Standard Algorithm with Enhanced Security

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Abstract: In this age of electronic connectivity, only possible way of preventing data breaches is encryption and hence in this paper we have introduced a new cipher based on DES with enhanced block and key size.

Keywords: Data Encryption Standard (DES), plain text, cipher text, Feistel structure, key, S-box.

Track: ***Computer Science***

Paper ID: ***IEMSC-21_paper12***

A Comprehensive Review on Cloud Computing for Optimization algorithms regarding Database Migration

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Abstract: Cloud computing has become popular due to its attractive features. The load on the cloud is increasing tremendously with the development of new applications. Cloud computing is the delivery of computing services including servers, storage, databases, networking, software, analytics, and intelligence over the Internet. Cloud computing eliminates the capital expense of buying hardware and software. A key challenge in porting enterprise software systems to the cloud is the migration of their database. Choosing a cloud provider and service option (e.g., a database-as-a-service or a manually configured set of virtual machines) typically requires the estimation of the cost and migration duration for each considered option. Many organizations also require this information for budgeting and planning purposes. Existing cloud migration research focuses on the software components, and therefore does not address this need. We introduce a two-stage approach which accurately estimates the migration cost, migration duration and cloud running costs of relational databases. In this paper, we have developed a tabular representation of various optimization algorithm which are helpful for the construction of the workload/workflow model.

Keywords: Cloud computing, cloud, database migration, optimization algorithms.

Track: ***Computer Science***

Paper ID: ***IEMSC-21_paper13***

Quotient Structures of Fuzzy Multiset Finite Automata

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Abstract: The objective of this paper is to characterize the quotient structures of fuzzy multiset finite automata. We introduce different congruence relation on multiset associated with fuzzy multiset finite automata and show that each congruence relation associates a semigroup with the fuzzy multiset finite automata. Furthermore, we define the admissible relation and discuss its characterization. Finally, we establish an isomorphism between fuzzy multiset finite automata and the quotient structures on another fuzzy multiset finite automata.

Keywords: Fuzzy Multiset, Fuzzy Multiset Automata, Fuzzy Multiset Languages, Congruence relation.

Track: ***Computer Science***

Paper ID: ***IEMSC-21_paper15***

Blue Brain Technology

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Abstract: Today scientists are in research to create a virtual brain that can think, respond, take decision and keep anything in memory. To upload human brain into machine is the main aim. So that man can think, take decision with no effort. After the body's death, the virtual brain will act as the man. So, even after the death of a person, the knowledge, intelligence, personalities, feelings and memories of that man cannot be lost, that can be used for the development of the human society. IBM is now in research to create a virtual brain, called "Blue brain". If possible, this will be the first virtual brain of the world. IBM, alongwith scientists of Switzerland's Ecole Polytech- nique Federale de Lausanne's (EPFL) Brain and Mind Institute will begin simulating the brain's biological systems and output the data as a working 3-D model which will recreate the high-speed electrochemical interactions that take place within the brain's inside. These contain cognitive functions such as language, learning, perception and memory along with brain malfunction such as psychiatric disorders like depression and autism. From there, the modelling will stretch to other regions of the brain and, if successful, throw light on the relationships between genetic, molecular and cognitive functions of the brain.

Keywords: FTP (floating point unit), ASIC (application specific integrated circuit), electrochemical interactions.

Track: ***Computer Science***

Paper ID: ***IEMSC-21_paper20***

Developments in Post Quantum Cryptography

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Abstract: Cryptography deals with the design of mechanisms based on mathematical algorithms that provide fundamental **information security** services for computers and communication systems. Modern day cryptography makes use of binary bit sequences and relies on publicly known algorithms based on concepts such as number theory, computational-complexity theory, and probability theory that are practically impossible for conventional computers to compute. However, when powerful **quantum computers** would be brought into widespread use, today's encryption processes would become insecure. Quantum computers use quantum bits or **Qubits** and can get us "a quantum speed up" which will take seconds to solve these complex computations, for example, running the Shor's Algorithm that conventional computers would take millions of years to solve. This **quantum supremacy**, which scientists hope to attain by the next two decades would pose a serious threat to the existing cryptographic systems. Organisations like NIST have thus started working to understand the status of quantum computing and to develop **quantum resilient algorithms** that would be secure to attacks by a quantum computer as well as a classical computer and can interoperate with existing communication protocols and networks. The main algorithms that have been proposed for post-quantum primitives are based on lattices, multivariate polynomials, codes, hash functions, super-singular elliptical curves and so on. A significant effort will be involved to ensure a smooth and secure transition from modern day public key cryptography to their quantum computing resistant counterparts. Thus, even if the exact time of advent of the quantum computing era cannot be predicted, we should continue to research and analyse newer algorithms in order to secure our information. This review paper focuses on the developments that have so far been made in the field of **Post Quantum Cryptography** and its future prospects.

Keywords: Information security, Quantum Computers, Qubits, Quantum Supremacy, Quantum resilient algorithms, Post Quantum Cryptography.

Track: ***Computer Science***

Paper ID: ***IEMSC-21_paper21***

Smart Garbage Monitoring System using IoT

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Abstract: We are living in the era of Smart cities where everything is planned and systematic. The problem we are facing is of the population, which is rising rapidly. In recent years, urban migration has skyrocketed. This has resulted in the rise of garbage waste everywhere. Dumping of garbage in public places creates a polluted environment in the neighborhood. It could cause a number of serious diseases to the people living around. This will embarrass the evaluation of the affected area. In order to reduce waste and maintain good hygiene, we need a systematic approach to tackle the problem. We propose a solution to this waste problem which manages the garbage waste smartly. This research paper proposes an IoT based smart system based on clean waste management that assesses the level of waste on dustbins through sensory systems. In this system the microcontroller is used as a visual connector connecting sensor and the IoT system. We have worked for a village in native village of UP under the scheme Unnat Bharat and the results have been promising.

Keywords: Internet of Things, Smart dustbin, Arduino Board, GPS, GSM, Arduino IDE.

Track: ***Computer Science***

Paper ID: ***IEMSC-21_paper22***

Video Watermarking Technique based on Motion Frames by using Encryption Method

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Abstract: Rapidly growing technologies over the internet used to transfer the digital media content at a high rate nowadays. The growth in these technologies results to create the identical copies of original multimedia data easily. The creation of these identical copies states the false claim of the ownership of digital media by any malicious user. The proposed method suggest to protect these type of false claim by inserting a watermark into selected motion frames. Before embedding the watermark, it is scrambled by using an algorithm having a secret key. With help of this key the scrambled watermark will be reconstructed whenever it is required. With the help of DWT method along with using SVD technique watermark is inserted into selected frame from original media. The results of proposed algorithm shows that the scheme is secure and robust against different types of attacks whether it is intentional and unintentional. The proposed scheme is found more secure for the protection of false claim of malicious user over digital media.

Keywords: Ownership protection, Wavelet Transform, Motion Frames, Singular Value Decomposition, Video Watermarking.

Track: ***Computer Science***

Paper ID: ***IEMSC-21_paper27***

A Neural Network model which classifies risk for diabetes within the next 5 years based on health data

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Abstract: Diabetes is considered as one of the deadliest and chronic diseases which causes an increase in blood sugar. Many problems occur if the diabetes remains untreated or unidentified. But the rise in AI and ML approaches solves this critical problem. The motive of this is to design such a model which can prognosticate the probability of diabetes in patients with the maximum accuracy. Experiments are performed on Pima Indians Diabetes Database (PIDD) which is sourced from UCI machine learning repository. The whole thing work as a function approximator so you give it an input and its corresponding output and then it's going to try to map that input value to that output value so it's going do that bunch of times then you can give it new input values and it will predict give you the predicted value.

Keywords: Stroke, circulatory system, diabetes, neural network classifiers, supervised learning, machine learning.

Track: ***Computer Science***

Paper ID: ***IEMSC-21_paper30***

A Review on Hyper-Parameter Optimisation by analysing Deep Learning Experiments

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Abstract: It has been found that during the runtime of a deep learning experiment, the interim result data gets removed as the concerned experiment progresses. The interim result, after some trials, gets erased as the experiment advances forward. This removal of data forces the interim experiment to roll back to a certain initial point after which the hyper- parameters or results become difficult to obtain (mostly for a vast set of experimental data). Hyper-parameters are the various constraints / measures that a learning model requires in order to generalise distinct data patterns and control the learning process. A proper choice and optimization of these hyper-parameters must be made so that:

- the learning model can resolve the given machine learning problem
- during training, particular performance goal on a dataset for an algorithm is optimised

This review paper aims at presenting a Parameter Optimisation for Learning (POL) model highlighting the all-round aspects of a deep learning experiment through an application-based programming interface (API). This provides the means of:

- storing parameters
- retrieving parameters
- analysing parameter settings and interim results.

To ease the process of optimisation of hyper-parameters further, the model involves the application of optimisation functions, analysis and data management. Moreover, the prescribed model boasts of a high level of interoperability and sharing across various machine learning researches who can further use it for data management.

Keywords: Hyper-Parameters, Parameter Optimization for Learning (POL), Algorithm, Optimisation functions, Application based programming interface (API), Learning model.

Track: ***Computer Science***

Paper ID: ***IEMSC-21_paper34***

Values, challenges and future directions of big data analytics in healthcare: A systematic review

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Abstract: The emergence of powerful software has created conditions and approaches for large datasets to be collected and analyzed which has led to informed decision-making towards tackling health issues. The objective of this study is to systematically review 804 scholarly publications related to big data analytics in health in order to identify the organizational and social values along with associated challenges. Key principles of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology were followed for conducting systematic reviews. Following a research path, we present the values, challenges and future directions of the scientific area using indicative examples from relevant published articles. The study reveals that one of the main values created is the development of analytical techniques which provides personalized health services to users and supports human decision-making using automated algorithms, challenging the power issues in the doctor-patient relationship and creating new working conditions. A main challenge to data analytics is data management and security when processing large volumes of sensitive, personal health data. Future research is directed towards the development of systems that will standardize and secure the process of extracting private healthcare datasets from relevant organizations. Our systematic literature review aims to provide to governments and health policy makers a better understanding of how the development of a data driven strategy can improve public health and the functioning of healthcare organizations but also how can create challenges that need to be addressed in the near future to avoid societal malfunctions.

Keywords: Systematic review, Big Data analytics, Health-medicine, Decision-making.

Track: ***Computer Science***

Paper ID: ***IEMSC-21_paper65***

Autonomous Vehicles: Levels, Technologies, Impacts and Concerns

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Abstract: Autonomous vehicles also commonly known as driverless or self-driving vehicles, are automobiles that require no human involvement for operating or controlling them. In recent years, advancement in automated vehicle concepts has progressed but still some human input is required, depending upon the level of automation. Experts anticipate that automobiles will be capable of driving themselves within 2-5 years. This paper describes current status, recent trends and research of self-driving vehicles in the automobile industry. A detailed analysis of the technologies used by automated vehicles to sense their environment and the level of automation in such vehicles is also included. The expected short-term and long term, positive and negative, beneficial and harmful impacts of driverless technology such as greenhouse gas emission, energy consumption etc. are assessed. As widespread adoption of self-driving vehicles is considered to be inevitable, therefore requirement of certain technical and legal guidelines will be essential for safe and tension-free travel. The potential concerns regarding autonomous vehicles must be discarded with safe policies and technologies as discussed in the paper.

Keywords: Autonomous cars, sensor technologies, carbon emission, LIDAR, impacts, applications.

Track: ***Computer Science***

Paper ID: ***IEMSC-21_paper73***

A fragmented world of IoT over networking technologies and proposal of a new protocol to overcome them

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Abstract: Smart home is one of the most promising applications of the Internet of Things. Although there have been studies about this technology in recent years, the adoption rate of smart homes is still low. One of the largest barriers is availability of multiple networking mediums and diverse protocols causing incompatibility and fragmentation within the smart home ecosystem and expensive infrastructure the manufactures need to maintain to support them. In this paper, we discuss some popular existing IoT protocols, their limitations and propose a software architecture for a new protocol that overcomes these limitations.

Key Words: Internet of Things, Networking.

Track: ***Computer Science***

Paper ID: ***IEMSC-21_paper87***

Predicting stock movement based on the sentiment of news headlines using LSTM and BiLSTM

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Abstract: At present, Stock market forecasting is very influential in planning business activities as high stock market value is considered the parameter of high economies. Many factors, like economic, social, and political, affect the movement of the stock market. News Headlines and people's opinions can change the entire game as this is the most sensitive field. The stock market is volatile, which may cause equal chances for earning and losing money from time to time, but investors can profit or minimize their losses if the near future for the same can be predicted. Active research has been going in this field for many years, but a mature solution has not been formulated yet because of the market's erratic nature. Hence, AI companies are now using sentiment analysis regarding the stock market to predict a particular stock's market trend or movement. This paper aims to analyze the effects of the top news headlines' sentiment crawled from Reddit World News Channel to predict the action, i.e. the stock price is going up, down or same, and compare results using the rule-based, machine learning, and deep learning approaches. Our approach Long short-term memory (LSTM), Bidirectional long short-term memory (BiLSTM) network, including Word embedding by Word2Vec perform well in stock related news data's sentiment analysis against ups and downs of the stock price with accuracy around 60%.

Keywords: Stock market, Sentiment analysis, Reddit news data, DIJA, Machine Learning, Deep learning, LSTM.