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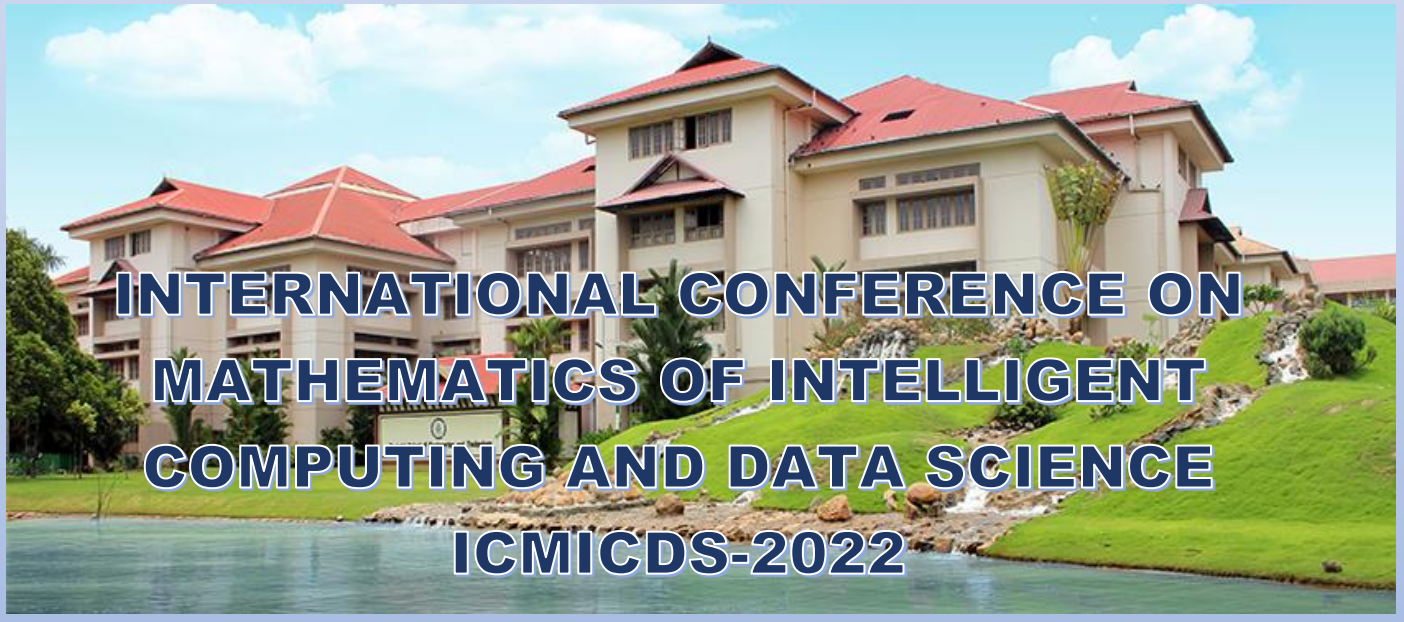
RAJAGIRI SCHOOL OF ENGINEERING AND TECHNOLOGY



INTERNATIONAL CONFERENCE ON MATHEMATICS OF INTELLIGENT COMPUTING AND DATA SCIENCE ICMICDS-2022

DEPARTMENT OF MATHEMATICS AND CENTRE FOR TOPOLOGY AND APPLICATIONS,
RAJAGIRI SCHOOL OF ENGINEERING AND TECHNOLOGY, KOCHI.

INTERNATIONAL CONFERENCE ON MATHEMATICS OF INTELLIGENT COMPUTING AND DATA SCIENCE

ICMICDS-22 (Hybrid Mode)

SEPTEMBER 15-17, 2022

Organized by

Dept. of Mathematics & Centre for Topology and Applications (CETA),RSET

SCHEDULE AND ABSTRACTS

Schedule of Invited talks, Contributory Paper Presentations and Tutorials

15/09/2022

9.30 am: Inauguration

10.00 – 11.00 am: Talk 1: Vineeth N Balasubramanian, IIT Hyderabad

Topic: Causality in Explainable AI: Motivation and Methods

11.15 -12.15 pm: - Talk 2: Vijay Natarajan, IISc Bangalore

Topic: Topological Descriptors and Scalar Field Comparison'

12.30 – 1.30 pm. – Talk 3: Patrizio Frosini, University of Bologna, Italy

Topic: Approaching topological data analysis and geometric deep learning through group equivariant non-expansive operators.

2.30 – 3.30 pm. – Talk 4: A. Krishnamoorthy, Centre for Research in Mathematics, Kottayam.

Topic: Random Networks

3.45 - 5.15 pm: Contributory paper presentation: Session 1 - C01 to C06

16/09/2022

9.15 am to 9.55 am: Tutorials 1 & 2.

10.00 – 11.00 am.- Talk 5: K. Poulose Jacob, Rajagiri School of Engineering & Technology

Topic: AI based approach towards Multiparty Privacy in Social Media Platforms

11.15 – 11.35 am: Tutorial 3

11.35 – 12.35 pm: Contributory paper presentation Session 2: C10 to C13

1.30 – 2.30 pm. – Talk 6: Narayanan. N, IIT Chennai.

Topic: Probabilistic Method in graph theory

3.00 – 4.00 pm.- Talk 7: Bratati Kahali, IISc Bangalore

Topic: Big data in human genetics and genomics research

4.10- 5.55 pm - Contributory paper presentation Session 3: C07 to C09, C14 to C17

4.10- 5.10 pm - Contributory paper presentation Session 4: CP18 to CP21.

17/09/2022

8.35 – 9.35 am - Contributory paper presentation Session 5: C22 to C25

8.35 – 9.35 am - Contributory paper presentation Session 6: CP26 to CP29.

9.35 – 9.55 am – Tutorial T4

10.00 – 11.00 am.- Talk 8: Amit Chattopadhyay, IIIT Bangalore

Topic: Computing Topological Distances between Multivariate Data

11.15-12.30 pm. – Talk 9: M. Ashok Kumar, IIT Palakkad

Topic: Probability and Statistical Tools for Data Science

1.30 – 2.30 pm. – Talk 10: Diya Thomas, Cybersecurity governance risk and Compliance officer, Sydney, Australia

Topic: A Deep Dive into the Ransomware Attacks

2.30 – 2.50 pm: Tutorial T5

2.50 – 4.50 pm: Contributory paper Session 7: C30 to C37,

2.50 – 4.50 pm : Contributory paper Session 8: CP38 to CP45.

Instructions: -

For attending the conference,

Join Zoom Meeting
https://us06web.zoom.us/j/89190734233?pwd=ZXJmdjVlaTg4cWVzSmE5Z1lENFBJZz09
Meeting ID: 891 9073 4233
Passcode: rajagiri

- Feedback link will be available during each talk.
- Participants who are presenting the Tutorials T1 to T5, Contributory papers C01 to C17, C22 to C25, C30 to C37 have to join the same zoom meet link provided above.
- Participants who are presenting Contributory papers CP18 to CP21, CP26 to CP29, CP38 to CP45 have to join Zoom Meeting

https://us04web.zoom.us/j/74829925331?pwd=QJN8jDBXIk5bJyDhIDu96rBQd4rqEr.1

Meeting ID: 748 2992 5331

Passcode: 7pmhj4

- Contributory Paper Presentation should not lag more than 15 minutes which should include 10 minutes presentation and 5 minutes Q&A session.
- Maximum time allotted for Tutorial Presentation is 20 minutes.

- All are requested to be ready with the presentation 5 minutes before the scheduled time.

Convener: Dr. Ramkumar P.B (9947746160)

Coordinator: Dr. Binu. R (9946167116)

SCHEDULE FOR CONTRIBUTORY PAPER PRESENTATION

CONTRIBUTORY PAPER SESSION 1			
DATE : 15/09/2022 TIME : 3.45 PM – 5.15 PM			
ZOOM MEETING LINK : https://us06web.zoom.us/j/89190734233?pwd=ZXJmdjVlaTg4cWVzSmE5Z1lENFBJZz09 **Meeting ID**: 891 9073 4233 **Passcode**: rajagiri			
SL.NO.	PRESENTATION NO.	NAME	TOPIC
1	C01	Ghurumuruhan Ganesan	Edge weight based colouring and matching in inhomogeneous random graphs
2	C02	Anjana T S, Silpa Sreekumar, Silpa S, Manjusha P	Super Domination Number of Cycle based Graphs and Comb Product of Graphs
3	C03	Divya G. Adalja	Sum Divisor Cordial Labeling for Middle Graph and Total Graph of Some Graphs
4	C04	Amarendra Kumar Pattanayak	Study The Domains of Infinite Algorithms of Calculation of Nilpotent Matrix Groups
5	C05	P Monisha, S Sindu Devi	Stability Analysis and Backward Bifurcation of Malaria Model
6	C06	Reeja S B, John K Rajan	On The Core and Noncore Vertices of Singular Graphs

CONTRIBUTORY PAPER SESSION 2			
DATE : 16/09/2022 TIME : 11.40 AM – 12.40 PM			
ZOOM MEETING LINK : https://us06web.zoom.us/j/89190734233?pwd=ZXJmdjVlaTg4cWVzSmE5Z1lENFBJZz09 **Meeting ID**: 891 9073 4233 **Passcode**: rajagiri			
SL.NO.	PRESENTATION NO.	NAME	TOPIC
1	C10	Rini T Paul, Divya Sindhu Lekha	Network Representation Learning : A Survey
2	C11	Gokul S Jayakumar, Sangeetha V	On C-Perfection of Modular Product of Graphs
3	C12	Sreekumar K G, Jayakumar C, Preenu C S, Manilal K	A Study on Topological Indices of Bipartite Kneser B Type-1 Graphs
4	C13	Suja N Thomas, P B Vinod Kumar	On Maps with Dense Periodic Points and Set of Periods Z+

CONTRIBUTORY PAPER SESSION 3			
DATE : 16/09/2022 TIME : 4.10 PM – 5.55 PM			
ZOOM MEETING LINK : https://us06web.zoom.us/j/89190734233?pwd=ZXJmdjVlaTg4cWVzSmE5Z1lENFBJZz09 **Meeting ID**: 891 9073 4233 **Passcode**: rajagiri			
SL.NO.	PRESENTATION NO.	NAME	TOPIC
1	C07	Sujit Bebortta, Sumanta Kumar Singh	U-DARE: An Intelligent UAV-based Framework Towards Detection of Network Anomaly for Reliable Communication
2	C08	Mangal R. Sonone, Dr.Vishwajeet Goswami	Analysis of Brain Arteries using Persistent Homology Tools and

			Machine Learning Techniques in Topological Data Analysis
3	C09	Supriya Rajendran, Jiji Mol M, Kumar Abhishek , Radha Rajamani Iyer	On the Detour Eccentric Sum of Graphs
4	C14	Sindu Mathew P , Narayanan C. Viswanath	A Birth-Death Process with Temporary Growth Halts and Population Independent Death Rate
5	C15	S Sweatha, S Sindu Devi	Mathematical Model for Diabetes using Fuzzy Parameters
6	C16	Shiny K S, Narayanan C. Viswanath	Study of Birth-Death Processes with Growth Interruptions
7	C17	Arthana M , Dr. Jasmine Mathew	A Study on Graphs in Sequential Games

CONTRIBUTORY PAPER SESSION 4

DATE : 16/09/2022 TIME : 4.10 PM – 5.10 PM

ZOOM MEETING LINK :

https://us04web.zoom.us/j/74829925331?pwd=QJN8jDBXIk5bJyDhIDu96rBQd4rqEr.1

Meeting ID: 748 2992 5331 **Passcode**: 7pmhj4

SL.NO.	PRESENTATION NO.	NAME	TOPIC
1	CP18	Asha G Pillai, Ramkumar P B	On The Bitopological Space Associated with a 3-Uniform Semigraph
2	CP19	Sanooj B, Vinodkumar P B	Li-Yorke Chaotic Eigen Set of Direct Sum of Linear Operators
3	CP20	Jayakrishna V, Lisa Mathew, Juby Mathew	On Jumping Graph Grammars

4	CP21	Julie Andrews, Rose Paul	A Study on The Thermal and Physical Properties of Titana-Water and Alumina-Water Nanofluids

CONTRIBUTORY PAPER SESSION 5			
DATE : 17/09/2022 TIME : 8.35 AM – 9.35 AM			
ZOOM MEETING LINK : https://us06web.zoom.us/j/89190734233?pwd=ZXJmdjVlaTg4cWVzSmE5Z1lENFBJZz09 **Meeting ID**: 891 9073 4233 **Passcode**: rajagiri			
SL.NO.	PRESENTATION NO.	NAME	TOPIC
1	C22	T K Murali, P B Vinodkumar, P K Pramod	Birth and Death Processes – A Probabilistic Metric Space Approach
2	C23	J Shwetha, K Somasundaram	Study on Marketing Dynamics on Sales of Electric Vehicles and Swot Analysis
3	C24	Ishita Sarkar, N Manjunath	Second Hyper-Zagreb Indices of Products Related to Triangle Parallel Graphs
4	C25	Archana V Chattar, Dr. Prabha Rastogi	A Survey of Topological Data Analysis Based Image Segmentation

CONTRIBUTORY PAPER SESSION 6			
DATE : 17/09/2022 TIME : 8.35 AM – 9.35 AM			
ZOOM MEETING LINK : https://us04web.zoom.us/j/74829925331?pwd=QJN8jDBXIk5bJyDhIDu96rBQd4rqEr.1 **Meeting ID**: 748 2992 5331 **Passcode**: 7pmhj4			
SL.NO.	PRESENTATION NO.	NAME	TOPIC

1	CP26	Selvy R, Vinod Kumar P.B	Fuzzy Iterated Function Systems
2	CP27	Manju Somanath, Radhika Das, Bindu V.A	Structure of Different Categories of Diophantine 3-tuples concerning -centred Polygonal Numbers
3	CP28	Jauda P P, Vinod Kumar P.B	Dynamics of a Family of Maps with Constant Mass Centre
4	CP29	Jeeva Jose C, Vinod Kumar P.B	On the Space of Generalised Persistence Diagrams

CONTRIBUTORY PAPER SESSION 7

DATE : 17/09/2022 TIME : 2.50 PM – 4.50 PM

ZOOM MEETING LINK :

https://us06web.zoom.us/j/89190734233?pwd=ZXJmdjVlaTg4cWVzSmE5Z1lENFBJZz09

Meeting ID: 891 9073 4233 **Passcode**: rajagiri

SL.NO.	PRESENTATION NO.	NAME	TOPIC
1	C30	Sindhu V, Manilal K	Spectrum of Bipartite Kneser Type-k Graphs
2	C31	Elakkiya Mohankumar, Kumar Abhishek	On Uniform Number of Graphs and Other Graph Invariants
3	C32	Kumar Abhishek, Elakkiya M	Strong Homometric Number of a Graph
4	C33	Sunayana Saikia	A New Approach of Ranking of Interval Type-2 Fuzzy Numbers using Expected Value and Ambiguity
5	C34	K Lakshmisree, K Somasundaram	Fraud Detection in Bitcoin Transactions using Graph Based Anomaly Techniques

6	C35	J. Jayasudha, S. Raghavi	Introduction to Interval-valued Neutrosophic Hyper-soft Expert Set
7	C36	K T Shivaram	Wavelet-based quadrature rule to evaluating quasi-type singular integral equations
8	C37	Pavithra C, Saradha M	Dimensionality Reduction of 2D-digital Image using Linear Discriminant Analysis

CONTRIBUTORY PAPER SESSION 8

DATE : 17/09/2022 TIME : 2.50 PM – 4.50 PM

ZOOM MEETING LINK :

https://us04web.zoom.us/j/74829925331?pwd=QJN8jDBXIk5bJyDhIDu96rBQd4rqEr.1

Meeting ID: 748 2992 5331 **Passcode**: 7pmhj4

SL.NO.	PRESENTATION NO.	NAME	TOPIC
1	CP38	Ramkumar P B, Dhanya P M	Applications of Topological Data Analysis with Morphology Operators on Hypergraphs
2	CP39	Reya Kuruvila, Narayanan C Viswanath	Comparison of Vacation and Mt/Mt/1 Queueing Models for Traffic Flow at Signalized Intersections
3	CP40	Pranathi Jalapally, Dr. Sminu Izudheen	Fuzzy-Fractal Dimension of Covid-19 variants proteins
4	CP41	Abraham Jacob, Ramkumar P B	A study of Intuitionistic Fuzzy Graph using Morphological operators and its Application
5	CP42	Manju Somanath, Bindu V.A, Radhika Das	On the exponential Diophantine equation related to the powers of Cluster Primes

6	CP43	Cindrella T J , Vinod Kumar P.B	Connectedness of the Space of Homeomorphisms of a Compact Manifold
7	CP44	Miseriya Majeed, Ramkumar P B	A study on Ramanujan Graphs
8	CP45	Deepti Chandran, Ramkumar P.B	Some eigen value properties of uniform hyperstar using recurrence relation

Instructions:-

Contributory Paper Presentation should not lag more than 15 minutes, which should include 10 minutes presentation and 5 minutes Q&A session.

All are requested to be ready with the presentation atleast 5 minutes before their scheduled time.

SCHEDULE FOR TUTORIAL

ZOOM MEETING LINK :
https://us06web.zoom.us/j/89190734233?pwd=ZXJmdjVlaTg4cWVzSmE5Z1lENFBJZz09
Meeting ID: 891 9073 4233 **Passcode**: rajagiri

PRESENTATION NO.	DATE AND TIME	NAME	TOPIC
T1	16/09/2022 09.20 AM - 09.40 AM	Dr. D. Sasikala	Topological Data Analysis
T2	16/09/2022 09.40 AM - 10.00 AM	Dr. Raghav Prasad Parouha	Nature-Inspired Algorithms for Optimization

T3	16/09/2022 11.20 AM - 11.40 AM	Rajrupa singh	Application of Zero Knowledge Proof in Block Mining
T4	17/09/2022 9.35 AM- 9.55 AM	Sandhya Singh	Approximation Theory
T5	17/09/2022 2.30 PM - 2.50 PM	Javir Prajakta Sadashiv	Boundary Layer

Instructions:-

Maximum time allotted for Tutorial Presentation is 20 minutes.

All are requested to be ready with the presentation 5 minutes before the scheduled time.

ABSTRACT OF INVITED TALKS AND CONTRIBUTORY PAPERS

ABSTRACT OF INVITED TALKS

INVITED TALK 1

VINEETH N BALASUBRAMANIAN

INDIAN INSTITUTE OF TECHNOLOGY, HYDERABAD

INDIA

Causality in Explainable AI: Motivation and Methods

The need for explainability of Deep Neural Network (DNN) models and the development of AI systems that can fundamentally reason has exponentially increased in recent years, especially with the increasing use of AI/ML models in risk-sensitive and safety-critical applications. Causal reasoning helps identify input variables that *cause* a certain prediction, rather than merely be correlated, and thus provide useful explanations in practice. Similarly, focusing on causal input-output relationships can help a DNN model generalize to out-of-distribution samples better, where spurious correlations in training data may otherwise mislead a model. This talk will introduce the growing field of explainable AI, summarize existing

efforts and focus on one important aspect of causality in DNN models -- the notion of causal attributions between input and output variables of the model. We will do this from two perspectives -- firstly, we will study how one can "deduce" what causal input-output attributions an already-trained DNN model has learned, and provide an efficient mechanism to compute such causal attributions (based on our work published at ICML 2019). Secondly, we will explore the complementary side of this problem on how one can "induce" known prior causal information into DNN models during the training process itself (based on our work published at ICML 2022) . Both of these efforts are derived by a first-principles approach to integrating causal principles into DNN models, and can have significant implications on practice in real-world applications.

INVITED TALK 2

VIJAY NATARAJAN

INDIAN INSTITUTE OF SCIENCE, BANGALORE

INDIA

Topological Descriptors and Scalar Field Comparison

Data resulting from high fidelity computational simulations and high resolution imaging devices is becoming increasingly complex both in terms of the size of the data and the number of features. This necessitates the development of new classes of techniques for efficient analysis and effective data exploration. Topological descriptors provide abstract representations of features in the data, are succinct, and amenable to visual analysis. Topological Data Analysis refers to the study of such abstract representations for data analysis, visualization, and exploration of feature-rich data sets. A merge tree captures the topology of sub-level and super-level sets of a scalar function. Comparative tasks such as visual identification of correspondence between features in the data or locating key events require a feature-aware comparison measure between scalar functions. We present an approach based on tree edit distance to compare merge trees. The comparison measure satisfies metric properties, it can be computed efficiently, and the cost model for the edit operations is both intuitive and captures well-known properties of merge trees. I will introduce the distance measure, outline an algorithm for computing the measure, and describe how the edit distance supports feature-driven analysis and visualization of time-varying scalar functions from CFD and 3D cryo electron microscopy data. [https://vgl.csa.iisc.ac.in] [https://www.youtube.com/c/vgliisc]

INVITED TALK 3

PATRIZIO FROSINI

UNIVERSITY OF BOLOGNA

ITALY

Approaching Topological Data Analysis And Geometric Deep Learning Through Group Equivariant Non-Expansive Operators

Group equivariant non-expansive operators (GENEOs) have been recently introduced as mathematical tools for approximating data observers, when data are represented by real-valued or vector-valued functions. The use of these operators is based on the assumption that the interpretation of data depends on the geometric properties of the observers. In this talk we will illustrate some recent results in the theory of GENEOs, showing how these operators could be used for topological data analysis and geometric deep learning.

INVITED TALK 4

A. KRISHNAMOORTHY

CENTRE FOR RESEARCH IN MATHEMATICS,

CMS COLLEGE, KOTTAYAM

INDIA

We have an m+1 state Markov chain with state space labelled as {1,2, ..., m, m+1}. State m+1 is absorbing and the remaining ones are transient. A particle choses one of the transient nodes(nodes) according to the probability vector (α_1, α_2, …, α_m) with α_(m+1) assumed to be zero. These two put together is called the initial probability vector. We represent by $\underline{\alpha}$ the first m components given in the bracket. The movement of the particle among the states is governed by a semi-Markov process with sojourn time in each state to be exponentially distributed rather than general one. This assumption is made to facilitate a continuous time Markov chain (CTMC). Our objective is to compute the distribution of the time until the particle hits (gets absorbed) the state m+1. We show that this random duration follows the Phase type distribution with representation PH($\underline{\alpha}$, $\underline{U}$) of order m. In particular, we investigate

the distributions associated with i) only one transient state is visited; ii) several transient transient states are visited, with each one only once; iii) all transient states are visited exactly once before absorption into m+1; iv) The last one is the case of a connected graph without a cycle. Questions such as, forming a cycle with or without visiting all states, will also be addressed. These have applications in telecommunication networks, computer networks and many other branches of study.

INVITED TALK 5

K. POULOSE JACOB

RAJAGIRI SCHOOL OF ENGINEERING AND TECHNOLOGY

AI Based Approach Towards Multiparty Privacy In Social Media Platforms

Intelligent systems have been identified as those that perceive and respond to the world around them. Artificial Intelligence (AI) has a profound impact on human lives in solving some of the critical challenges faced by society. Social Media, in some of their facets, can be seen to pose some such challenge. Viewed as online facilitators of human networks which enhance social connectivity, these platforms are user-centric with the impressive capability of supporting community activity. It is even perceived as a forum for Collective Intelligence (CI), which might enhance its role as a technological support base.

The driving force of social media is its content generated by the users which include text posts or comments, digital photos or videos, and scientifically more prudent data generated through various online interactions. As social media keeps on enlarging their domain, the risk of breach of privacy is also on the rise. Interlopers are often seen hawking over social media with personal or business intentions which are not always well meaning. Invasion of privacy is a threat in social media platforms, more susceptible when multiple parties are involved.

Can AI impact Social media interactions more positively? This presentation is more towards a short review with a view to identifying some posers which are worthy to be investigated by potential researchers.

INVITED TALK 6

NARAYANAN N.

INDIAN INSTITUTE OF TECHNOLOGY, CHENNAI

INDIA

Probabilistic Method in graph theory

Paul Erdos pioneered what is known as the probabilistic method, where tools from probability were used in combinatorics. In this talk, we see some examples where probability is used to obtain bounds for various graph parameters.

INVITED TALK 7

BRATATI KAHALI
INDIAN INSTITUTE OF SCIENCE, BANGALORE,
INDIA

Big Data In Human Genetics And Genomics Research

One of the primary forces advancing biomedical research is data integration across different "omics" branches. Biological and clinical data are now being generated and collected at an unprecedented speed and scale from various studies conducted in the general population, as well as disease cohorts. Big data technologies are increasingly applied in bioinformatics and clinical informatics to further human disease related discoveries and facilitate health care research. The sequence of the human genome is the foundation for understanding how our genetic (DNA) code lead to biological functions. We analyze the whole genomes of thousands of individuals to identify variations in DNA sequence among them, that can lead to differential disease predispositions, and subsequently identify novel pathways involved in disease. Because genetic variants are often rare, or have small effect sizes, large datasets are required to make valid inferences about the roles of these variants in disease. This collective large amount of genetic information is often termed genomics big data. Specifically, in genomics, transcriptomics, metabolomics and bioinformatics, high-throughput big data analyses for genome-wide association studies of diseases, finding nucleotide changes and regulatory regions in the genome, distinct gene expression and tissue expression profiles, recognizing

disease specific patterns in metabolites can expedite therapeutic strategies. Similarly, in clinical informatics, the field benefits from the vast amount of collected patient data for making intelligent decisions. Nowadays, cloud based data storage and real time analysis of imaging data helps share workflows and medical results, thus advancing public health. We can also leverage big data techniques for predicting and monitoring infectious disease outbreaks. With advanced artificial intelligence and machine learning algorithms, we are able to guide prediction of disease outcomes and assist clinicians in decision making, often times based on the genetic makeup and environmental exposures of every individual, thus taking steps towards precision medicine.

INVITED TALK 8

DR. AMIT CHATTOPADHYAY

IIIT-BANGALORE

INDIA

Computing Topological Distances between Multivariate Data

Computing distance/similarity between a pair of shapes or data is an important problem in topological data analysis. The problem of computing distance measures using scalar topology has been studied extensively and proven useful in the shape/ data clustering and feature extraction. However, not all features in a data can be described using the scalar topology and developing new tools for computing multivariate or multi-field (consists of multiple scalar fields) topology is indispensable. In this talk, we briefly introduce different techniques in the literature for computing distance between scalar topology and then highlight few of our recent contributions towards computing topological distances between multivariate data.

INVITED TALK 9

M. ASHOK KUMAR

INDIAN INSTITUTE OF TECHNOLOGY, PALAKKAD

INDIA

Probability And Statistical Tools For Data Science

In this talk, we will have a closer look at some of the probability and statistical tools such as Chernoof bound, Central Limit Theorem, interval estimation, etc., and their relevance to data science.

INVITED TALK 10

DIYA THOMAS

CYBERSECURITY GOVERNANCE RISK AND COMPLIANCE OFFICER, SYDNEY,

AUSTRALIA

A Deep Dive into the Ransomware Attacks

The ransomware attack also known as the encryption attack is considered to be one of the key applications of cryptography. In the ransomware attack, the entire system is made unavailable until a ransom (cryptocurrency like bitcoin) is paid. One of the notorious example of the ransomware attack is WannaCry which infected many computer systems and the network all over the world. WannaCry ransomware encrypted the system files resulting in the complete system shutdown. Due to COVID-19 pandemic and Russian invasion of Ukraine, there is a sudden surge in the ransomware attacks across various sectors such as governments, educational, transportation, financials, and healthcare. Based on a research published by Check Point, the ransomware attacks surge by 102 percent globally in 2021, India was the worst hit with 213 weekly ransomware attacks per organization. Considering the devastating impact of the ransomware attack, one of the proactive measure to prevent this type of attack is security awareness training. The main objective of the presentation is to spread awareness on the ransomware attacks and strategies to mitigate such attacks. The presentation, after a brief overview of the ransomware attacks and types, touches upon the common encryption techniques used in the ransomware attacks with examples. The presentation will also discuss the mitigation steps that can be followed to thwart such attacks. A case study of the ransomware attack will also be discussed during the presentation.

Abstract of Contributory Papers

ABSTRACT NO: 1

STRUCTURE OF DIFFERENT CATEGORIES OF DIOPHANTINE 3-TUPLES CONCERNING -CENTRED POLYGONAL NUMBERS.

Manju Somanath 1 , Radhika Das 2 , Bindu V.A 3

1. Research Supervisor, Department of Mathematics, National College, Autonomous, Affiliated to Bharathidasan University, Trichy

2. Assistant Professor, Department of Mathematics, Rajagiri School of Engineering &Technology, Autonomous, Kochi

3. Assistant Professor, Department of Mathematics, Rajagiri School of Engineering & Technology, Autonomous, Kochi

In this paper, extension of Diophantine triples concerning -centred polygonal numbers are evaluated using different centered polygonal numbers like centered decagonal number, centred dodecagonal numbers, centered tetradecogonal numbers and centered octadecogonal numbers.

ABSTRACT NO: 2

BIRTH AND DEATH PROCESSES – A PROBABILISTIC METRIC SPACE APPROACH

T. K. Murali[1], P. B. Vinodkumar[2], P. K. Pramod[3]

1.Department of Mathematics

K. K. T. M. Government College Pullut ,Thrissur, India.

email: 2007murali@gmail.com

2.Department of Mathematics

Rajagiri School of Engineering Technology Kakkanad, India.

3 Department of Mathematics

Panambilly Memorial Government College Chalakkudy, India.

Birth and Death processes are a special type of Markov processes in which there are only two state transitions. One of them increases the state variable by one and is called birth and the second one decreases the state variable by one and is called death. In this paper we are

expressing some birth and death processes as stationary Markov Chain and they are reconstructed as a probabilistic metric space. In this case a distance distribution function can be assinged to any pair of states of the processes. More properties of the processes can be explored using the theoretical background of probabilistic metric spaces.

ABSTRACT NO: 3

ON THE CORE AND NONCORE VERTICES OF SINGULAR GRAPHS

Reeja S. B.[1] , John K. Rajan[2]

1.Research Scholar, Department of Mathematics, University College, University of Kerala, Thiruvananthapuram

2.Associate Professor, Department of Mathematics, University College, University of Kerala, Thiruvananthapuram

A graph G is called singular with nullity η if the nullity of its adjacency matrix A, $\eta(A) \geq 1$. Singular graphs have core and non- core vertices. In this paper core and noncore vertices of singular graphs with nullity $\eta > 1$ is defined and some techniques for identifying the core and noncore vertices were developed.

ABSTRACT NO: 4

STABILITY ANALYSIS AND BACKWARD BIFURCATION OF MALARIA MODEL

P. Monisha[1] and S. Sindu Devi[2]

1. Research Scholar, Department of Mathematics, SRM Institute of Science & Technology, Ramapuram, Chennai- 600089, Tamil Nadu, India

2. Assistant Professor, Department of Mathematics, SRM Institute of Science & Technology, Ramapuram, Chennai-600089, Tamil Nadu, India

sindudes@srmist.edu.in

In this study, we examined a fuzzy SIR model for malaria transmission. To find stability analysis and fuzzy basic reproduction numbers of the virus spread, we established two

equilibrium points. Dynamical systems techniques are used to examine the model, and the results show that the backward bifurcation occurs for a certain range of values.

ABSTRACT NO: 5

ON MAPS WITH DENSE PERIODIC POINTS AND SET OF PERIODS Z+

Suja N Thomas[1], P.B Vinod Kumar[2]
1. College of Engineering Cherthala,Alappuzha.
APJ Abdul Kalam Technological University,Kerala, India.
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2. Rajagiri School of Engineering and Technology,Kochi.
APJ Abdul Kalam Technological University,Kerala, India.
vinod_kumar@rajagiritech.edu.in

In this paper,the maps with dense set of periodic points and set of periods Z+ are referred as Periodically Rich maps. We prove that (1) Every compact manifold of dimension greater than or equal to one admits Periodically Rich maps and (2) The function space C[0.∞) admits Periodically Rich maps.

ABSTRACT NO: 6

A BIRTH-DEATH PROCESS WITH TEMPORARY GROWTH HALTS AND POPULATION INDEPENDENT DEATH RATE

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Birth-death processes, in which death rate is independent of the population size, might have potential applications in various fields such as biology and telecommunications. This paper presents a finite state space birth-death process with time-inhomogeneous birth and death rates, where the death rate is independent of the population size also. In addition to this, it is assumed

that the birth process is subject to temporary halts and resumptions thereafter. An explicit steady state distribution of the above process is obtained. Dependence of various system performance measures on different system parameters is studied numerically.

ABSTRACT NO: 7

MATHEMATICAL MODEL FOR DIABETES USING FUZZY PARAMETERS

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This paper provides a system of nonlinear fuzzy dierential equation models for diabetes. We nd the analytical solution using the Homotopy Perturbation Method (HPM) Stability of the system is investigated. The positivity and boundedness of solution are also proven analytically and graphically. Results show that the disease tends to die out over a while.

ABSTRACT NO: 8

DIMENSIONALITY REDUCTION OF 2D-DIGITAL IMAGE USING LINEAR DISCRIMINANT ANALYSIS

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The dimensionality reduction of the data helps to build the model with less machine effort and also increases the speed of learning and generalization of steps in the machine learning process. LDA aims to maximize the distance between the mean of each class and minimize the

spreading within the class itself. LDA uses within classes and between classes as measures. LDA performs well by maximizing the distance between the means of each class when projecting the data in a lower-dimensional space can lead to better classification results. The objective of the research paper is to implement the dimensionality reduction technique to digital image processing by performing feature extraction in 2D, deploying Linear discriminant analysis. Initially feature extraction is executed which contributes to gather large set of data value. Consequently, the obtained vector values are stored in the database and the dimension of the same is reduced using linear discriminant analysis.

ABSTRACT NO: 9

A STUDY OF INTUITIONISTIC FUZZY GRAPH USING MORPHOLOGICAL OPERATORS AND ITS APPLICATION

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The study focuses on some properties of mathematical morphological operators on intuitionistic fuzzy graph. Morphological operators like dilation and erosion and its composition are useful in the application of intuitionistic fuzzy graph. It is extended to study the topological properties using the topological data analysis with the help of bar codes and betti numbers obtained by constructing minimal spanning trees which extracts topological properties of intuitionistic fuzzy graph. Finally, an algorithm for analysing spread of disease is presented in this study.

ABSTRACT NO: 10

A STUDY ON TOPOLOGICAL INDICES OF BIPARTITE KNESER B TYPE-1 GRAPHS

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For fixed integers n > 1 and k ≥ 1, let $\mathcal{B}_n^+ = \{a_1, a_2, a_3, \dots, a_n\}$. Let V_1 be the set of k-element subsets of $\mathcal{B}_n^+$, 1≤k<n. $V_2 = \phi(\mathcal{B}_n) - V_1$. Here, for a fixed integer n > 1, $\mathcal{B}_n = \{\pm a_1, \pm a_2, \pm a_3, \dots, \pm a_n\}$,where $a_i \epsilon R^+$i = 1, 2, 3, . . . , n, $a_1 <$, $a_2 <$, $a_3 < \cdots <$, $a_n$and$-a_n \notin \mathcal{B}_n$. Let B† = {|x| : x ∈ B}, where B ∈ φ($\mathcal{B}_n$). Define a bipartite graph with parts $V_1$and V_2 and having adjacency as: A ∈ V_1 is adjacent to B ∈ V_2 if and only if A ⊂ B † or B † ⊂ A. This graph is called the bipartite Kneser B type-k graph and is denoted as H_B (n, k). These graphs are investigated for their topological properties. The size of automorphism groups of bi- partite Kneser B type-k graphs are prodigious. For any integers n ≥ 2, the topological indices of bipartite Kneser B type-1 graphs are determined. The bipartite Kneser B type-1 graph's Wiener index, peripheral Wiener index, and peripheral Wiener polynomial are established.

ABSTRACT NO: 11

ON THE BITOPOLOGICAL SPACE ASSOCIATED WITH A 3-UNIFORM SEMIGRAPH

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In this paper, the outlying neighbourhood N_i^o of the vertex 'i'of a 3 − uniform semigraph is defined as N_i^o = V – C_i ,where V is the vertex set and C_i is the set of vertices which are consecutively adjacent to 'i'.Let E and M denote the collection of end vertices and middle vertices respectively. Define $\tau_E = \cap_{i \in E}$
P(N_i^o) and $\tau_M = \cap_{i \in M}$P(N_i^o).τ_E and τ_M are the discrete topologies on the end vertex set and the middle vertex set respectively. τ '$_E$ = V ∪τ_E and τ '$_M$ = V ∪ τ_M are two different topologies

defined on the vertex set of the 3-uniform semigraph and hence (V, τ'_E, τ'_M) is a bitopological space. Some properties of this bitopological space are discussed.

ABSTRACT NO: 12

ON THE EXPONENTIAL DIOPHANTINE EQUATION RELATED TO THE POWERS OF CLUSTER PRIMES

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This research is an attempt to highlight the rarity of Cluster primes in the world of number systems. We will also look into the solution of an equation. This also assumes more significance when only a select few of the Cluster prime numbers are found eligible and satisfy the given equation. The paper is further corroborated by means of programming to delve into a bigger range of values which further substantiates the claim that a few cluster primes will go ahead and satisfy the said equation.

ABSTRACT NO: 13

A STUDY ON GRAPHS IN SEQUENTIAL GAMES

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This paper describes the application of Graph Theory in sequential Games. Graph Theory has many applications in the fields of engineering, science, social science industry and in

operations research. Game theory is an important area in operations research. In this paper, a study of sequential games in graph theory is studied. Graph theoretical tools is applied in game theory in particular to sequential games. A connected acyclic directed graph is used to represent game. In sequential game the players know each others movement and took decision before the movement and plays sequentially. Game trees were used to indicate the movement of players. The position of the game is represented by vertices and legal moves between these positions are represented by edges. Here graphs of different sequential games are shown as examples.

ABSTRACT NO: 14

COMPARISON OF VACATION AND $M_t/M_t/1$ QUEUEING MODELS FOR TRAFFIC FLOW AT SIGNALIZED INTERSECTIONS

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Several models, including those based on queueing theory; exist for predicting traffic queue size at signalized intersections. However, the traffic characteristics such as speed, density, flow, and congestion are so diverse that a tailor-made model, where the computation of the parameters could be done at each signal at regular intervals seems the most appropriate one. A vacation queueing model as in Lioris et al. (2017) falls in this category. In the above model, it is assumed that the arrival of vehicles is according to a Poisson process with parameter and their service time follows an exponential distribution with parameter. The server (traffic signal), goes on single vacations (red signal) after a random duration (green signal), which is exponentially distributed with parameter. Each vacation duration follows an exponential distribution with parameter. Steady state analytic expression for the average number of vehicles and the delay at the signal can then be obtained in terms of the above parameters. However, depending on the per minute vehicle arrival rate , the underlying Markov chain may take several minutes to reach the steady state. Hence, the steady state measures may vary from reality. The present study shows that even the transient measures don’t give a better prediction. Motie &

Savla (2017) applied a pure birth process for the red period and an M/D/1/N queue for the green period of the traffic signal. Transient study of their combined model showed better performance, compared to the steady state analysis of the Lioris et al. (2017) model. Our study shows that an

M_t /M_t /1 queue gives a similar performance as the Motie & Savla (2017) model. Capturing the traffic at a signal in Kerala, India, we compared the performance of the transient Lioris et al. (2017), Motie & Savla (2017), and the M_t /M_t /1 queueing models. Our results suggest that the performance of the Motie & Savla (2017) and the M_t/M_t/1queueing models are similar; whereas the performance of the vacation queueing model deviates from reality.

ABSTRACT NO: 15

LI-YORKE CHAOTIC EIGEN SET OF DIRECT SUM OF LINEAR OPERATORS

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The Li-Yorke chaotic eigen set of an operator consisting of all λ's such that T − λI is Li-Yorke chaotic. In this paper, the Li-Yorke chaotic eigen set of the direct sum of linear operators is found to be the union of Li- Yorke chaotic sets of the corresponding operators. Also we discuss about the Li- Yorke chaotic eigen set of compact operators, normal operators and self adjoint operators.

ABSTRACT NO: 16

STUDY THE DOMAINS OF INFINITE ALGORTHIMS OF CALCULATION OF NILPOTENT MATRIX GROUPS

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Guided and Communicated by Dr. Arihant Jain

We design algorithms for nilpotent groups using the methods we describe for computing with matrix groups defined over a variety of infinite domains. In particular, we present an efficient approach for checking the nilpotency of matrix groups over an infinite field. For a given nilpotent matrix group, we also propose techniques that resolve a number of related structural concerns.

ABSTRACT NO: 17

ON JUMPING GRAPH GRAMMARS

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This paper introduces the notion of jumping graph gram- mars. In particular it focuses on the non-confluent version. As a graphical counterpart of general jumping grammars, jumping graph grammars have a greater generative power compared to existing graph grammars.

ABSTRACT NO: 18

U-DARE: AN INTELLIGENT UAV-BASED FRAMEWORK TOWARDS DETECTION OF NETWORK ANOMALY FOR RELIABLE COMMUNICATION

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The advent of Unmanned Aerial Vehicles (UAVs) have proven to be a quite promising in different industries including, agriculture, healthcare, industrial automation, remote surveillance, and military applications. The UAVs are largely dependent of wireless communication protocols for facilitating communication in the UAV network and for capturing data from other connected Internet of Things (IoT)-based devices. The factors arising due to remote operation and dependence on wireless
protocols makes them prone to attacks. This leads to the urgency for devising Intrusion Detection System (IDS) for UAVs for timely detection and isolation of attacks. In this view, the present work focuses on developing intelligent framework for anomaly detection in UAV networks acronymed as U-DARE. The proposed model is experimentally validated with real-world UAV data to depict its efficacy over different performance metrics like precision, recall, F-measure, prediction accuracy, and CPU time. It was observed that the proposed model outperformed base models by providing an accuracy of 99.372 %.

ABSTRACT NO: 19

STUDY OF BIRTH-DEATH PROCESSES WITH GROWTH INTERRUPTIONS

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In the literature, various authors have studied birth-death processes in which the birth/growth comes to a halt as the population size grows beyond certain threshold. Logistic growth is an example to such growth. Such processes might have applications in several fields such as biology, ecology, and energy harvesting. This study, considers birth-death processes with temporary birth halts. A stability condition under which the population size remains finite with

probability 1 is obtained. An explicit expression has been obtained for the steady state distribution of the process. We also studied a truncated version of the above process, which might have potential applications in several fields such as tumor progression modelling and energy harvesting modelling. An explicit steady state distribution is obtained for the truncated process also. Dependence of the average steady state population size on various modelling parameters is studied numerically for finite and infinite processes.

ABSTRACT NO: 20

A STUDY ON THE THERMAL AND PHYSICAL PROPERTIES OF TITANA-WATER AND ALUMINA-WATER NANOFLUIDS

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Nanofluids, in which nano-sized particles (typically less than 100 nanometers) suspended in liquids,

have emerged as a potential candidate for the design of heat transfer fluids. The main goal of nanofluids is to achieve the highest possible thermal properties at the smallest possible concentrations by uniform dispersion and stable suspension of nanoparticles in host fluids. The objective of this paper is to study about the thermophysical properties such as specific heat capacity, density, dynamic viscosity, Prandtl number and effective thermal conductivity of titana-water (titanium dioxide water) nanofluid and alumina-water (aluminium oxide water) nanofluid for a given volume fraction. The MATLAB is used to obtain the numerical solution and the drawings of the problem. The sketches of different parameters versus the different volume fractions are given with requisite ponderings.

ABSTRACT NO: 21

SECOND HYPER-ZAGREB INDICES OF PRODUCTS RELATED TO TRIANGLE PARALLEL GRAPHS

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The cognitive and evidential features of the graph discipline are significantly influenced by the implementation of graph operations. Molecular descriptor acts as a fundamental network invariant relevant to a particular molecular structure in the framework of chemical graph theory. The semi-total point graph features the edges of subdivision graph as well as the edges of the original graph. In this paper, we explore combinatorial inequalities associated with the edges, vertices and its corresponding neighborhood notions along with the inclusion of other molecular descriptors in the computations for the determination of exact expressions of second hyper-zagreb index for certain corona products involving the semi-total point graph.

ABSTRACT NO: 22

A SURVEY OF TOPOLOGICAL DATA ANALYSIS BASED IMAGE SEGMENTATION

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Image segmentation (IS) is the most challenging and fundamental task in computer vision for analyzing medical images. Amongst several medical image segmentation methods available in the literature, Persistent Homology (PH) based methods are relatively new and have several good features with many applications in medical imaging. PH is a rapidly growing technique from Topological Data Analysis (TDA). TDA is a decade-old field built on the tools from

Algebraic Topology (branch of pure mathematics), which studies the shape of data. TDA is rapidly growing due to its unique way of analyzing inferring exploiting complex data sets. In PH-based methods, images are converted to point clouds; then, simplicial complexes are constructed at different varying scales on the top of point clouds using the filtration process. Several topological features like connected components loops or holes are obtained during the filtration process at different scales. Then Image is segmented based on these features. This review is devoted to PH-based medical segmentation. All the methods are systematically reviewed. In addition, PH with a deep learning segmentation technique is also discussed.

ABSTRACT NO: 23

ANALYSIS OF BRAIN ARTERIES USING PERSISTENT HOMOLOGY TOOLS AND MACHINE LEARNING TECHNIQUES IN TOPOLOGICAL DATA ANALYSIS

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In recent years, Topological Data Analysis (TDA) has been effectively used to a variety of applications like processing and segmenting a digital image, getting insights into patterns generated by biological systems such as flocks of birds or a herd of buffaloes. It is also used in locating sensor networks, or simply detecting the underlying geometry of the item they exist on from a sequence of discrete data-points. TDA is a mathematical technique that aims to find mathematical relationships or patterns in data from complicated systems. It makes no claim to comprehend their internal mechanism. Topological Data Analysis (TDA) analyses datasets using topological approaches. In this work, we will look at how topological data analysis assist in the discovery of new insights into brain artery trees using persistent homology and machine learning.

ABSTRACT NO: 24

SUM DIVISOR CORDIAL LABELING FOR MIDDLE GRAPH AND TOTAL GRAPH OF SOME GRAPHS

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Graph labeling is one of the most interesting concepts in graph theory which has a numerous application in different fields. A labeling of graph is the allocation of labels, conventionally reserved as integers, to edges and/or nodes of a graph. Sum divisor cordial labeling is a new variant of divisor cordial labeling. In the present investigations we have derived six new out-turns admitting SDCL for middle graph of path, cycle and star, total graph of path, cycle and star graph.

ABSTRACT NO: 25

SPECTRUM OF BIPARTITE KNESER TYPE-K GRAPHS

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Let n and k be integers with $n > 1$, $k \geq 1$. Let $S_n = \{1, 2, 3, \ldots, n\}$. Let $\varphi(S_n)$ be the set of all non-empty subsets of S_n. Let V_1 be the set of all k-element subsets of S_n and $V_2 = \varphi(S_n) - V_1$. A bipartite Kneser type-k graph H_T (n, k) is a graph with set of all k and $(2n-1)-k$ subsets of S_n as vertices, in which two vertices are adjacent if and only if one of them is a subset of the other .In this paper we determine the spectrum of H_T (n, k) and its distance spectrum.

ABSTRACT NO: 26

SUPER DOMINATION NUMBER OF CYCLE BASED GRAPHS AND COMB PRODUCT OF GRAPHS

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Consider simple connected undirected graph having V as the vertex set and E as the edge set. A set S⊆ V is called the super dominating set if ∀ v ∈ $\bar{S}$, ∃ u ∈ S : N(u) ∩ $\bar{S}$ = {v}, where $\bar{S}$= V \ S. The least cardinality of the the super dominating sets in G is the super domination number, γsp(G). By choosing a copy of G and |V (G)| copies of R, the comb product of the graphs G and R, G ▷ ◦R is obtained. We analysed some graphs and calculated the super domination number. We further analysed
the comb products of some graphs. The super domination number of the comb product and the relationship of super domination number of comb product with other graph parameters were also discussed in this paper.

ABSTRACT NO: 27

ON UNIFORM NUMBER OF GRAPHS AND OTHER GRAPH INVARIANTS

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In 2020, Elakiyya et al., introduced the notion of uniform number of a connected graph G, denoted as ς(G), as the least cardinality of a nonempty subset M of the vertex set of G for which the function fM : Mc → P(X) − {∅} defined as fM(x) = {D(x, y) : y ∈ M} is a constant function, where D(x, y) is the detour distance between x and y in G and P(X) is the power set of X = {D(xi, xj) : xi ≠ xj}. In the present article, we investigate the behavior of newly introduced graph parameter uniform number of a graph ς(G) with the domination number γ(G), clique number ω(G), independence number β(G) and chromatic number χ(G) of a graph.

ABSTRACT NO: 28

STRONG HOMOMETRIC NUMBER OF A GRAPH

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Two subsets of vertices in a graph G are homometric if the multisets of distances determined by them are the same. The largest integer h such that there are two disjoint homometric sets of order h in G is the homometric number of G, denoted by h(G). The notion of homometric number of a graph as introduced by Albertson et al. in 2011 was extended to detour homometric number of a graph in 2017. Two subsets of vertices in a graph G are said to be detour homometric if the multisets of detour distances determined by them are the same. The largest integer h^* such that there are two disjoint detour homometric sets of order h^* in G is the detour homometric number of G, denoted as $h^*(G)$. In this note, we present and investigate a new graph parameter, the strong homometric number ħ(G) of a graph G. Two subsets of vertices in a graph are said to be strong homometric if it is homometric as well as detour homometric. The largest integer ħ, such that there are two disjoint strong homometric sets of order ħ in G is referred to as strong homometric number of G. In this article, we investigate strong homometric number of graphs.

ABSTRACT NO: 29

STUDY ON MARKETING DYNAMICS ON SALES OF ELECTRIC VEHICLES AND SWOT ANALYSIS

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India is one of the most polluted countries in the world. The Government of India is constantly trying to mitigate greenhouse gas emissions by proposing various measures. The pollutants caused by the transport sector also contribute to the decreasing air quality level in India forcing the Government of India to promote electric vehicles (EVs) by introducing multiple initiatives. India has witnessed the growth of electric vehicles in various segments of the transport sector over the years. To gain a good
insight into the EV market, data is being collected from each segment in the transport sector.

In this paper, the growth of EVs is being predicted by the year 2030 through few statistical and neural network models. The extracted data is analyzed using descriptive, and predictive methods. The models are being compared and the best model is being selected based on accuracy for further forecasting. The forecasting is applied to all the segments in the EV industry. In particular, statistical models like SARIMA (Seasonal Auto-Regressive Moving Average), Moving average smoothing, exponential smoothing, regression, and neural network model like LSTM (Long-Short Time Memory) are implemented to get accuracy. The models are evaluated using the train-test spilt method and the most accurate model is chosen. The dynamics of the EV market in the present scenario are being discussed and illustrated. The Strength, Weaknesses, Opportunities, and Threats of the electric vehicle industry are identified and analyzed. We observed that the SARIMA model provides good accuracy in terms of performance measure and it is used for forecasting. After analyzing the data, we found that Compounded Annual Growth Rate (CAGR) for two and three-wheelers electric vehicles,electric cars, and electric bus are 27.34 %, 20.87 % and 18.17 % respectively.

ABSTRACT NO: 30

ON THE DETOUR ECCENTRIC SUM OF GRAPHS

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In 2005 Gupta et al. introduced a topological graph invariant eccentric distance sum of a graph. In this article, we extend the notion of eccentric distance sum to detour eccentric sum by considering detour distance instead of distance between two vertices of a graph. For a simple connected finite graph G we define detour eccentric sum of G as $\xi D(G) = PeD(v) \cdot SD(v)$ where eD(v) is the detour eccentricity of the vertex $v \in V(G)$ and SD(v) is the sum of all detour distances from v to the remaining vertices in G. In this article, we evaluate the value of the new invariant for some graphs

containing at least one cycle.

ABSTRACT NO: 31

ON C-PERFECTION OF MODULAR PRODUCT OF GRAPHS

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A graph G is said to be C-perfect if, for all induced subgraphs H of G, the induced cycle independence number is equal to its corresponding induce cycle covering number, where every vertex in H belongs to at least one cycle in H. This article deals with the study on C-perfection of modular product of graphs. Through this article, we study various structural properties of C-perfect modular product of graphs and also characterize them.

ABSTRACT NO: 32

EDGE WEIGHT BASED COLOURING AND MATCHING IN INHOMOGENOUS RANDOM GRAPHS

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In this paper, we study edge weight based colouring and matching in a random graph G with non-uniform edge probabilities. We equip each edge of G with a deterministic weight from a given set and establish bounds on the minimum cardinality of the weight set that ensures the existence of a proper induced colouring. Next we use a variant of the polynomial edge weight based testing method to search for a perfect matching in G. We make crucial use of a Schwartz-Zippel type estimate (obtained using the probabilistic method) for the number of zeros of a homogenous polynomial in a finite field.

ABSTRACT NO: 33

NETWORK REPRESENTATION LEARNING: A SURVEY

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Network embedding transforms one network into a low-dimensional vector space but preserves the entire network structure. This paper compares different network embedding techniques that learn node embeddings by discovering a latent node attribute subspace.The latent space is simply a representation of compressed data in which similar data points are closer together in space. The resultant latent subspace can achieve network structure in a more efficient way towards learning high-quality node representations.This paper also compares the link prediction performance of different embeddings.

ABSTRACT NO: 34

A NEW APPROACH OF RANKING OF INTERVAL TYPE-2 FUZZY NUMBERS USING EXPECTED VALUE AND AMBIGUITY

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Interval type-2 fuzzy numbers are used in the real world to make decisions in uncertain situations. That interval type-2 fuzzy numbers have the highest ranking priority is not unexpected. In this work, an unique method for ranking interval type-2 fuzzy numbers was developed by coupling the quantity expected value with the uncertainty present in ill-defined quantity ambiguity. The superior discriminating skills of the proposed approach over numerous well-known techniques are further illustrated through the analysis of a range of numerical examples. The given ranking interval type-2 fuzzy numbers technique is then used to resolve a project selection challenge for a car manufacturing facility.

ABSTRACT NO: 35

FUZZY ITERATED FUNCTION SYSTEMS

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It is noticed that IFS is defined for integer values n. In this work we study the dynamics of functions, where iterations take continuous times. Taking some concepts from fuzzy sets, r-times iterations is defined for rεR. We study ε − chaotic function using these iterative concepts.

ABSTRACT NO: 36

DYNAMICS OF A FAMILY OF MAPS WITH CONSTANT MASS CENTRE

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In this paper we discuss the dynamics of a family of maps with constant mass centre. We study the bifurcations and chaotic nature of the family of maps. It is also proved that there exist a real number after which all the members of the family are chaotic.

ABSTRACT NO: 37

APPLICATIONS OF TOPOLOGICAL DATA ANALYSIS WITH MORPHOLOGY OPERATORS ON HYPERGRAPHS

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A hypergraph is a type of graph, H = (V, E) where V is the set of nodes and E is the set of hyperedges; where one edge consists of many nodes. Morphological operators are nonlinear operators which can be applied on images, graphs , hypergraphs etc. Dilation and erosion are morphological operators and other operators like opening, closing can be obtained by repeated application of these operators. Topological space consists of a set X together with topology τ defined on X, which satisfies the axioms namely Nullset, arbitrary union of opensets and finite intersection of opensets. Such a topological space S = (X, T) is compatible with a hypergraph H if $X = V_H \cup E_H$ where V_H and E_H are the vertex set and edge set respectively. The morphological operators induces several topology on hypergraph with its compatible

topological space S = (X, T). The neighborhood of a node is defined in many ways which can be considered as open sets in the corresponding topological space. The purpose of this paper is to apply topological properties on hypergraphs using morphological operators. Separation axiom and closure function are illustrated using hypergraph structure. The work is extended to crime analysis, text processing and patient disease analysis. Topological feature extraction is done on Barcodes created from crime hypergraphs. This gives a better visualization of crime analysis.

ABSTRACT NO: 38

FRAUD DETECTION IN BITCOIN TRANSACTIONS USING GRAPH BASED ANOMALY TECHNIQUES

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Anti money laundering has been an issue in our society from the beginning of time. It simply refers to certain regulations and laws set by the government to uncover illegal money which is passed as legal income. Now with the emergence of cryptocurrency, it ensures pseudonymity to the users. Cryptocurrency is a type of currency which is not authorised by the Government that doesn't exist physically but only paperlessly. This provides a better platform for criminals for their illicit transactions. But as new algorithms are found everyday, the field of deep learning and machine learning gives us hope in identifying these anomalies in transactions. We have selected Elliptic Bitcoin Dataset. This is a transaction graph dataset collected from the blockchain which is anonymized. Each transaction is mapped to real entities with two categories; licit and illicit. Some of them are unlabelled. We have run different algorithms for predicting illicit transactions like Logistic Regression, Random Forest, Support Vector Machine, Long Short Term Memory and a variation of Graph Neural Networks which is Graph Convolution network which is of special interest in our case. Our metrics of comparison were Accuracy and Area Under the Curve (AUC). Our results show that Random Forest is the better fit for this particular dataset in terms of Accuracy and AUC.

ABSTRACT NO: 39

INTRODUCTION TO INTERVAL-VALUED NEUTROSOPHIC HYPERSOFT EXPERT SET

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In this paper, we generalize the idea of Interval-valued neutrosophic hyper-soft set by defining Interval-valued neutrosophic hyper-soft expert set which is a blend of Interval-valued neutrosophic set and hyper-soft expert set. Further, some fundamental notions and operations based on IVNHSES have been introduced along with their properties and examples.

ABSTRACT NO: 40

WAVELET-BASED QUADRATURE RULE TO EVALUATING QUASI-TYPE SINGULAR INTEGRAL EQUATIONS

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The Haar wavelet and hybrid wavelet quadrature-based scheme are employed to perform quasi-type singular definite integrals appearing in electro-magnetic field theory, numerical results are provided to illustrate with several numerical examples.

ABSTRACT NO: 41

FUZZY-FRACTAL DIMENSION OF COVID-19 VARIANTS PROTEINS

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Numerous studies conducted since the Covid-19 pandemic began in early 2020 have revealed that only 14 to 15% of infected individuals experience severe sickness; the remainder either have minimal or no symptoms. The COVID pandemic continues as new variants of covid-19 are emerging as a result of modifications to the virus's genetic coding. It is important to understand the modifications in covid-19 protein structure. The fractal analysis of covid-19 proteins can provide better understanding about the protein structure. When a structural or dynamic pattern repeats at various spatial or temporal scales, it is known as a fractal and is one of the most striking examples of self-similarity. It is well known that the self-similarity that appears in the distributions of their biophysical and biochemical properties of proteins can be used as a useful tool to identify the fundamentally nonlinear and inhomogeneous behaviors of protein structures. In this paper, we have proposed a method to calculated fuzzy fractal dimension and covering ability of protein structure network of covid-19 variant proteins. Interestingly, we observed that the protein structure network of alpha, beta and delta variants of covid-19 have same fractal dimension, but for omicron variant fractal dimension comparatively less.

ABSTRACT NO: 42

CONNECTEDNESS OF THE SPACE OF HOMEOMORPHISMS OF A COMPACT MANIFOLD

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Let X be a compact manifold and H(X) be its space of homeomorphisms. It is well known that a compact manifold of dimension > 1 is n−homogeneous.Using this, we study about the properties of the sets $H(x,y) = \{h \in H(X)/h(O_f(x)) = O_f(y)\}$ and $[x] = \cup_{.y \in pern(f)} H(x,y)$ where f is a continuous function and $O_f(x)$,$per_n(f)$ denotes the orbit of x and the set of n−periodic points respectively. Finally, we prove that the space of homeomorphisms of a compact manifold is disconnected.

ABSTRACT NO: 43

A STUDY ON RAMANUJAN GRAPHS

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The purpose of this is a short survey of the theory of the Ramanujan graph. Ramanujan graph has considerable importance in view of the fact that they have optimal spectral expansion and hence can be adopted as interconnection networks and error correcting codes. M. Ram Murti describes in his paper, Ramanujan graphs as it fuses diverse branches of pure mathematics namely number theory, representation theory, and algebraic geometry. We briefly discuss how these are related and how certain Cayley graphs are considered examples of Ramanujan graphs and how their spectrum is analysed. We also consider some explicit constructions of infinite families of Ramanujan graphs.

ABSTRACT NO: 44

ON THE SPACE OF GENERALISED PERSISTENCE DIAGRAMS

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In Topological Data Analysis, persistence diagrams are useful tool for visualising persistent homology. Set of diagrams endowed with Wasserstein distance and Bottleneck distance, form metric spaces which has several properties that make them useful for data analysis. In this paper we define a generalized persistence diagram in which instead of taking points from R 2 we have points from arbitrary vector spaces. Metric spaces on such generalized diagrams and several properties of these metric spaces are discussed in this paper.

ABSTRACT NO: 45

SOME EIGEN VALUE PROPERTIES OF UNIFORM HYPERSTAR USING RECURRENCE RELATION

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Hypergraph is the best tool to represent multiple relationship. Complex form of social, biological, chemical relation can be represented by hypergraphs. Consider a hypergraph H with vertex set $V = \{v_1, v_2, \ldots v_3\}$ and hyperedge set $E = \{e_1, e_2 \ldots e_n\}$. Two edges are adjacent if their intersection is non-empty. A neighbourhood of a vertex v_i, denoted by N(vi) is defined as the collection of vertices in adjacent edges of vi

A special type of hypergraph, 3-uniform hyperstar is considered here. A detailed study of characteristic equation is made using adjacency matrix of some of the 3-uniform hyperstar and the k-uniform hyperstar. Some of the recurrence relations are derived for some of the coefficients of characteristic equation.

The general form of an n degree characteristic equation is taken as $-\lambda_n + C_{n-1}\lambda_{n-1} + \cdots + --- + C_2\lambda_2 + C\lambda + C_0$. For a k-uniform hyperstar, the number of vertices is given by the form, n = (m+1)k−m+k−1; m = 1, 2, 3, ...The sum of the product of three eigen values of a k-uniform hyperstar is given by $\sum_{i,j,k=1}^{(m+1)k-m+k-1} \lambda_i \lambda_j \lambda_k = s(k-2)\,2(m+1);$, or $P[(m+1)k - m + k - 1] = s(k-2)\,2(m+2)$, where m = 1, 2, 3—— with the recurrence relation $P[(m+1)k - m + k - 1] = P[(m+1)k - m] + 2\,s(k-2)$; $P(2k-1) = 4\,s(k-2)$.
