BOOK OF ABSTRACTS

MATHEMATICS DAY

2^{nd} *INTERNATIONAL CONFERENCE*

on

NONLINEAR APPLIED ANALYSIS

and

OPTIMIZATION

(ICNAAO-2022)

December 19-22, 2022

Department of Mathematical Sciences

Indian Institute of Technology (BHU), Varanasi

Supported by SERB, New Delhi

Indian Institute of Technology (Banaras Hindu University)

The Indian Institute of Technology (Banaras Hindu University), Varanasi, owes its existence to the farsighted vision and relentless efforts of the founder Mahamana Pandit Madan Mohan Malaviya ji who created the first comprehensive residential university of India. Three engineering and technological institutions were established viz the Benaras Engineering College (BENCO) in 1919, the College of Mining and Metallurgy (MINMET) in 1923, and the College of Technology (TECHNO) in 1932 as the constituent units of Banaras Hindu University. The first ever Bachelor's degree course in Electrical, Mechanical, Metallurgy, Mining, Ceramics, and Pharmaceutics in India was pioneered at BHU, while Pharmaceutics also being the first in Asia. After the country's independence in 1947, postgraduate and doctoral research programs were also introduced here. These colleges produced outstanding engineers who led various indigenous industries, academic institutions, and R&D laboratories both within and outside the country. The three engineering colleges were merged to form the Institute of Technology (BHU) in 1968. The erstwhile IT(BHU) was converted into IIT (BHU) Varanasi w.e.f. 29th June 2012. Since then IIT (BHU) has been witnessing the realization of several significant academics, research, and developmental programs and new initiatives in all spheres of the Institute.

The Conference

The 2nd International Conference on Nonlinear Analysis and Optimization is scheduled at the Department of Mathematical Sciences during December 19-22, 2022, under the aegis of the Indian Institute of Technology (Banaras Hindu University), Varanasi. This conference is aimed at providing an opportunity for young researchers to attend talks of International level experts, interact with them during short discussions, and present their contributions if accepted.

The objective of the conference is to motivate and equip the participants with the recent state-of-the-art in the focus areas of nonlinear analysis, fixed point theory, dynamical systems, optimization, fractals, applications to differential/integral equations, and signal and image processing, soft computing, as well as expose the young talents with the newer dimensions in these areas with their practical approaches to tackle the real-life problems in engineering, medical and social sciences, and the Ramanujan's Conjectures so that the participants can take up various challenges in future.

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From the Organizing Chair's Desk

The 2nd International Conference on Nonlinear Applied Analysis & Optimization and National Mathematics (ICNAAO & NMD-2022) is being organized at the Indian Institute of Technology (BHU) Varanasi, INDIA, during Dec 19-22, 2022, which is in continuation of the event ICNAAO & NMD-2021 held during Dec 21-23, 2021. The main objective of ICNAAO & NMD-2022 is to motivate and equip the participants with the recent state-of-the-art in the areas mentioned below and to expose the young talents to the newer avenues of research to tackle the real-life problems in engineering, medical and social sciences, etc. The high-level deliberations are arranged by several reputed experts from around the globe engaged in high-quality research and The participants working on nonlinear analysis, fixed point theory, fractals, dynamical systems, differential/integral equations, optimization, soft computing, and decision-making. The participants are going to be benefitted from the talks of Professor R P Agarwal (University of Texas, USA), Dr. Sorin-Mihai Grad (France) on Nonlinear Analysis, Prof. Y J Cho (Gyeongsang National University, China), Professor A Petrusel (Babeş-Bolyai University, Romania), Professor V Vetrivel (IIT Madras), Professor B S Choudhury (IIEST, Shibpur, India), Dr. Lakshmi K Dey (NIT Durgapur, India) on Fixed point theory, Professor B V Rathish Kumar (IIT Kanpur) on Mathematical Modeling, Professor H K Xu (Hangzhou Dianzi University, China), Professor Akhtar A Khan (Rochester Institute of Technology, USA), on Optimization, Dr. V K Singh (IIT BHU, India) on Numerical Analysis, Professor Peter Massopust (Technical University of Munich, Germany), Professor Mrinal K Roychowdhury (University of Texas, USA) and Professor Karoly Simon (Budapest University of Technology and Economics, Hungary and also the Chinese University of Hong Kong) on Fractals, Professor Laszlo T Koczy (Technical University of Budapest, Hungary), Professor Oscar Castillo (Institute of Technology Tijuana, Mexico), Professor S K Singh (IIT BHU, India), Professor R N Bhaumik (Central University of Agartala, India), Professor A Mukherjee (Central University of Agartala, India) on Fuzzy set extension, soft computing, and decision making, and Dr. Anoop Singh (IIT BHU, India) on Algebra. About seventy-five participants are going to participate and get benefitted from the four days of academic exercises planned by the department. The authors have the option to publish their papers in the Special Issue of the Journals viz. i) Optimization, ii) The Journal of Analysis and iii) The Dynamical Systems and Applications dedicated to the conference ICNAAO-2022. I am grateful to all the organizing committee members and research students engaged in arranging the conference. The Organizing Chair is highly thankful to **SERB** New Delhi for its financial support to ICNAAO&NMD-2022.

T. Som, Professor
Organizing Chair, ICNAAO-2021,
Department of Mathematical Sciences
IIT (BHU), Varanasi.

List of Speakers

Keynote Speakers

R. P. Agrawal
H. K. Xu

Plenary Speakers

Y. J. Cho
B. V. Rathish Kumar
B. S. Choudhury
Oscar Castillo
K Simon
P Massopust
Laszlo T. Koczy
Akhtar A Khan
A. Petruşel
M. K. Roychowdhury

Invited Speakers

A. Mukherjee
V. Vetrivel
V. K. Singh
Lakshmi Kanta Dey
S. K. Singh
S. M. Grad
Rabi Nanda Bhaumik
Anoop Singh

Abstracts

Abstracts of Invited Speakers

RAVI P AGARWAL
Texas A&M University-Kingsville, U.S.A.

Upper and lower solution method for nth order BVPs on an infinite interval

This work is devoted to study a nth order ordinary differential equation on a half-line with Sturm-Liouville boundary conditions. The existence results of a solution and triple solutions are established by employing a generalized version of the upper and lower solution method, Schäuder fixed point theorem, and topological degree theory. In our problem the nonlinearity depends on derivatives, and we allow solutions to be unbounded, which is an extra interesting feature. To demonstrate the usefulness of our results we illustrate two examples.

H K XU
Hangzhou Dianzi University, China

Extra Gradient and Extra Anchor Methods for Optimization and Nonlinear Mappings

Gradient methods are popular techniques in optimization and variational inequalities. If the continuously differentiable convex objective function f of a minimization problem (or the governing monotone mapping of a variational inequality A) is strongly convex or co-coercive (also known as inverse strongly monotone), then the gradient method works and at each iteration, only one gradient is required to compute. If, however, f (or A) fails to be cocoercive, then one-step gradient methods may fail to converge. Consequently, extra gradients are required to assert convergence of gradient methods. In this talk we shall discuss some recent progresses in extra-gradient methods and extra-anchor methods for optimization problems and fixed point problems of nonexpansive mappings.

Y J Cho

Gyeongsang National University, China

Some Inertial Algorithms for Nonlinear Problems in Hilbert Spaces and their Effectiveness

- First, we introduce **some nonlinear problems**;
- Second, we introduce **some properties of the metric projection and nonlinear mappings**;
- Third, we introduce **some projection methods** and **inertial algorithms** for some nonlinear problems in Hilbert spaces;
- Finally, we give **some Remarks** for the convergence rate of some algorithms.

B V RATHISH KUMAR

Indian Institute of Technology Kanpur, Uttar Pradesh, India

Cardiac Electrical Activity: Modelling and Simulation

The heart electrical conduction system propagates the electrical impulse originated from the sino-atrial node (SA) called cardiac pacemaker, situated in the left atrium, due to which heart muscle starts to contract, and then this signal travels to the whole heart, and the contraction of entire heart muscle takes place. The basis of the electrical activity is the action potential, which is facilitated by ionic channels and the ionic cell transporters that enable the movement of ions across the cardiac cell membrane. Myocardial ischemia takes place when the blood flow to the heart and oxygen supply to the heart is abnormal. It is one of the leading causes of sudden death. Due to this myocardial ischemia metabolism and electrophysiological changes appear which results in the alteration of cardiac electrical activity. In this talk, we will discuss the modelling and simulation of aspects CEA in Human Cardiac Tissue (HCT). The different PDE models related to the CEA in HCT will be introduced. Further the ODE models related to the ionic activity will also be introduced. Later, a coupled PDE-ODE model for CEA in HCT will be considered. Existence-uniqueness and well-posedness of the governing model will be elaborated. Further, the weak variational formulation of the combined PDE-ODE model amenable for finite element approximation will be discussed. Theoretical results related to the convergence analysis of FE scheme will be discussed and finally the numerical computations related to CEA in healthy and diseased HCT will be presented.

B S CHOUDHURY

Indian Institute of Engineering Science and Technology, West Bengal, India

A Hundred Year of Metric Fixed Point Theory

The journey of metric fixed point theory began in 1922 with the publication of the famous contraction mapping principle by S. Banach. Since then the subject developed and proliferated in various directions which is continued even in the present times with undiminished pace. In this context some of its main streams in its journey of hundred years are discussed with due regard to chronology of the development.

OSCAR CASTILLO

Tijuana Institute of Technology,Tijuana, Mexico

Type-2 and Type-3 Fuzzy Systems and their Applications

Type-2 fuzzy systems are powerful intelligent models based on the theory of fuzzy sets, originally proposed by Prof. Zadeh. Most real-world applications up to now are based on type-1 fuzzy systems, which are built based on the original (Type-1) fuzzy sets that extend the concept of classical sets. Type-2 fuzzy sets extend type-1 fuzzy sets by allowing the membership to be fuzzy, in this way allowing a higher level of uncertainty management. Even with the current successful applications of Type-1 fuzzy systems, now several papers have shown that type-2 is able to outperform Type-1 in control, pattern recognition, manufacturing and other areas. The key challenge in dealing with Type-2 fuzzy models is that their design has a higher level of complexity, and in this regard the use of bio-inspired optimization techniques is of great help in finding the optimal structure and parameters of the Type-2 fuzzy systems for particular applications, like in control, robotics, manufacturing and others. Methodologies for designing type-2 fuzzy systems using bio-inspired optimization in different areas of application are presented as illustration. Finally, the proposal for Type-3 fuzzy sets and systems, theory and applications will be discussed.

KAROLY SIMON

Institute of Mathematics, Budapest University of Technology and Economics, Hungary

Special Families of Piecewise Linear Interated function Systems

In this paper, we investigate the dimension theory of some familes of con- tinuous piecewise linear iterated function systems. For one family, we show that the Hausdorff dimension of the attractor is equal to the exponential growth rate obtained from the most natural covering system. We also prove that for Lebesgue typical parameters, the 1-dimensional Lebesgue measure of the underlying attractor is positive, if this number is bigger than 1, and all the contraction ratios are positive.

PETER MASSOPUST
Technische Universität München, Germany

Clifford B-Splines

Inspired by the classical definition of cardinal polynomial B-splines on the real line $\mathbb{R}$ in the Fourier domain, we introduce a new class of B-splines supported on balls in $\mathbb{R}^d$ using a Clifford-analytic approach. We present and discuss properties of these new multi-dimensional splines.

LASZLO T KOCZY
Budapest University of Technology and Economics, Hungary

Solving difficult problems approximately with memetic algoirithms

Evolutionary algorithms attempt to copy the solutions nature offers for solving (in the quasi-optimal sense) intractable problems, whose exact mathematical solution is impossible. The prototype of such algorithms is the Genetic Algorithm, which is, however rather slow and often does not find a sufficient solution. Nawa and Furuhashi proposed a more efficient modified one, under the name of Bacterial Evolutionary Algorithm (BEA). Moscato proposed the combination of evolutionary global search with nested local search based on traditional optimization techniques, and called the new approach memetic algorithm (MA).

Our group started to combine BEA with Levenberg-Marquardt local search and we obtained very good results on a series of benchmarks. The next step was to apply the new type of MA for NP-hard discrete optimization, starting with the classic and well known Traveling Salesman Problem (TSP), applying discrete local search, and thus proposing the novel Discrete Bacterial Memetic Evolutionary Algorithm (DBMEA). Then, we continued with a series of related, but mathematically different graph search problems, applying the same approach. Although we could not improve the tailor made Helsgaun-Lin-Kernighan (HLK) heuristics for the basic TSP, we got comparably good results, and in some other problem cases, we obtained new, so far the best accuracy and running time combinations. The Traveling Repairman Problem is an eminent example, where DBMEA delivers the best solutions.

The advantages of the new approach are as follows:
- General applicability. With minimal adaptation to the concrete problem type the same method could be successfully applied, there was no need to construct new tailor made algorithms for every new problem
- Predictability. Knowing the problem size, it was easy to give a good estimation of the running time, assuming a certain accuracy. This is not true for any of the other approaches,

including the HLK, and especially not true for other methods, finding approximate solutions (often with large error)

In the talk, several examples will be presented with standard benchmarks going up to large numbers of graph nodes, and the DBMEA results will be compared with the best practices from the literature. The predictability feature will also be illustrated by size-running time graphs.

Reference will be made to the importance of determining the initial population in achieving fast and accurate results. A new approach, the Bounded Radius Heuristics will be presented.

In the last part of the talk, a series of fuzzy extensions of the Time Dependent TSP (TD TSP) will be introduced, an extension of the TSP with real life aspects where the natural fluctuation of the traffic in certain areas causes non-deterministic features causing additional difficulties in the quasi-optimization. The novel extensions will be also tackled with the DBMEA approach successfully.

As a conclusion, one more example will be mentioned where the discrete NP-hard problem is of a rather different nature, and it will be shown that by changing the local search technique appropriately, DBMEA can still deliver superior results.

AKHTAR A KHAN

Rochester Institute of Technology,USA

Elasticity Imaging Inverse Problem of Tumor Identification

This talk will focus on the inverse problem of parameter identification in general saddle point problems. For saddle point problems, the use of elliptic regularization is an essential component. This talk aims to analyze the impact of regularizing the saddle point problem on the inverse problem. An application to the elasticity imaging inverse problem of identifying cancerous tumors will be presented.

ADRIAN PETRUŞEL

Babeş-Bolyai University, Cluj-Napoca, Romania

Fixed point theorems for monotone type operators

In this talk we will present existence, uniquemess, data dependence and stability results for monotone type operators in Hilbert spaces. Some open questions are also pointed out.
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M K ROYCHOWDHURY

The University of Texas Rio Grande Valley, USA

Quantization Dimension

Quantization for a probability distribution refers to the idea of estimating a given probability by a discrete probability supported by a set with no more than n points for some positive integer n. Quantization dimension measures the speed how fast the quantization error goes to zero as n approaches infinity. Quantization dimension is also connected with other dimensions of dynamical systems. I will mainly talk about quantization dimension of different probability distributions.

A MUKHERJEE

Tripura(central) University, India

Pythagorean Interval valued Neutrosophic Refined Sets and Its Application in Medical Science

In recent times many ideas have been introduced to deal with indeterminacy, uncertainty, vagueness. Fuzzy set theory(Zadeh 1965), intuitionistic fuzzy sets (Atanassov 1986) ,rough set theory (Pawlak 1982) play different measures in handling inconsistent dates. However, all these above theories failed to deal with inconsistent information which exists in beliefs system.

In 1995, Smarandache (Smarandache 1995) developed a new concept called neutrosophic set (NS) which generalizes probability set, fuzzy set and intuitionistic fuzzy set. Neutrosophic set can be described by membership degree, indeterminacy degree and non-membership degree. Smarandache (Smarandache 2018) gave n-valued refined neutrosophic logic and its applications. Then, Ye and Ye (Ye S & Ye J 2014) gave single valued neutrosophic sets and operations laws. R. Jansi (Jansi at.el 2019) introduced the concept of Pythagorean Neutrosophic set (PNset) with T and F as dependent components. In PN sets, membership, non-membership and indeterminacy degrees are gratifying the condition

$0 \leq (\mu_A(x))^2 + (v_A(x)^2 + (\delta_A(x))^2 \leq 2$ instead of $(\mu_A(x)) + (v_A(x) + (\delta_A(x)) > 2$ as in neutrosophic sets.

In this paper a new set called Pythagorean Interval-Valued Neutrosophic Refined Set is introduced . Pythagorean Interval -Valued Neutrosophic Refined Topological Spaces and some of the basic definitions and results are introduced and explained with suitable examples. Pythagorean Interval-Valued Neutrosophic Refined (PIVNR) generalized weighted distance measure has been introduced. Lastly we present an application of PIVNR set in medical diagnosis.

V VETRIVEL

Indian Institute of Technology Madras, Chennai, India

Remarks on Edelstein's Theorem and Related Results

A classical theorem of Edelstein states that a mapping on a compact metric space satisfying for all has a unique fixed point. In this talk, we shall explore this for a broader class of mappings. Some related results for such a class of mappings under various settings.

LAKSHMI KANTA DEY

National Institute of Technology Durgapur, India

Riemann integration in Banach spaces and the property of Lebesgue

In this talk, we are going to discuss about the Riemann integrability of a function defined on $[a, b]$ with values in a Banach space X. We will see that a Riemann integrable function need not be continuous almost everywhere. It is therefore an interesting problem to determine which spaces have the property that every Riemann integrable function is continuous almost everywhere. Discussion of this topic is the focus of this talk.

S M GRAD

ENSTA Paris, France

Extending the proximal point algorithm beyond convexity

Introduced in in the 1970's by Martinet for minimizing convex functions and extended shortly afterwards by Rockafellar towards monotone inclusion problems, the proximal point algorithm turned out to be a viable computational method for solving various classes of (structured) optimization problems even beyond the convex framework.

In this talk we discuss some extensions of proximal point type algorithms beyond convexity. We propose a relaxed-inertial proximal point type algorithm for solving optimization problems consisting in minimizing strongly quasiconvex functions whose variables lie in finitely dimensional linear subspaces, that can be extended to equilibrium functions involving such functions. Computational results confirm the theoretical advances.

RABI NANDA BHAUMIK

Retired Prof. Tripura University (A Central Univ.)

Some Applications of Rough Set Theory

I shall start my talk with the memory of Srinivasa Ramanujan on his Birthday. Two Applications of Rough Set Theory- (i) Prediction of Coronary Artery Disease from medical databases and (ii) The study of Covid- 19 patients, will be discussed. The hospital databases contain patient information that can be used by decision systems to improve medical care, uncover new relationships among data and hidden patterns that can help to predict diseases or suggest more effective treatments. Pawlak's rough set theory for handling imprecision and uncertainty in data has an advantage over the other techniques. Coronary Artery Disease (CAD) or Coronary Heart Disease (CHD) is the leading cause of death in the world. Coronary heart disease (CHD) is a narrowing of the small blood vessels that supply blood and oxygen to the heart. A heart attack [or acute myocardial infarction (MI)] occurs when one of the arteries that supplies the heart muscle becomes blocked. In this paper, we have studied medical data of patients of Tripura to predict Coronary Artery Disease using Rough Set Theory with the help of ROSETTA software.

ANOOP SINGH

Indian Institute of Technology (BHU), Varanasi

From Infinity to Finity

We consider some moduli spaces and compute rings of algebraic functions on them. We also see some algebro-geometric invariants on these moduli spaces, like Picard group, Chow group etc.

Abstracts of Participants

CHANDRA PRAKASH DHURI

Guru Ghasidas Vishwavidyalaya (A Central University) Bilaspur Chhattisgarh, India

Some Results on Bipolar Metric Spaces

The purpose of this paper is to establish some fixed point theorems in Bipolar metric space by employing the comparison function. We have used contractive type and expansive type mappings in our theorems.

MANJARI DEWANGAN

Pt. Ravishankar Shukla University, Raipur(Chhattisgarh))

Best Proximity points for cyclic contractions of Rational Expression in Dislocated Metric space

In this paper, we define a generalized expanding mapping through rational expression. We give some convergence and existence results for best proximity points in setting of dislocated metric space(d-metric space). we also give some examples to support our work.

RASHMI BHAGAT

Pt.Ravishankar Shukla University Raipur, India

Thakur's iterative scheme for approximating common best proximity points of proximally mean nonexpansive mappings in Banach spaces

In this article, the three-step Thakur's iterative process associated with three mappings in the setting of Banach space. Using this Thakur's iteration, we approximate a common best proximity point for proximally mean nonexpansive mappings. And we support our main result with a numerical example.

PRIYANKA BERIYA

Assam University, Silchar, India

Some Fixed Point Theorems in S_b-metric spaces

In 2016, Souayah and Mlaiki [1] introduced the notion of S_b-metric space as a generalization of S- metric space and b-metric space and obtained some useful fixed point results on these spaces. In this paper, we introduce the notion of continuity in S_b-metric spaces. Finally, we generalize some fixed point results obtained by Sedghi and others ([2], [3]) in the setting of S_b-metric spaces.

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JAYANTA SARKAR

IIT (BHU) Varanasi

Generalized Hausdorff metric on Sb-metric space and some fixed point results

The concept of b-metric space came into the picture by Bakhtin, on which few researchers have developed some fixed point results, however Czerwick developed the extensions of the Banach contraction principle in a profuse manner by taking disparate contractive conditions. Various mathematicians have explored the S-metric space and manifested numerous consequences allied to the endurance of fixed points. Persuaded by the job of Bakhtin, Souayah and Mlaiki have generalized the theory of b-metric space, presently known as S_b-metric space, and evinced certain fixed point results under distinguished categories of contractions in a complete S_b-metric space. Mlaiki had further generalized the theory of S_b-metric space to extend S_b-metric space. In this paper, a metric on S_b-metric space analogous to the Hausdorff metric has been introduced and some basic properties are obtained on multi-valued S_b-metric space. Further, the fundamental multi-valued contraction of Nadler(1962) has been extended to the S_b-metric space setting, and two results have been established. The entire study is supported by suitable examples.

SWAPNIL VERMA

Kamala Nehru College, University of Delhi

Existence of Fixed Point on Interpolative Boyd Wong Type Contraction in Quasi-Partial b-Metric Space

In the early years of the 20th century, the renowned mathematician Banach [1] commenced the concept of the Banach Contraction Principle. Due to its consequences and feasible implementations, the idea has been enlarged and generalized in various directions [2]-[6].

Recently, Karapinar [7] adopted an interpolative approach to establish fixed point results in the setting of complete metric space. In 2016, Gupta and Gautam [8] defined a new metric space known as quasi-partial b -metric space and proved fixed point theorems on this space. Inspired by these results, we have redefined the Boyd Wong type contraction in the framework of r quasi-partial b-metric space and proved the corresponding fixed point theorem by adopting the notion of interpolation. The results are further validated with the application based on them. The applications of interpolative contraction in sensitivity analysis of experimental signals and synthesis of scientific data where approximation of natural curves and surfaces is needed are illustrated here. Examples are given, which are based on the new approach.

Keywords: Quasi-partial b-metric space; fixed point; interpolation; Boyd Wong contraction

MSC: 46H99; 47H10; 54H25

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NITISH KUMAR SINGH

Banaras Hindu University, Varanasi, India

Second-Order ILC for Discrete Singular Switched Systems

This paper deals with the problem of iterative learning control for a class of discrete-time switched singular systems with arbitrary switching rules. According to the characteristics of the systems, two types of second-order iterative learning algorithms are proposed and the corresponding convergence analysis of the algorithms is studied. Under some given assumptions, the algorithms can ensure the system state converges to the desired state

trajectory on a finite time interval. Finally, two numerical examples are constructed to support the theoretical analysis.

SHIKHER SHARMA

Banaras Hindu University, Varanasi, India

Approximation of common fixed points of an uncountable family of mappings on $CAT(0)$ spaces via property $(\mathscr{A})$

The concept of property $(\mathscr{A})$ introduced by Sahu et. al. (J.Glob. Optim. (2013) 56:1631-1651) has important role to find the fixed point of uncountable family of mappings in Banach space. The advantage of property $(\mathscr{A})$ is that by knowing the convergence of fixed point sequence of one family of mappings, we can find the convergence of that sequence for another family of mappings. The purpose of this paper is to deal with property $(\mathscr{A})$ for the following families defined on $CAT(0)$ spaces: family of proximal operators, family of resolvent operators of monotone operator and family of resolvent operators of bifunction. We proposed an iterative algorithm based on S-iteration method for approximating common fixed points of family of mappings by using property $(\mathscr{A})$ on $CAT(0)$ spaces.

DIPTI THAKUR

Pt.Ravishankar Shukla University Raipur, India

Approximation of Fixed points for total Asymptotically Nonexpansive Mappings in $CAT(0)$ spaces

The motive of this paper is to study the convergence analysis of a modified iteration procedure for total asymptotically nonexpansive mapping under some suitable conditions in the setting of $CAT(0)$ spaces. We establish Δ-convergence and strong convergence theorems for such iterative process on a $CAT(0)$ space which extend and improve many results appeared in the literature.

2010 Mathematics Subject Classification: 47H09, 47H10

Key words and phrases: Total asymptotically nonexpansive mappings, Δ-convergence and strong convergence theorem, CAT(0) space.

AJAY KUMAR

Pt.Ravishankar Shukla University Raipur, India

Strong convergence algorithm for proximal split feasibility problem

The purpose of this paper is to propose an algorithm for solving the proximal split feasibility problem in Hilbert spaces. The algorithm is motivated by the inertial method and the split proximal algorithm with a self-adaptive stepsize. We apply our main result to the split feasibility problem, and the fixed point problem of nonexpansive semigroups. At last, a

numerical example is given to study the efficiency and implementation of our scheme.
2020 Mathematics Subject Classification: 47H10, 47J25, 65J15.
Keywords and phrases: Strong convergence, proximal split feasibility problem, fixed point problem.

EKTA TAMRAKAR
Pt.Ravishankar Shukla University Raipur, India

Fixed point results for multivalued contraction mappings in modular and non-Archimedean modular metric spaces

In this paper, we defined multivalued contraction mappings in the setting of modular metric space and non-Archimedean modular metric space endowed with a directed graph and obtain the existence and uniqueness of a fixed point for such contractions. Also, an application for multivalued fractals is obtained, and at last, some examples are given to show the efficiency of our results.
2020 Mathematics Subject Classification: 47H10, 54H25.
Keywords and phrases: Fixed point, directed graph, modular metric space, non-Archimedean modular metric space, multivalued fractals.

PRIYANKA T M C
Vellore Institute of Technology, Vellore

Bounded Fractal Operator Associated with the Fractional Integral

In this paper, the fractional integral of a real continuous function f defined on a real closed interval, $(I^v f)$ is perturbed using a family of self-referential functions $(I^v f)^\alpha$. To elicit this phenomenon, a fractal operator is proposed in the space of continuous functions on a real closed interval, an analogue to the existing fractal interpolation operator which perturbs f using α-fractal function f^α. In addition, the boundedness of the proposed operator is discussed.

AGATHIYAN A
VELLORE INSTITUTE OF TECHNOLOGY, VELLORE

Hidden Variable Fractal Interpolation: Fourier Transform Representation

This paper investigates the Fourier transform of a hidden variable fractal interpolation function (HFIF) with function scaling factors, which generalizes the Fourier transform of HFIF with constant scaling factors. Furthermore, the Fourier transform of quadratic hidden variable fractal interpolation function (QHFIF) with function scaling factors is also investigated. With an aim of maximizing the flexibility of HFIF and QHFIF, a class of iterated function systems involving function scalings is chosen for the present study.

VISHAL AGRAWAL

IIT (BHU) Varanasi

Some properties of fractal operator associated with complex valued fractal functions on the Sierpinski gasket

In this paper, we demonstrate several properties, such as Fred- holm, non-compactness of the complex-valued fractal operator associated with the complex-valued fractal functions, which is constructed using a germ function, base function, and scaling functions defined on the Sierpinski gasket. We show the existence of a non-trivial closed subspace of a complex-valued fractal operator. We prove that a complex-valued fractal function has finite energy under certain conditions on the parameters involved. Further, the existence of Schauder basis consists of a complex-valued fractal function is shown.

MUSKAN

Thapar Institute of Engineering & Technology (TIET), Patiala

The impact of control parameter on traffic flow in a percolation-backbone fractal

Traffic congestion on urban road networks has escalated in recent years, due to the rapid increase in the number of motor vehicles, inadequate infrastructure, and increased urbanization. Recently, the macroscopic fundamental diagram in urban traffic has drawn great attention as it provides the relation between the vehicular density and flow. The fundamental diagrams are obtained successfully for low density. But due to numerical instability, macroscopic fundamental diagram at intermediate and high densities has not been obtained. In real traffic, the speed of the vehicle decreases when traffic congestion occurs downstream due to which drivers try to match their speed to that on downstream. Thus, a new macroscopic traffic model without instability has been presented by matching speed downstream. In recent years, the percolation process has been investigated widely. It is well-known that the topology obtained in such processes has a complex structure, known as fractals. The concepts of self-similarity and fractal dimensions are used to characterize the percolation clusters. At low density, vehicles flow through complex traffic networks while repeating bifurcation and merging which may be similar to the process that electric current flows through the percolation cluster via singly-connected bonds and multiply-connected bonds.

In real traffic dynamics, the number of vehicles that can enter the road segment affects the traffic flow. Thus, defining a parameter that controls the traffic flow while entering or leaving the fractal network. The impact of control parameter on traffic flow in a percolation-backbone fractal network under open boundary conditions is investigated to study the traffic flow characteristics more realistically. The fractal network is transformed into cell-transmission graph. The urban-scale macroscopic fundamental diagrams are obtained numerically in the fractal network. It is observed that with the decrease in control

parameter, the traffic flow decreases. The theoretical results agree with the numerical simulation.

HARSHA GOPALKRISHNAN

Indian Institute of Technology, Tirupati, India

Sequential Labyrinth fractals

In this work, the sequential labyrinth fractal on a unit square is constructed, as well as its fractal dimension is found. Two sequences are used to create the sequential labyrinth fractals. Each stage of the construction's contraction factor is dependent on the corresponding terms of the selected sequences. The generated sequential labyrinth fractal is observed to be a self-affine structure. Further, the Hausdorff and box-counting dimensions of sequential labyrinth fractals formed from converging sequences are investigated.

M. MEENAKSHI

Vellore Institute of Technology, Vellore, India

Precipitation dynamics of India: A fractal dimension approach

Climate change is inevitable and important problem facing by worldwide. All livelihoods are facing the problems due to climate change. Scientists are in the pressure to find the solutions to reduce the pollution from industry revolution, greenhouse gases,urbanisation and deforestation. This research paper examines how level of precipitation is changed and affecting the climate change through fractal dimension. In this study few coastal areas from India are selected irrespective of their monsoon and explore the precipitation factor. Finally, by using the value of fractal dimension, this paper provides the short-term prediction of precipitation in India.

Keywords: Time series, Rescaled Range Analysis, Hurst Exponent, Fractal Dimension.

KAVITHA C

Vellore Institute of Technology, Vellore, India

On the variable order Wely-Marchurd fractional derivative on non-affine fractal function

The fractal technique is applied to study a wide variety of phenomena in the universe. In particular, fractal techniques can be generalized through traditional approaches to spatial interpolation. The novelty of this article is that demonstrated the Wely-Marchaud fractional derivative of variable order $0 < \zeta(t) < 1$ of a non affine fractal function with various scaling factors and base functions is again fractal function. Finally, some numerical simulations were shown to illustrate the relevance of the various scaling factors in the flexibility of fractal functions and their Wely-Marchaud fractional derivative.

Key Words: Iterated Function System, Fractal interpolation function, Wely-Marchaud fractional derivative.
AMS Subject Classification: 26A18, 28A80, 28A33.

CHANDRA PRAKASH
Delhi Technological University, Delhi, India

Approximation by the Operators using Apostol-Genocchi Polynomials

This paper has constructed a new sequence of operators involving Apostop-Genocchi polynomials based on certain parameters. We investigate the rate of convergence of the operators given in this paper using the second-order modulus of continuity and Voronovskaja type approximation theorem. Moreover, we find the weighted approximation result of the given operators. Finally, we derive the Kanorovich variant of the given operators and discussed the approximation results.

MEGALA
Indian Institute of Technology, Tirupati, India

Spectrum of a self-affine measure with four element digit set

In this research work, it has been proved that there exists a Δ such that the set is an orthonormal basis of for an expansive matrix with all entries are even and digit set $D = (0,0)^t, (1,0)^t, (0,1)^t, (-1,-1)^t$. Also, spectrum Δ has been derived explicitly for some specific M and D. N

MONA MANOJ KUMAR GOTHI
Sanklchand Patel university

Optimizing Transportation Problem Through Linear Constraints with Optimality

A transportation problem is fundamentally pertaining to achieve the best likely way to satisfy the demand of n destinations using the capacities of m sources. We contemplate the fundamental concept of transportation problem unraveled by linear algebra having linear equations. The intent of the presented paper showcases a specialized method for acquiring a basic primal solution through the linear equations. This proposed method is named as the linear method for optimization of the transportation problem. As well, we explore the new optimality for accomplishing the optimal solution for the transportation problem. This algorithm explains simpler streamlined procedures by obtaining the optimal solution for the all type of transportation problems of maximizing and/or minimizing objective functions through providing the numerical examples to assist the algorithm.

NAGENDRA SINGH

AMU Aligarh, India

Nonsmooth vector variational inequalities on Hadamard manifold and existence results

In this paper, we consider nonsmooth vector variational inequality problem (NVVIP), Minty nonsmooth vector variational inequality problems (MNVVIP) and δ-Perturbed nonsmooth vector variational inequality problems ($\delta - PNVVIP$) on Hadamard manifolds using the concept of bifunctions. We also define the class of $\mathbb{R}^m_+$ -pseudomonotonicity, v-continuity, and geodesic upper sign continuity of vector valued bifunctions on Hadamard manifold and established relations among them. Furthermore, some existence results for NVVIP, MNVVIP, and δ-PNVVIP are derived. These results extend some knowing corresponding results in literature.

AKRITI DWIVEDI

Banaras Hindu University, Varanasi

On optimality conditions and duality results for approximate solutions of interval-valued mutiobjective optimization problems using convexificators

The aim of this paper is to study interval-valued mutiobjective optimization problems involving inequality and set constraints. We derive Karush-Kuhn-Tucker type necessary optimality conditions to identify approximate efficient solutions for the problem under consideration under suitable constraint qualifications using the tool of semi-regular convexificators. We also derive sufficient optimality conditions under approximate convexity assumptions. The dual models are also formulated to establish duality results.

PRACHI SACHAN

Banaras Hindu University Varanasi

On multiobjective optimization problems involving higher order strongly convex functions in terms of directional convexificators

The aim of this paper is to study mutiobjective optimization problems with inequality constraints involving higher order strongly convex functions not necessarily continuous. We derive Fritz-John type and Karush-Kuhn-Tucker type necessary optimality conditions under suitable constraint qualifications to identify strict minimizers of higher order using the tool of directional convexificators. We also derive conditions to identify mixed saddle points of higher order for the partial Lagrangian associated with the mutiobjective optimization problem. We also formulate dual models and derive duality results focused on strict minimizers of higher order.

S.KARTHIGA

Thiagarajar college of Engineering, India

CNN Hyper parameter Optimization for Efficient ECG Signals Classification using River Flow Dynamics

Arrhythmia is a dangerous disease which points out the cardiac health conditions in a human body. Electrocardiogram is popularly used technique to detect the cardiac illness. Considering the huge amount of patients in a hospital, evaluating the ECG signals of those patients becomes unmanageable when they find the frequency variations and other fluctuations in the signals. There is lot of research works done for evaluating the ECG signals automatically and diagnosing the exact disease still has difficulties. The classification of Cardiac diseases can be done using the deep learning algorithms to help the doctors to examine and diagnose the exact heart disease. However it is necessary to have advanced domain experience on these cardiovascular diseases to make the perfect classification. Arrhythmia produces different kinds of ailments such as RBB, LBB, Atrial Fibrillation, etc. In this paper two stage approaches is encouraged. One is deep learning classification algorithm, Convolution Neural Network (CNN) is used to classify the ECGs in 5 classes such as Normal, RBB, LBB, Atrial Fibrillation and Severe. To obtain the best classification accuracy the hyper parameter tuning along with RFD (River Flow Dynamics) Optimization is done as the second stage to get the optimal parameters for tuning the activation functions. Through parameter adjustments the proposed CNN-RFD approach yields 97.6% accuracy on the MIT-BIH database.

BHUVNESH KHATANA

Indian Institute of Technology Kharagpur, Kharagpur, India

An Iterative Method for a Class of Bilevel Programming Problems

In this paper, a class of bilevel programming problems is studied. The lower level is a parametric quadratic programming problem, and the upper level problem consists of a convex objective function with linear constraints. A direction-finding subproblem is constructed to obtain a feasible direction that decreases the upper level objective in each iteration. We take the benefit of the active set method of single level optimization to modify the subproblem in each iteration. The algorithm stops at a locally optimal solution to the problem. Some theoretical results are proven to justify the strategy. Numerical computations are provided to support the methodology.

TULI BAKSHI

Calcutta Institute of Technology, India

An Optimization Framework for Travelling Tournament Problem

The travelling tournament problem (TTP) is a scheduling problem which is used in sports time tabling situation. This problem abstracts the important criteria in creating time tables for teams involved in travelling from one venue to other. The goal is to minimize the total travelling time or distances of the teams of players. Even a very small instances of this problem seem to be quite complicated to solve. Different practical applications of importance make this problem an interesting challenge for combinatorial optimization method. We represent this problem, give some interesting benchmark classes of instances and corresponding solution technique.

ANVEKSHA MOAR

University of Delhi, India

Solving Polytopic Set Optimization Problem based on a Partial Order Relation

In this presentation, we propose an algorithm for solving an un- constrained set optimization problem. We consider the problems in which the graph of the objective function is given by finitely many linear inequalities. In literature various set order relations (see [1,2,3]) are considered for comparing sets. We consider the solution concept based on the partial m-order relation using Minkowski difference proposed by Karaman et al. [2]. We derive the optimality conditions by associating the set optimization problem with a scalar linear programming problem. Numerical examples are also presented to illustrate the algorithm.

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RIMPI

University of Delhi, India

Necessary Optimality Conditions under Guignard Constraint Qualification in terms of Convexificators

This paper is motivated by the work in [1–3], where unlike smooth scalar programming problems, some extra assumptions are needed to overcome the gap generated by using Guignard constraint qualification (GCQ) while deriving necessary optimality conditions for smooth vector problems. Similarly, GCQ is less preferred for nonsmooth problems and a regularity condition, namely concavity on the generalized directional derivative of

the objective function at an optimal point has been considered in the literature [4, 5]. However, we establish the optimality conditions under GCQ in terms of upper semi-regular convexificators [6] only by assuming convexity of the tangent cone of the feasible set. We further illustrate the gap under GCQ for nonsmooth problems through an example.

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Dr. KISHAN CHOUDHURI

National Institute of Technology, Agartala, India

Optimization of the size and shape of the piston-slipper assembly of an axial piston pump using ANSYS

ANSYS is a popular finite-element modeling software used for solving a number of mechanical problems. Here in this work, a structural optimization of a piston-slipper assembly is carried out using ANSYS. Piston-slipper assembly is an integral part of axial piston pump. The objective of the optimization is to minimize the volume of the piston and slipper subjected to the stresses in each node lies below the yield point of the material. The Sub-problem approximation method is used for optimization. First the solid model is done in Pro E software.Then it was transformed to ANSYS. Solid 20 node 95 Brick element has chosen for meshing the piston and slipper assembly. For measurable weight reduction of the parts from the initial design, a design optimization is a perfect tool and can be used in any structural design. At the end of this paper, the optimized design data are computed and comparison between optimized design and initial design are drawn.

GOURAV KUMAR

IIT (BHU)

Fenchel duality for interval optimization problems

In this article, we present Fenchel duality results for interval optimization problems (IOPs). We provide optimality conditions and duality results for IOPs. The whole study is supported by suitable examples.

MONIRUL ISLAM

Aligarh Muslim University, Aligarh, India

Coincidence and fixed point theorems on Hadamard manifold with applications

In the paper, we establish a coincidence theorem under the noncompact settings in Hadamard manifolds. We derive some fixed point theorems for a family of set-valued maps in the setting of Hadamard manifolds. We obtain a social equilibrium existence theorem with the help of the derived fixed point theorem. Lastly, we study the quasi-variational inequalities and proved the existence result for a solution to such a system in the setting of Hadamard manifolds.

VIVEK LAHA

BHU, Varanasi

On quasidifferentiable optimization problems

The aim of this presentation is to discuss optimization problems involving quasidifferentiable functions [1] and to present suitable optimality conditions for fractional programming [2]. A Minty variational principle in terms of quasidifferentiable variational inequaliites is also given [3]. The presentation deals with Fritz-John (FJ) and Karush-Kuhn-Tucker (KKT) type necessary optimality conditions at an optimal point in the framework of the quasidifferentiable analysis. Further, several other applications of the results are investigated in different fields of optimization.

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RAJALAKSHMI J

Sethu Institute of Technology, Kariapatti

The Enactment of an Ensemble Deep Learning Method to the Prediction of Short-Term Energy Prices

As the global population rises, the need to cut down on energy use in industries and buildings increases, necessitating smart energy strategies, optimization methods, and efficient management. Optimal energy forecasting is performed nowadays using a wide range of artificial intelligence (AI) based algorithms, modelling tools, and engineering techniques to extrapolate future demand from existing patterns. However, because it relies only on past data, nonlinear modelling of energy needs lacks a cutting edge that would allow it to more effectively deal with both temporal dependencies (both short and long) and static features. Here, we present an ensemble deep learning-based method for forecasting future energy demand and consumption based on temporal relationships. The models accuracy is dependent on the preliminary data processing performed by our system, which includes cleaning, normalising, and transforming the data. In addition, the pre-processed data is input into the suggested ensemble model, which employs convolution neural network (CNN), stacking, and bidirectional long-short term memory (LSTM) architectures to generate hybrid discriminative features. To provide accurate long-term predictions of future energy demand and consumption, we used past data to train our suggested system. To guarantee and improve the accuracy of the systems forecasts, we proposed a technique based on active learning with sliding windows. It is possible that the suggested approach might be used to showcase the significance and efficacy of energy usage in the manufacturing and construction industries. We conducted tests on datasets representing benchmark buildings, residential UCIs, and local Korean commercial structures to gauge the efficacy of the proposed method. Extensive experiments were done using a variety of assessment matrices to demonstrate the error rate; these experiments show that the suggested system produces less error than competing methods.

NIKHILESH METIYA

Sovarani Memorial College, Jagatballavpur, Howrah, West Bengal, India

A Global Optimality using Coupled Proximal Contractions with Stability Analysis

In this work a multivalued coupled proximal contraction mapping is used for determining the distance between two sets through determination of two pairs of points simultaneously. It is a global optimization problem by its very nature which is converted here into a problem of determining an optimal approximation of the solution of a multivalued coupled fixed point problem where the actual solution does not exist in the most general case. The result is well demonstrated with example. In another part we study a kind of weak stability as

well as data dependence property of the solution set. The study is in the framework of metric spaces and broadly falls within the domain of setvalued optimization.
Keywords: Metric space; proximal α-dominated map; coupled best proximity point; stability
Mathematics Subject Classification: 47H10, 54H10, 54H25

PANKAJ GAUTAM
Indian Institute of Technology, Madras, Chennai, India

A Parameterized Douglas-Rachford method for generalized DC programming

In this paper, we consider the difference of convex functions (DC) programming problems which is the backbone of nonconvex programming and global optimization. The classical problem contains the difference between two proper convex and lower semicontinuous functions. This paper deals with the generalized DC programming problem which deals with the minimization of three convex functions. We propose novel parametrized Douglas Rachford DC algorithms to solve the problem and study its convergence behavior in the Hilbert space. Moreover, we also conduct numerical experiments to support our theoretical findings.
Keywords: Parameterized Douglas–Rachford splitting methods; DC programming; Nonconvex optimization

MUZAFFAR SARKAR RAJU
Aligarh Muslim University, Aligarh, India

Proximal Point Method For Quasiconvex Pseudomonotone Equilibrium Problems

In this paper we propose a proximal point method using Bregman distance to solve quasiconvex pseudomonotone equilibrium problems. Under suitable assumptions, we prove that the composed algorithm is well defined and converges to a solution of the equilibrium problem, whenever the bifunction is strongly quasiconvex in its second argument. Our method goes beyond the usual assumption of the bifunction's convexity in the second argument, extending the validity of the convergence analysis of proximal point methods for equilibrium problems. For a particular choice of the Bregman function, our method reduces to the traditional proximal point method. At the last we illustrate the numerical applications.

SHIV PRASAD YADAV
IIT Roorkee, India

A Two-stage Network Data Envelopment Analysis: An Education Sector Application

In general, data envelopment analysis (DEA) works like a black box that does not provide any adequate detail to identify the specific reason for inefficiency in decision-making units (DMUs). The motivation of this study is to analyze the cause of the inefficiency of DMUs in a decision process with the help of a two-stage relational network DEA model. In the current study, a two-stage relational network DEA model is applied to measure the performance of DMUs for the whole process and each stage independently. In general, past studies used conventional DEA models in education sectors to analyze the performances of educational institutions. In the current study, by considering quantitative attributes to measure the performance of Indian institutes of management (IIMs) by using network DEA, we develop a procedure that captures both quality and quantity.

ADITYA TIWARY
IPS Academy Institute of Engineering & Science, (Indore), India

A Genetic Algorithm (GA) based Innovative Methodology for achieving Optimum Failure Rate in a Complex Engineering system

Reliability is very important when we have to take into account the system complexity and other vital parameters. For any engineering system/devices/components or systems in which maintenance can be done and they can be further used, reliability parameters are very relevant and necessary. One of the basic reliability indices is failure rate. In view of the above, in this paper genetic algorithm based methodology is developed to find the optimum value of the failure rate of each and every component of the engineering system which is under consideration. The mean values are also shown for each component. The modified values of the Mean time to failure (MTTF) and reliability of the components in the complex engineering system considered was also evaluated and are shown. The system reliability modeling was done and also the overall reliability of the complex engineering system is evaluated.

CALIN-ADRIAN POPA
Polytechnic University Timisoara, Romania

Neutral-type, leakage, and time-varying delays in quaternion-valued neural networks: Finite-time synchronization analysis

A better representation of high-dimensional data, and especially three-dimensional data, is facilitated by the use of quaternions. This observation has led to the introduction of

quaternion-valued neural networks. On the other hand, time delays naturally appear in real-world implementations of neural networks. Taking these facts into account, this paper is concerned with deducing sufficient conditions to realize the finite-time synchronization of drive-response quaternion-valued neural networks with neutral-type, leakage, and time-varying delays. The proposed model is very general, and was rarely discussed in the existing literature concerning quaternion-valued neural networks. A correspondingly general Lyapunov-type functional is constructed, and a general state feedback control scheme is utilized to achieve finite-time synchronization. Instead of decomposing the system into real-valued systems, the direct quaternion approach is used, which is more suited for situations in which the quaternion-valued neural network cannot be easily decomposed. The obtained theoretical results are illustrated via one numerical example.

VIJENDRA PRATAP SINGH

Mahatma Gandhi Kashi Vidyapith Varanasi, India

Energy and Cost Efficient Pre-trained Convolutional Neural Network (ResNet-50) Model for Tomato Disease Recognition Using Cloud Platform

Tomato (Solanum Lycopersicum) is a popular crop worldwide. The harvesting of tomatoes is highly profitable for farmers but due to some diseases in a tomato plant, farmers suffer from several problems. Due to these diseases, the overall production of tomato fruits is reduced. The main goal of this research is to raise the overall production of tomato fruits. To accomplish this task, we have to identify the infection in tomato leaves at its initial stage and work to make the tomato plant infection-free. To recognize the disease at its initial stage, we have used an image classification model to resolve such types of problems. We have used a CNN model with residual network-50 as a learning algorithm for tomato disease classification. With the help of this algorithm, we have classified the infected tomato leaves and healthy tomato leaves separately by using MATLAB 2019(a). We have collected 6594 images of tomato leaves for training and evaluation. We have taken fifty percent of the entire data set for training & fifty percent of the dataset for testing purposes for ResNet-50. These leaves are contaminated by six different tomato diseases. After applying the above model, we obtained an effective outcome with 99.83% accuracy in a time span of 47.68 min only. The novelty of this research paper is to calculate time with accuracy. This model can be useful for farmers to defend tomato plants in opposition to disease. Our experiments exhibit the use of a pre-trained model for disease classification with better accuracy.

J. RAJALAKSHMI

Sethu Institute of Technology, India

Improving Antenna Capacity for MMO IoT using optimal Deep learning based CNN classifier approach

Abstract—An effective deep learning (DL) based Convolutional Neural Network (CNN) scheme is presented for the purpose of end-to-end multi-input multiple-output (MIMO) based Internet of Things (IoT) seamless communication system. The main aim of presented approach is to enhance the capacity parameters of the antenna with the use of efficient Chicken Swarm optimization scheme (CSO) and DLCNN techniques. This method mostly depends on the transmit antenna scheme selection (AS-antenna) at the correlated channel condition. The conservative DL schemes contradictions such as classification by single-label multi-class, the use of this multi-label idea is thus preferred in this suggested DLCNN based MIMO transmit AS approach which thus decreases the labels of training length effectively in the selection of antenna. By using chicken swarm secrecy probability, the optimization process is carried. The cooperative AS neural network classifier is employed for classification purpose. However, the application of this DL concept thus enhances the prediction rate accuracy in the training model of DLCNN at the large-scale correlated channel condition of MIMO with less data in training. The outcomes attained from simulation illustrates that presented DLCNN-dependent scheme of AS is thus capable of acquiring near-optimal capacity performance in real time, and a performance is comparatively insensitive to the flawed effects of CSI.
Index Terms— Antenna capacity,Optimization, MIMO, DLCNN, CSO, Antenna selection.

ANURAG SINHA
IGNOU, New Delhi, India

A novel Adhesive-Net for ROI optimization in Neural network classifier for Segmentation task based on Epilepsy EEG image and gastro intestinal cancer endoscopic data

Soft computing is the emerging field of computational intelligence because of its efficiency in task optimization and adherence to solving complex problems by providing optimal solutions. A bio-inspired algorithm is the emerging area of soft computing that connects all the subfields of engineering like emergence, social behavior, and swarming. Swarm intelligence and meta heuristic algorithms, in a nutshell, are components of a bio-inspired algorithm that can provide an optimal solution with in-depth details of its components. Nature-inspired algorithms are simply smart action plans derived from nature and animals such as dolphins that solve complex problems efficiently, so the meta-heuristic algorithm resembles the efficiency component factor in problem solving.In this chapter, our aim is to propose Stacked-NIO, or stacked nature-inspired optimization algorithm, which consists of the functionalities of various layers of convergence and population gathered from stacked layers of algorithms used for machine learning and deep learning parameter tuning and hyper parameter optimization such as number of epochs, number of layers, number of random shifts, and so on. Overall, this paper proposal is tested on two different image data sets using a deep learning algorithm to compare its efficiency of optimization. Applying

meta-heuristics to any concept for hyperparameter tuning is just like solving an optimization problem. This chapter shows how to fine-tune the number of neurons and the number of layers within the neural network in a model of chromosomes such that it contains values for each parameter being tuned. Considering this, this article proposes, tests, and designs a novel stacked-NIO for accurate feature mapping and selection, optimization of the learning path, training optimization, and hyperparameter tuning in a rough unsupervised data set of gastro-intestinal cancer and an EEG event-based dataset.

PARESH KUMAR PANIGRAHI

VIT-AP University, India

Solving Linear System of Equations Using Interval Type 2 Triangular Fuzzy Number

Here, authors have discussed a solution technique to solve linear system of equations in interval type 2 fuzzy environment. The investigation is carried out by using Interval Type 2 Triangular Fuzzy Number (IT2TFN). As such, an uncertain linear system of equations is modeled with IT2TFN. A parametric form is proposed to handle the IT2TFN. Then the same is used solve the modeled interval type 2 fuzzy linear system of equations. In addition, with the help of α-cut, authors have transformed the interval type 2 fuzzy system into a crisp system. Further, three possible cases are considered to solve the system. The three cases can be determined by both only fuzzy and fully fuzzy. Using the proposed approach, both the only fuzzy and fully fuzzy linear systems of equation with different cases was investigated through example problems.

Dr.MAHIMA THAKUR

Jabalpur Engg.College,jabalpur M.P., India

C-Compactness in Fermatean Fuzzy Topological Spaces

The concept of Fermatean fuzzy topological spaces by motivating from the notion of intuitionistic fuzzy topological space and Fermatean fuzzy continuity of a function defined between Fermatean fuzzy topological spaces was introduced by Hariwan z. Ibrahim (. J. Appl. Math. & Informatics Vol. 40(2022), No. 1 - 2, pp. 85 – 98). In the present paper we extend the concept of C-Compactness in Fermatean fuzzy topological spaces and obtain some of their characterization and properties.

Dr. SHAILENDRA KUMAR BHARTI

D.A.V. P.G. College, M.S.D. State University Azamgarh

Segmented intuitionistic fuzzy programming and its application

For the better handling of intuitionistic fuzzy linear programming problem (IFLPP), a new concept and model, called the segmented intuitionistic fuzzy programming problem (SIFPP) is introduced in this paper. Many modifications of IFLPP have been presented using the ordinary linear membership and non-membership functions. However, the membership and non-membership cannot always be linear and it can be segmented. Therefore, in the context of uncertainty and hesitation, the segmented membership and non-membership functions play a vital role in the IFLPP rather than ordinary, and for this, we construct the concave segmented membership and non-membership functions, and a computational algorithm is developed for the solution of SIFLPP. Finally, the obtained results are compared on basis of degree of closeness with the results of existing methods.

Dr. ARCHANA KUMARI PRASAD

Swami Vivekanand Government College, Lakhnadon, M.P. India

Fermatean Fuzzy Soft Topological Spaces

Imprecision in the decision making process is an essential consideration. In order to navigate the imprecise decision making framework, measuring tools and methods have been developed. Fermatean fuzzy soft sets are one of the new methods for dealing with imprecision. The Fermatean fuzzy soft sets are a parameterized family of Fermatean fuzzy sets and simultaneously generalizes the Fermatean fuzzy sets and soft sets. In this paper Fermatean fuzzy soft topological spaces are created which is an extension of Pythagorean fuzzy soft topological spaces and Fermatean fuzzy topological spaces. The concepts of interior, closure, boundary, neighborhood, bases, subspaces and separation axioms in Fermatean fuzzy soft spaces are presented and its properties are figured out.

MEENA YADAV

IIT Roorkee, India

Development of Intuitionistic fuzzy data envelopment analysis model based on interval data envelopment analysis model with an application of MGNREGA 2018-19

In modelling real life problems, Intuitionistic fuzzy variables are best way of modelling linguistic variables. They can express the vagueness of variables to a great extent. In this paper, we develop a new approach for measuring relative efficiency of decision making units with intuitionistic fuzzy inputs and outputs. Derived from DEA and interval DEA, the proposed model calculates the relative efficiency in interval form. The merit of the proposed model over the existing methods is justified comparison of units over same production possibility set. We also develop a ranking algorithm for comparison of decision making units. We verify our results using an example and apply our model to the scheme of MGNREGA and check the efficiency intervals and ranking of Indian States and Union

Territories. The states of Telangana, West Bengal and Jharkhand have emerged as best performing states. The worst performers are Karnataka, Nagaland Bihar and Goa.

SACHIN KUMAR

VBS Purvanchal University, India

Energy-Efficient Model "DenseNet201 Based on Deep Convolutional Neural Network" Using Cloud Platform for Detection of COVID-19 Infected Patients

Background and purpose: The outbreak of the COVID-19 virus causes major rashes in more than 151 countries around the world, and the Coronavirus has a bad impact on human life worldwide. A critical step in the fight against COVID-19 is finding infected patients early enough and placing those infected under special care. Our main goal is to separate COVID-19 patients from other patients.
Materials and Methods: In this research article, we used DenseNet201 available on a cloud platform as a learning network. DenseNet201 is a 201-layer deep convolutional neural network. We used a pre-trained version of DenseNet201 available on the cloud platform that was trained on ImageNet. The input size of pre-trained DenseNet201 images is 224 x 224 x 3. The deep convolutional neural network model can analyze X-ray images to classify the patient's condition about the affected disease.
Result: DenseNet201 experiments and evaluation were effectively performed based on 80% of the training x-rays and 20% of the x-rays of the test phases, respectively. DenseNet201 available on cloud platform shows a good experimental result with an accuracy of 99.24% in 7.47 minutes.
Conclusion: This paper used a deep CNN model to classify COVID-19 disease using X-ray images based on the projected DenseNet201 available on the cloud platform. Scientific studies will be the next target of this research article.

Keywords: Convolution neural network (CNN), DenseNet201, COVID-19, Chest diseases, Cloud Platform

TAMIL SELVAN T

NIT Calicut, India

Analysis of a stochastic epidemic model driven by bilinear incidence rate with two different transmission mechanisms

Study on double epidemics is attracting the attention from researchers in recent times as to make models which are close with reality. In this paper, an epidemic model with two transmission mechanisms, Susceptible-Infected-Recovered (SIR) and Susceptible-Infected-Recovered-Susceptible (SIRS), is considered. The model is stochastically perturbed at transmission rates and the resulting stochastic model is examined for existence of positive global solution. Further, extinction, persistence and co-persitence results are studied with

suitable sufficient conditions. Finally, some numerical examples are presented to support the theoretical results established.

SOMNATH KARMAKAR

NIT Rourkela, India

Vibration of Nonhomogeneous Timoshenko Nanobeam resting on Winkler-Pasternak Foundation

This work investigates the vibration of nonhomogeneous Timoshenko nanobeam resting on Winkler Pasternak foundation. Eringen's nonlocal theory has been used to investigate small scale effects. Differential Quadrature method is used to obtain the frequency parameters with various classical boundary conditions. The nonhomogeneous beam model has been considered, where Young's modulus and density of the beam material vary linearly and quadratically. Convergence of frequency parameters is also discussed. The influence of mechanical properties and scaling parameters, on vibration frequencies are investigated for different boundary conditions.

ANJALI SANG

UIT, RGPV, India

A Non-Linear Model with Caputo Derivative for Worm Propagation problem

Fractional Calculus emerges as a new field with its wide applications in fields of science and engineering. There is an increasing trend to find application of fractional calculus in various real life non-linear and non-local problems, to develop new models for existing problems. Many mathematical models are suggested, in the search of better mathematical methods to predict the behaviour of the worm propagation, we established a new model called SEQIR to simulate the transmission of worms over computer network, after conducting a comparative study of several common models of worm transmission. Various results reported by the researchers, and many more are on the way to be discovered. This article tries to offer a few concise descriptions of the work by eminent academians in the field of simulating the spread of viruses and worms using fractional calculus. We believe that this partial but crucial material will serve as a guide for many researchers, aiding them in understanding this potent mathematical tool and some of its most important real-world applications. We hope that this collection will also assist other eminent academians. Along with this a fractional SEQIR model of virus propagation with the help of Caputo derivative is taken in this work. Its equilibrium point and asymptotic stability is discussed. Numerical methods are used to validate our model.

BAPPA GHOSH

NIT Rourkela, India

An efficient numerical scheme to solve nonlinear fractional Volterra integro-differential equations involving delay

In this study, an efficient numerical scheme is developed and analyzed to solve nonlinear fractional Volterra integro-differential equations involving a delay of the following type:

$$D_x^\alpha u(x) = f(x, u(x)) + \lambda \int_0^x K(x, s, u(s-\tau))ds, x \in (0, L],$$
$$u(x) = \phi(x), x \in [-\tau, 0],$$

where D_x^α denotes the fractional differential operator of order $\alpha \in (0, 1)$ in the Caputo sense. The parameters $\tau > 0$ be the delay λ and $L > 0$ is a real constant. f, K are given functions that satisfy the Lipschitz condition with respect to the second and third arguments, respectively. In addition, we provide sufficient conditions for the existence and uniqueness of the solution with the help of the Banach fixed point theorem. The classical L1 scheme is used to discretize the Caputo fractional derivative on a uniform mesh. In contrast, the composite trapezoidal rule approximates the integral in the equation. The Daftardar-Gejji and Jafari method is employed to solve the corresponding implicit algebraic equation. Convergence analysis and error bounds are carried out. Numerical experiments demonstrate the applicability and efficacy of the proposed scheme.

SWEETY SEHGAL

Lovely Professional University, India

Comprehensive Study of Plant Disease Detection and Classification Models

Disease detection in plants and crops is very important as it directly affects the productivity and quality , consequently, resulting in economic loss. In recent years, much advancement is seen in area of artificial intelligence. Deep learning has made its significant presence in the domain of image processing, providing better diagnosis of plant diseases compared to traditional methods. How models are developed using different deep learning techniques to diagnose various plant diseases at early stages is a research issue among researchers. This review introduces to the plant disease detection problem, different factors affecting the crop, comparison of traditional plant pathogen detection methods with recent deep learning models ,data sets used and the performance of existing models is compared. This study also outlines the possible challenges faced in detection and classifying the plant diseases using deep learning techniques. This study highlights the huge capabilities of deep learning techniques in field of agriculture and provides the scope for future research which aims at developing a good disease detection model in terms of performance and accuracy.

ANJALI SONKARIYA

Indian Institute of Technology Roorkee, India

Window Data Envelopment Analysis: An Application to the Indian Public Sector Banks

One of the most vital part of data envelopment analysis (DEA) is Window Data Envelopment Analysis (WDEA), which is used to measure the efficiency of decision-making units (DMUs) over a period of time. WDEA is a non parametric method in which each DMU is considered as a different DMU in different periods. In this study, we used the input minimization BCC (IMBCC) model to evaluate the efficiency of DMUs. As an application the IMBCC model is applied to calculate the dynamic efficiency of the Indian public sector banks from the year 2016 to 2021. The presented window analysis shows the critical changes in the performance of the Indian public sector banks over the five years.

BISWAJIT PRUSTY

Dhirubhai Ambani Institute of Information and Communication Technology, India

A robust higher-order scheme for fractional delay differential equations involving Caputo's derivative

This article presents higher order numerical scheme of order $o(h^{4-\alpha})$ based on interpolation approximation for the solution of fractional delay differential equations involving Caputo derivative. Also, we discuss the stability and error analysis for the developed method. The efficacy of the proposed method is tested through various examples.

TANVI SINGLA

Thapar Institute of Engineering and Technology, India

Thermal conductivity model of Al_2O_3/CuO-H_2O based hybrid nanofluids between two stretchable rotating disks

The flow and heat transfer properties of Al_2O_3/CuO-H_2O based hybrid nanofluids are simulated numerically between two parallel, co-axial, stretchable, and rotating disks containing the porous media. Rotating disk problems have a wide range of engineering applications, such as gas turbine engines, gears, flywheels, and brakes. Convective heat transfer along with velocity slips at the vicinity of both disks are considered in this study. Convective heat transfer is essential in areas involving high temperatures, such as gas turbines, nuclear power plants, etc. The concerned nanoparticles Al_2O_3 and CuO have various applications in the industrial sector such as Al_2O_3 are used in making circuit baseboards, laser crystals, cutting tools, making waterproof materials, etc., and CuO acts as good catalyst in various chemical reactions and have numerous photothermal and photoconductive utilities. Moreover, due to the increase in the human population, it can become necessary to enhance the thermal properties of some existing nanoparticles. So the idea of mixing nanoparticles came into existence. Adding two or more nanoparticles in the base fluid results in hybrid nanofluids. The corresponding PDEs are transformed into ODEs using the Von Karman

similarity approach. The Cattaneo-Christov heat flux model is used to model the energy equation. The resulting equations are solved by using the finite difference method. The axial, radial, and tangential velocity profiles and temperature profiles are discussed under the influence of associative parameters like stretching parameter, rotation parameter, porosity parameter, thermal relaxation parameter, velocity slip parameter, and thermal Biot number. Thermal efficiency of Al_2O_3/CuO-H_2O and CuO-H_2O with Al_2O_3/CuO-H_2O are also compared. Significant engineering quantities like skin friction coefficient and Nusselt number are also computed for governing parameters to understand the physics of flow and heat in a better way.

ANIL RATHI

IIT Kanpur, India

Finite Element Study of Transient MHD Stokes Equations Modelling a Doubly Driven Cavity Flow

In this study, we derive a Galerkin finite element scheme for approximating the evolutionary Stokes Equations under magnetic effects which are governing a flow dynamics in a doubly driven cavity. The stable finite element numerical scheme is applied to trace the physics associated with the complex flow dynamics under the different MHD forces. Later, the study is extended to MHD-NS equations. The flow pattern is traced for different Hartmann and Reynolds Numbers and the obtained results are discussed in detail.

RAKESH KUMAR

IIT Kanpur, India

Jacobi Spectral Galerkin Methods for Weakly Singular system of Linear Volterra Integral Equations

In this study, we propose the Jacobi Spectral Galerkin and iterated Jacobi Spectral Galerkin Methods for a system of linear Weakly Singular Volterra Integral Equations. We carry out the convergence analysis both for sufficiently smooth and non-smooth cases. We improve the order of convergence in iterated Jacobi spectral Galerkin method over Jacobi spectral Galerkin method. We will also give numerical examples for verifying the theoretical outcomes.

SHUBHANGI DWIVED

IIT Mandi, India

Impact of Cross Border Reverse Migration in Delhi-UP Region of India during COVID-19 Lockdown

The declaration of India's nationwide lockdown caused millions of migrant workers (especially from Uttar Pradesh (UP) and Bihar) to start returning to their respective places without proper transportation and social distancing from various cities like Delhi, Mumbai, and Hyderabad. This unanticipated migration and social mixing accelerated the disease transmission across the country. In view of this, we have developed a patchy disease transmission model for two neighbouring Indian states, Delhi-UP to analyze the reverse migration's impact on disease progression. Essential mathematical properties of the model, including positivity, boundedness, equilibrium points (EPs) and their linear stability, computation of basic reproduction number are studied. Mathematical analysis reveals that the model with active reverse migration cannot reach disease-free equilibrium, indicating that a failure of restrictive mobility intervention caused by reverse migration kept the disease propagation alive. Further, PRCC analysis highlights the need for effective home isolation, better disease detection techniques, and medical interventions to curb the spread. The study estimates significantly shorter doubling time for exponential growth of the disease in both the region. Additionally, the occurrence of synchronous pattern between epidemic trajectories of the Delhi-UP regions accentuate the severe implications of migrant plight on UP's already fragile rural health infrastructure. Using the COVID-19 incidence data, we quantify key epidemiological parameters, and our scenario analyses demonstrate how different lockdown plans might have impacted the disease prevalence. Based on our observations, the transmission rate has the most significant impact on COVID-19 cases. This case study exemplifies the importance of considering these issues carefully before implementing lockdowns and social isolation throughout the country to combat future outbreaks.

SAURABH PAL

VBS Purvanchal University, India

COVID-19 Disease Detection using Pre-Trained Deep Convolutional Neural Network (GoogleNet) on Cloud Platform

Background and Purpose: The COVID -19 epidemics are causing the main rash in more than 151 countries around the whole world. Covid-19 has a bad effect on human life worldwide. One of the critical steps in fighting COVID-19 is finding the contaminated patients early enough and putting these infected people under special care. Our main aim is to separate COVID-19 patients from other patients.

Materials and Methods: In this research article, we used GoogleNet as a learning network. GoogleNet is a deep convolutional neural network of 22 layers deep. We have used a pre-trained version of the GoogleNet trained on ImageNet. The pre-trained GoogleNet image input size is 224 x 224.GoogleNet; the deep convolutional neural network model can analyze X-ray images to classify the patient's condition of the affected disease.

Result: Experiments and evaluation of the GoogleNet have been effectively done based on 80% of X-ray pictures for training and 20% of X-ray pictures for testing phases respectively. GoogleNet shows a good result for disease classification with 91.40% of accuracy in 2.49

minutes.
Conclusion: In this research paper, we have used the deep CNN model to classify COVID-19 disease using X-ray images based on the projected GoogleNet. Scientific studies will be the next goal of this research article.

SHAILENDRA SINGH

National Institute of Technology, India

Painlevé analysis, auto-Bäcklund transformation and new exact solutions of (2+1) and (3+1)-dimensional extended Sakovich equation with time dependent variable coefficients in ocean physics

This article considers time-dependent variable coefficients $(2 + 1)$ and $(3 + 1)$-dimensional extended Sakovich equation. Painlevé analysis and auto-Bäcklund transformation methods are used to examine both the considered equations. Painlevé analysis is appeared to test the integrability while an auto-Bäcklund transformation method is being presented to derive new analytic soliton solution families for both the considered equations. Two new family of exact analytical solutions are being obtained successfully for each of the considered equations. The soliton solutions in the form of rational and exponential functions are being depicted. The results are also expressed graphically to illustrate the potential and physical behaviour of both equations. Both the considered equations have applications in ocean wave theory as they depict new solitary wave soliton solutions by 3D and 2D graphs.

AMBESH KUMAR PANDEY

National Institute of Technology Rourkela, India

Existence of weak solutions to nonlinear elliptic equations involving Hardy potential and variable exponent singularity

Some of the important problems in science and engineering can be solved using nonlinear elliptic PDEs. In recent years, singular nonlinear elliptic PDEs have attracted considerable attention. We study the existence of weak positive solutions to the semilinear elliptic problem whose general model is given by

$$-\text{div } (M(x)\nabla_u - \lambda\frac{u}{|x|^2} = \frac{f(x)}{u^{\eta(x)}} \text{ in } \Omega \text{ and } u = 0 \text{ on } \partial\Omega.$$

Here, $\Omega \subset \mathbb{R}^N$, $N \geq 3$ is a bounded domain with $0 \in \Omega$, $0 \leq \lambda \leq \mu_{N,2}$, where $\mu_{N,2} = \left(\frac{N-2}{2}\right)^2$ and $0 < \eta(x) \in C^1(\bar{\Omega})$. The function $f = 0$ is in suitable Lebsegue spaces. The given problem is notable due to the variable exponent $\eta(x)$, and it has singularity on the boundary of the domain Ω as well as at the origin. For proving the existence of weak solutions, we mainly use Schauder's fixed point theorem, Sobolev embeddings, and weak convergence.

Dr. VINOD PATIDAR
Sir Padampat Singhania University, India

Lossless image encryption using robust chaos based dynamic DNA coding, XORing and complementing

In this paper, we present a lossless image encryption algorithm utilizing robust chaos based dynamic DNA coding and DNA operations (DNA XOR and DNA Complement). The entire process of encryption is controlled by the pseudo-random number sequences generated through a 1D robust chaos map that exhibits chaotic behavior in a very large region of parameter space with no apparent periodic window and therefore possesses a fairly large key space. Due to peculiar feed-forward and feedback mechanisms, which modify the synthetic image (created to initiate the encryption process) at the encryption of each pixel, the proposed algorithm possesses extreme sensitivity to the plain image, cipher image and secret key. The performance analysis prove that the proposed algorithm exhibits excellent features (as expected from ideal image encryption algorithms) and is robust against various statistical and cryptanalytic attacks.

ATUL KUMAR
Dayalbagh Educational Institute, India

Dynamical System with Piecewise Derivatives

This model presents a concept of piecewise derivatives using the Classical-power-law randomness, Classical Mittag-Leffler-law-randomness and Classical fading memory randomness frac-tional operators. We use the fractional Adams-Bashforth method for the approximation of these piecewise derivatives.Various simulations has been obtained using a numerical scheme based on Lagrange polynomial interpolation. It was noticed that the obtained figures show real world behaviors of dynamical system with piecewise patterns.

UMAR MOHD KHAN
AMU, Aligarh, India

Study of Hemi-Slant Submanifolds in locally conformal Kähler Manifolds

In this paper we study hemi-slant submanifolds (also known as pseudo-slant sub-manifolds) in locally conformal Kähler manifolds. We establish characterisations for a hemi-slant submanifold to be a Riemannian product of the leaves of the totally real and slant distributions. As a natural generalisation of Riemannian products, we next study when a hemi-slant submanifold can be immersed as a warped product of the leaves of the totally real and slant distributions and obtain interesting characterisa-tions in terms of the Lee vector field. Finally we conclude by establishing inequalities for the norm of the second fundamental form of a hemi slant submanifold in a locally conformal Kähler manifold.

SHWETA DUBEY

National Institute of Technology Rourkela, Odisha

Approximate solutions of charge-controlled memcapacitor system using Adams-Bashforth method

This study aims to investigate the dynamics of a novel charge-controlled memcapacitor system by considering time fractional derivatives. The considered model is assessed by using fractional derivatives with singular and non singular kernels. The fractional Adams–Bashforth method based on Lagrange polynomial interpolation is applied to solve the system with Caputo differential operators. The solutions obtained by Adams–Bashforth method are compared with the RK4 for integer order, which validate the results and then we further go for the solutions of fractional order system. The graphical illustration of solutions show the dynamic behaivor of the charge-controlled memcapacitor system for different integer and fractional order.

SHANMUGAPRIYA. A

Central University of Tamilnadu, India

Characterizing the dual of the tensor product of positive semidefinite cones

Here we characterize the elements in the dual of the projective tensor product of positive semidefinite cones. This happened in the course of finding the dual of tensor product of cones. Let K_1 and K_2 be two cones in a finite dimensional real vector spaces V and W respectively. The projective or minimal tensor product of cones K_1 and K_2 is denoted as $K_1 \otimes K_2 = \{\sum_{i,j}(x_i \otimes y_i) | x_i \in K_1, y_i \in K_2 \forall I, j\}$ and it is in the tensor product space of $V \otimes W$. The dual of $K_1 \otimes K_2$ is denoted as $(K_1 \otimes K_2)^* := \{\sum_i v_i \otimes w_i \in V \otimes W | \langle \sum_{i,j}(x_i \otimes y_i), \sum_{k,l}(v_k \otimes w_l) \rangle \geq 0, \forall \sum_{i,j}(x_i \otimes y_i) \in K_1 \otimes K_2\}$. In [2] and [3] Bruyn had studied the properties of projective and injective tensor product of cones. In the space of all real symmetric matrices $S_n(\mathbb{R})$ we have S_n^+ thepositive semidefinite cone which is a proper cone and self dual. Aubrun et al. in [1] had given $S_n^+ \otimes S_n^+$ as an example of entangleable pair which is not self dual but it is sub dual. While characterizing the elements of dual of $S_n^+ \otimes S_n^+$ we use the properties of Hadamard product and Kronecker product of matrices. Our motivation comes from the problem of finding the Lyapunovrankof tensor product of cones. Projective tensor product cone $S_n^+ \otimes S_n^+$ has wide application in quantum mechanics which is a special case of general probabilistic theories.

GURPREET KAUR

Amity Institute of Information Technology, India

PSIS based blind watermarking scheme (PSISBW) with tamper detection

This works aims to provide an alternative method of using Shamir's secret sharing (SSS) scheme as secret image sharing (SIS) in blind watermarking. The embedding location in the host image is randomly selected on the basis of compound chaotic maps at locations that are based on secret keys of the maps. The host is secured with substitution of plain image with that of the compound chaos. For additional security of host image, multiple security layers can be used. While authenticating a minimum number of participants as threshold (k, n) , the host need not to be decrypted. The secret information/shares can be recovered in the encrypted domain which makes the algorithm suitable for applications where privacy is of utmost concern. While recovering the host image, the information of original plaintext (full or partial) is not required. For lossless recovery, some post processing is mentioned that is applicable only to the color image shares. The proposed scheme is evaluated for image quality in visual and statistical terms. Various other applications of proposed scheme are also discussed.

YEGNANARAYANAN V

Kalasalingam Academy of Research and Education, India

Computation of Certain Domination Numbers of Collaboration Graphs

In this paper we provide a crisp overview of the evaluation of the concept of Erdos number and the collaboration graph resulting out of the social networks dictated by the academic relation of coauthorship. We also discuss in some detail about the famous Rolf Nevanlinna Prize and its collaboration graph built on the basis of Erdos number of the prize winners. We have obtained some general results concerning maximum matching of a graph and verified the same for some of the collaboration graphs that arise out of modeling the academic relationship between the Rolf Nevanlinna Prize winners based on their Erdos number. Also, we have computed the strong and weak domination numbers and coloring numbers of these graphs.

T.KALAISELVI

Kalasalingam Academy of Research and Education

Half Certified Captive Domination number of graphs

Stimulated by the challenge of developing a monitoring and protecting mechanism of health care systems from attack by the cyber criminals, an attempt is made to compute the exact number of certain type of domination number of graphs so that one can place guards at the appropriate places to protect the system. Hence, the notion of half certified captive domination number is introduced here and the problem of determining the existence or non- existence of this number for certain classes graphs considered. Besides obtaining some characterization results we also computed this number exactly for several classes of graphs that includes an n-dimensional cube.

SUBHADIP PAL
NIT DURGAPUR

On Kannan type equicontraction mappings and its application to initial value problems

Motivated from the idea of Karakostas and Wardowskii who have extended the Krasnoselskii fixed point theorem for different classes of contraction mappings which comprise only continuous mappings in its corresponding domain, we have extended the Krasnoselskii fixed point theorem for the class of Kannan type equicontraction mapping along with compact mappings. The said class undoubtedly covers some continuous as well as some discontinuous mappings. To acquire a solution for the equation $T(u, C(u)) = u$ (the extended implicit form) corresponding to the mapping $T : A \times C(A) \longrightarrow X$, where u belongs to a closed and bounded subset A of a real Banach space X and the compact mapping C is defined from A to a complete metric space Z, two results have been established. We have used the theory of measure of noncompactness especially, the well known Sadovskii's theorem as a main tool for the second result which is the interesting one. The importance of the findings that were obtained has been demonstrated by taking into consideration a particular category of initial value problems for determining the existence of solution(s).

Department of Mathematical Sciences, IIT (BHU)

Department of Mathematical Sciences began its journey as a section to assist engineering departments of the institute, which, in the true sense, pioneered engineering education in the Indian Nation. It soon acquired the status of a full-fledged department in 1985. Its importance lies in the fact that it caters to the needs of the undergraduate as well as post-graduate students of the Institute. In addition, the department runs its own five years Integrated Dual Degree course in Mathematics and Computing. The department emphasizes research in analysis, algebra, topology, mathematical transforms, etc. Be it fluid dynamics, gas dynamics, biomechanics, fracture mechanics, digital image processing, generalized thermo elasticity, heat and mass transfer, cryptology, and many more fields of applied nature, the department's contribution is enormous in terms of numerous research papers published in reputed international journals over the past few decades. Computing is the glamour of the department. It annexes several dimensions in new and growing research areas and further facilitates the simulation of mathematical models constructed for interdisciplinary areas.