

2022-23 ISSUE

APRIL 2023

OPTIMYSTIC



Optimization // Simulation Modeling // Stochastics

www.ieor.iitb.ac.in

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PUBLISHED BY: IEOR, IIT BOMBAY
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Dear readers,

Welcome to the 2022-23 edition of our department magazine "Optimystic". After a brief break, we bring back the department magazine to revive and promote IEOR department culture.

In this edition, we bring a glimpse of the research, academia, and activities of the IEOR department.

We are grateful to all the volunteers, contributors and students for assisting in the development of the magazine. A special appreciation to the IEOR faculty and staff for their continued support.

Riti Newa

*Joint Secretary - Library and
Publications*

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IEOR DEPARTMENT



ABOUT IEOR

DEPARTMENT OVERVIEW

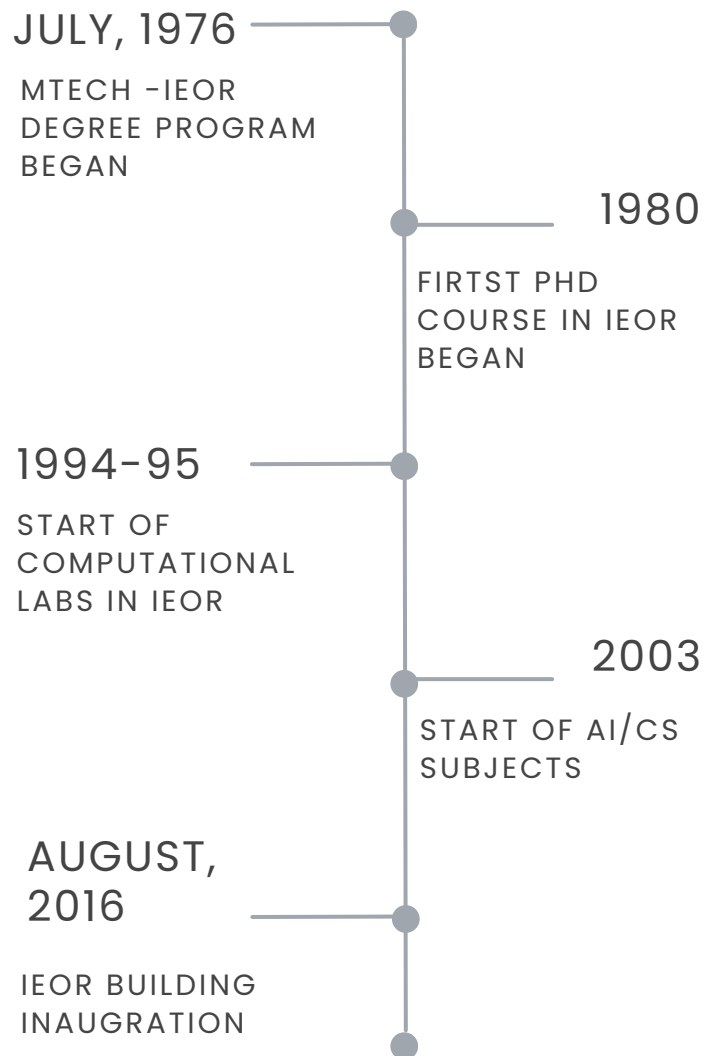
The interdisciplinary program in IEOR began at IIT Bombay in the academic year 1976-77 AD. Industrial Engineering and Operations Research is a discipline dealing with application of advanced analytical techniques for optimized decision making.


The IEOR department is dedicated to advance industrial engineering and operations research applications in industry and government sector. Currently the department offers Ph.D., M.Sc.Ph.D., M.Tech, B.Tech Minor, IDDDP, and CEP programs.



IEOR TIMELINE

DEPARTMENT OVERVIEW





MEET THE IEOR FACULTY

The IEOB Department has a core faculty of eleven distinguished professors. Associated faculty of the IEOB Department consists of three distinguished professors. Two of the previous faculty members have retired including Adjunct Professor Prakash G. Awate, the founding member of the IEOB Department.

In February, 2022 the IEOB department welcomed Dr. Urban Larsson as a fulltime Associate Professor (Visiting).

CORE FACULTY

FACULTY MEMBERS & CURRENT RESEARCH INTERESTS

Head

Jayendran Venkateswaran



Modeling & Distributed Simulation (Discrete-event, System Dynamics), Integrated Supply Chain Analysis

N. Hemachandra



Operations Research methodologies like Machine Learning, Markov decision models, Queueing models, Game theory

Ashutosh Mahajan



Theory, Algorithms & Software for Mixed-Integer Linear & Nonlinear Optimization

Narayan Rangaraj



Application of Operations Research to Logistics & Supply Chain Management, Manufacturing, Railway Operations, Transportation & Health Care

Manjesh Hanawal



Communication Networks, Machine Learning, & Network Economics

Vishnu Narayanan



Integer Programming, Convex Optimization, & Polyhedral Theory

CORE FACULTY

FACULTY MEMBERS & CURRENT RESEARCH INTERESTS

Veeraruna Kavitha



Stochastic processes, Performance Analysis, Queuing Theory, Polling systems, Optimal control, Game theory, Stochastic approximation, Wireless communications

K.S. Mallikarjuna Rao



Game theory, Stochastic Control, Probability, Partial Differential Equations, Viscosity Solutions

P. Balamurugan



Theoretical & practical aspects of Machine Learning, Data mining, Optimization for data science, Longitudinal Data Analysis & related applications

Avinash Bhardwaj



Conic (mixed) integer programming, Linear & Non Linear Discrete Optimization, Polyhedral cutting planes for mixed-integer programming, Polyhedral Combinatorics, Optimization under uncertainty, Combinatorial Optimization, Approximation Algorithms, Computational Optimization

Urban Larsson



Game Theory, Discrete Mathematics, Number Theory, Combinatorics, Cellular Automata, Mechanism Design, & Algorithms

ASSOCIATED FACULTY

FACULTY MEMBERS & CURRENT RESEARCH INTERESTS

Siddhartha SenGupta



Large scale Automated Railway Planning, Transportation planning, Creating value from ICT, Logistics & Supply Chain Management (including Pricing/Revenue Management), Machine Learning & Artificial Intelligence

Madhu Belur



Railway timetabling: development of tools, Singular & descriptor systems: impulse elimination, Dissipative systems: algorithms for storage functions, Operations research: timetabling, bottleneck identification & congestion control, Graph-theoretic methods & structural control, Allocation problems & matching techniques

Jayakrishnan Nair



Queueing theory, Communication networks, Heavy tails

IEOR OFFICE STAFF

Mr. Abasaheb Molavane



Jr. Assistant

Mr. Amlesh Kumar



Jr. Administrative
Assistant

Mr. Siddhartha Salve



Sr. Project
Assistant

Mr. Pramod Pawar



Attendant



SOME FACULTY HIGHLIGHTS 2022-23



Prof. Narayan Rangaraj
First Fellow of the Fraunhofer
ITWM Fellow Program

Selected as Fellow of
Operational Research Society
of India for his overall
contribution to field of
Operations Research



Prof. Ashutosh Mahajan
Awarded the "Departmental
Award for Excellence in Teaching,
2022" on the occasion of
Teacher's Day at IIT Bombay

5 QUESTIONS WITH PROF. URBAN LARSSON



Dr. Urban Larsson is a fulltime Associate Professor (Visiting) in IEOR.

Dr. Larsson works in the area of Game Theory, Number theory, Discrete Mathematics, Computer Science and Algorithms. His main contributions find bridges between combinatorial games and the neighbouring disciplines.

Urban has presented his research at more than 100 international conferences and seminars, he is an Associate Editor for International Journal of Game Theory, and he is the Editor of two Games of No Chance volumes.

What motivated you to pursue the field of game theory, number theory and combinatorics?

Initially I was pursuing engineering but dropped it shortly after. I began to explore different things such as poetry, filmmaking, photography etc. But when I came across number theory, I was completely engrossed. I was intrigued by interesting number theory sequences in games. While working under my professor, I realized I was very good at game theory which led me to publish my first paper on imitation games. I was even able to present the paper in US and meet the likes of John Nash. After coming across number theory and game theory, I discovered this was something I was good at and could keep doing it throughout my life and I haven't stopped since.

Can you mention one big open question or challenge in the field of combinatorial games?

The first big challenge is to spread knowledge about the field of combinatorial games which is often overshadowed. Also building bridge from combinatorial games to classical game theory is challenging because there have not been many collaborations and researches involving both together. One interesting question is how to bridge number theory and Turing Complete in Computer Science, which could be promising for future applications.

5 QUESTIONS WITH PROF. URBAN LARSSON



Dr. Urban Larsson is a fulltime Associate Professor (Visiting) in IEOR.

Dr. Larsson works in the area of Game Theory, Number theory, Discrete Mathematics, Computer Science and Algorithms. His main contributions find bridges between combinatorial games and the neighbouring disciplines. Urban has presented his research at more than 100 international conferences and seminars, he is an Associate Editor for International Journal of Game Theory, and he is the Editor of two Games of No Chance volumes.

List any one game you find most interesting by a game theory or combinatorial perspective. Why?

The Wythoff's Nim (corner the queen) is one of the most interesting game. It is a simple game but it is connected with the golden ratio. Few people look at the game from the perspective of biology but there are interesting literature on how this game is related to nature and not just limited to the number theory,

What do you think will be the most promising research area in your field in next five years?

One of the promising areas could be hidden information in combinatorial games. How to approach hidden information games using backward induction or otherwise.

Also looking into general sum games and studying it like a combinatorial game can be an interesting area of research.

How has your collaboration with IEOR department progressed your research? What exciting things can we expect in the department in the coming year?

I look forward to machine learning being a part of my journey here and also letting people in IEOR explore combinatorial games.

I am excited to work with more students here and also widen my network India wide.

TECHNICAL LANGUAGE PROCESSING

BY: ABIJITH PY (BATCH 2020-2022)
DATA SCIENTIST, EXXONMOBIL



Technical Language Processing (TLP) has become an increasingly important field in the world of artificial intelligence, natural language processing (NLP), and machine learning. As industries produce massive amounts of unstructured text data, such as maintenance logs, technical reports, and user manuals, the need for efficient and accurate processing of this data has grown exponentially.

TLP aims to adapt NLP techniques to analyze and process complex, domain-specific language found in technical texts, which often pose challenges for traditional NLP methods.

Technical Language Processing has a wide range of applications across various industries. Some notable use cases include:

- **Maintenance knowledge extraction:** By analyzing maintenance work orders and logs, TLP can help identify patterns, trends, and best practices, ultimately improving equipment reliability and reducing downtime.
- **Technical document summarization:** TLP can automatically generate concise summaries of lengthy technical documents, saving valuable time for engineers, researchers, and technicians.
- **Knowledge management:** TLP enables the extraction and organization of information from disparate sources, facilitating efficient knowledge sharing and retrieval within organizations.
- **Automated customer support:** TLP can enhance customer support systems by understanding technical queries and providing accurate, relevant responses.

The future of Technical Language Processing is promising. As industries continue to embrace digital transformation, the need for efficient processing and analysis of technical texts will only increase. Collaboration between academia, industry, and standard-setting organizations will play a crucial role in driving TLP's development, ensuring that the technology remains relevant and effective in addressing real-world challenges.

Technical Language Processing has emerged as a critical component in addressing the unique challenges posed by domain-specific technical language. Its use cases and importance to various industries demonstrate its potential to drive significant advancements in knowledge management, decision-making, and collaboration. As research and development in this area continue to evolve, TLP will undoubtedly play an increasingly important role in shaping the future of industry operations.

MODELING AND ANALYSIS OF SUSTAINABLE SUPPLY CHAIN MANAGEMENT

BY: RISHAV DEVAL,
SENIOR RESEARCH
FELLOW
SUPERVISOR: PROF.
JAYENDRAN
VENKATESWARAN



Existing literature on Production and Inventory Control System (PICS) fails to account for the systems' emission as feedback into the decision-making process. A feedback-based approach in Production-Inventory (PI) is proposed using Emission-based Production and Inventory Control System (EPICS). Such an approach ensures the system operates within permissible limits defined as Emission Permit (EP) mandated by the regulator.

Any deficit in permits can be bought from the existing carbon market at carbon price to increase Emission Allowance, EA (includes Emission Permit and additional permits from the carbon market). This generic module is integrated into a capacity expansion module for unit emission reduction. System performance is balanced with system cost and service level metrics of economic and social dimensions on sustainability indices. This integrated framework can be extended to the multiplayer setup (currently under exploration). Our eventual goal is to develop policies for systems to mitigate green bullwhip, commonly arising due to changes in environmental regulations.

The 40th International System Dynamics Conference (ISDC) in Frankfurt (Germany) was the first international/national conference I attended with my supervisor Prof. Jayendran Venkateswaran. ISDC is one kind of conference that brings globally renowned academicians and practitioners together to discuss challenges varying from Diversity to learning and teaching, Business and Strategy to Operations, Health to Psychology and Human Behavior, and many more. A poster on "Dynamics of Production and Inventory Control System under Emission Feedback" was presented, serving as a foundation for our current research. The conference had a session on Beer Distribution Game (a well-known educational game for coordination in the supply chain) to which I was assigned to deal with Factory operations; our team eventually won (an imaginary game with real beer as a reward!!) with \$999.5 as an operational cost with following second best at \$1650.

MODELING AND ANALYSIS OF SUSTAINABLE SUPPLY CHAIN MANAGEMENT

BY: RISHAV DEVAL, SENIOR RESEARCH FELLOW
SUPERVISOR: PROF. JAYENDRAN
VENKATESWARAN

The conference allowed me to interact with Prof. John Sterman, MIT, and discuss the beer game over an actual beer and many other people from/around Europe and America working with the System Dynamics methodology.

Another enriched experience of the international conference was at IEEE Conference on Industrial Engineering and Engineering Management (IEEM) held in Kuala Lumpur (Malaysia).

IEEM is a highly appreciated conference in the IE&OR community restricted into South-East Asia but attracts presenters from and around the globe. A paper titled "Stability Analysis of Emission-based Production and Inventory Control System" was co-authored by Prof. J. Venkateswaran and was presented at the conference. Probably this conference is best suited for our OR community to interact with people with a similar domain to your research and get something fruitful out of interaction or even look for future collaborations. "Dynamics of Capacity Upgradation and Emission-based Production and Inventory Control System" was recently presented at the International Conference on Sustainable Business Management held at the Indian Institute of Technology Roorkee (India). It was a short overview of our recently submitted papers at EUROSIM Congress 2023 and 41st ISDC 2023, which are currently under review, discussing the system's performance by introducing carbon price and capacity expansion.

IMPROVING OUR UNDERSTANDING OF PROTEINS FROM THE DATA DELUGE

BY: PRANAV VINOD MACHINGAL
PHD GRADUATE STUDENT (PRIME
MINISTER'S RESEARCH FELLOW)



Proteins are biomolecules that form the fundamental machinery in complex living organisms and are involved in every possible function such as growth, repair, reproduction, etc. Improving an understanding of how proteins work is of central importance in biology as it can aid in understanding diseases, developing treatments, and deriving insights into the evolutionary relationship between different organisms and their origins.

Protein sequence databases have grown rapidly due to improvements in sequencing technologies. The quantity of experimentally validated annotations, however, is quite small; for instance, only roughly 0.57 million of the 2.3 million sequences in the UniProt database, one of the largest sequence databases, have manually reviewed annotations.

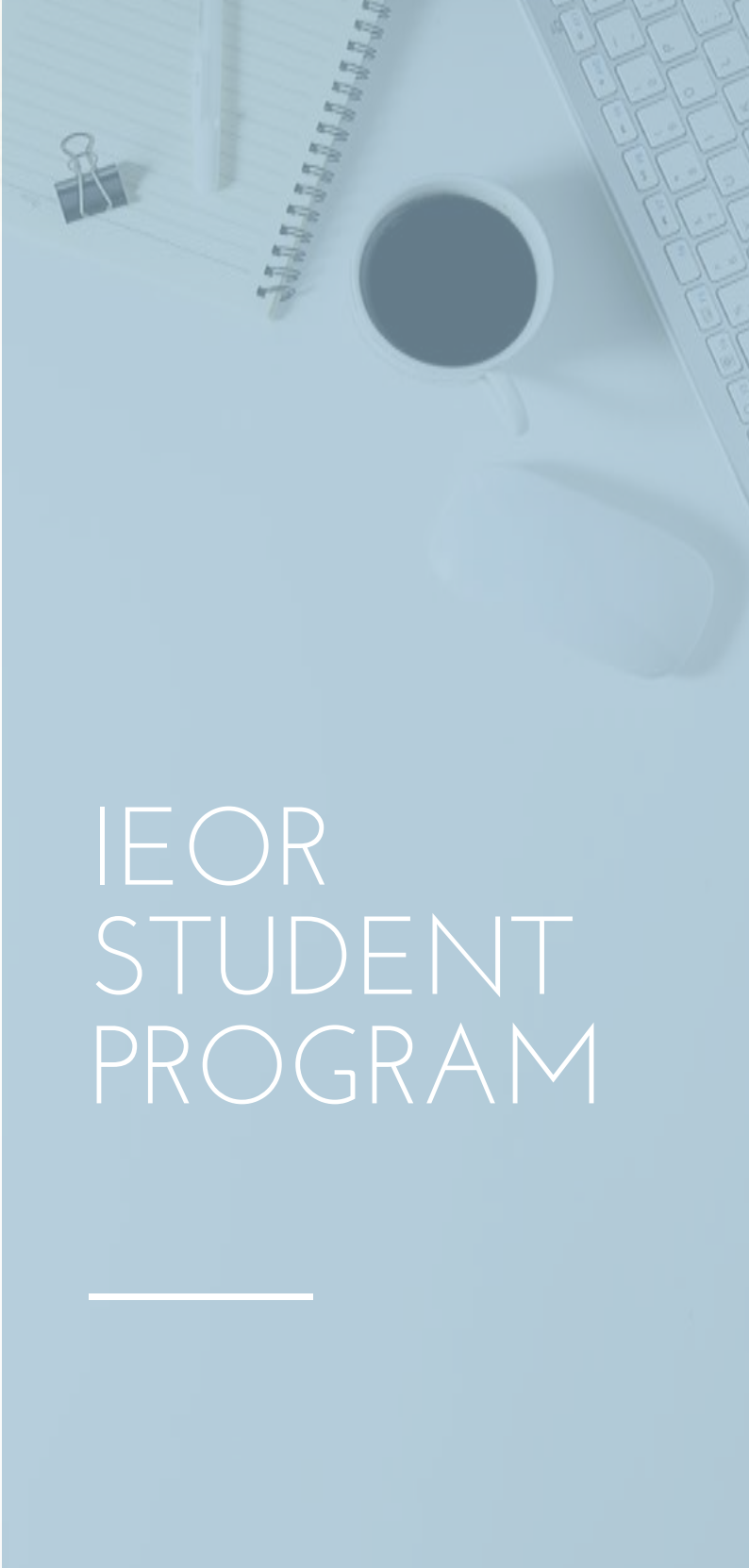
This is because the connection between sequence and function is hard to establish, and experimental approaches for figuring out function are time-consuming, call for particular conditions, and are thus not at all scalable. Predicting the 3-dimensional structure of a protein directly from its sequence information is called the “protein folding problem”. In 2020, AlphaFold, a deep learning algorithm released by DeepMind was able to predict highly accurate protein structures directly from sequence and showcased its superiority by beating other methods in the past by a significant margin. Recently, deep learning methods from natural language processing (NLP) have also been adopted to create protein language models which predict some structural and biophysical properties of proteins like their secondary structure and stability from only their sequences.

Deep learning methods, in general, utilize neural-network-based end-to-end differentiable function architectures to find desired function mapping from input space to output space. The function architecture is crafted and curated to be suitable for the given data and task at hand. A suitable gradient descent based optimization technique with backpropagation is used to identify the function parameters which minimize a loss function computed on the model output and the expected output for the training data. State-of-the-art deep learning models are typically trained on huge amounts of data with significant computational power. Many of these models, like recent transformer based models, do not use hand-crafted features and work directly on raw inputs while having multiple layers of processing which create intermediate representations which are often investigated to interpret the model's predictions. State-of-the-art deep learning models trained on protein sequences report high accuracy on large datasets for coarse-grained level functional annotations. However, these models are hard to interpret and fail to provide insights into the sequence function relationship or suggest any experimentally verifiable hypothesis.

IMPROVING OUR UNDERSTANDING OF PROTEINS FROM THE DATA DELUGE

BY: PRANAV VINOD MACHINGAL
PHD GRADUATE STUDENT (PRIME
MINISTER'S RESEARCH FELLOW)

In our ongoing work, we utilize a linear classifier and a feature subset selection algorithm on a set of interpretable features to identify a subset of features that can be used to discriminate paralogous protein family sequences. Paralogs are protein families that perform different functionalities but are considered to have originated from a common ancestor. The identified subset of features can be further probed by experimental biologists to investigate whether modifying these features can result in a change in the protein's functional activity. This is an ongoing collaborative work with my PhD advisors, Prof N. Hemachandra and Prof P. V. Balaji and Busi Rakesh, the latter two are associated with the department of Biosciences and Bioengineering, IIT Bombay.



IEOR STUDENT PROGRAM

The IEOR Department offers admissions in 6 academic streams for Indian and international students.

Ph.D.

supports work ranging from fundamental theoretical contributions to innovative applications

M.Sc.-Ph.D.

integrated doctoral programme, for those interested in a research oriented career

M.Tech.

prepares students for a professional career or provides adequate foundation for pursuing doctoral research

IDDDP

for UG students to pursue IEOR degree

B.Tech. Minor.

pursue IEOR courses during UG degree

CEP

to meet manpower training and knowledge upgradation needs of industry



IEOR STUDENT STATISTICS

45
STUDENTS
OLD BATCH

7 STUDENTS
2022 BATCH

PH.D.

13 STUDENTS
2021 BATCH

15 STUDENTS
2022 BATCH

M.SC. – PH.D.

19 STUDENTS
2021 BATCH

32 STUDENTS
2022 BATCH

M.TECH.

INSIGHTS FROM PH.D.

PH.D. HIGHLIGHTS

The Ph.D. students in IEOR department are constantly striving to contribute to research areas in the field of industrial engineering and operations research.

Some of the wide research area that remain the focus of the students are:

Optimization, stochastic model and stochastic control, simulation modeling and analysis, artificial intelligence based methods and game theory.

These research topics have applications on field of logistics and transportation, supply chain and inventory planning, scheduling and ERP, etc.

HIGHLIGHTS

Conference Presentation by Mustafa Vora under Prof. Ashutosh Mahajan

"Cutting planes from the Simplex Tableau for Quadratically Constrained Problems" *presented at HUGO 2022 XV Workshop on Global Optimization*

Conference Paper Publication by Tushar Shankar Walunj under Prof. Veeraruna Kavitha

2022 58th Annual Allerton Conference on Communication, Control, and Computing (Allerton)

International and National Conference Participation by Rishav Deval under Prof. Jayendran Venkateswaran

- 40th International System Dynamics Conference, Frankfurt (Germany)
- IEEE Conference on Industrial Engineering and Engineering Management, Kuala Lumpur (Malaysia)
- International Conference on Sustainable Business Management, IIT Roorkee (India)

Paper on "Learning with Operator-valued Kernels in Reproducing Kernel Krein Spaces" by Akash Saha under Prof. P. Balamurugan

INSIGHTS FROM PH.D.

PH.D. HIGHLIGHTS

HIGHLIGHTS

Publications by Prashant Trivedi under Prof. N Hemachandra

- Multi-Agent Congestion Cost Minimization with Linear Function Approximations. To appear in AISTATS 2023
- Noise-Robust Core Stable Coalition of Hedonic Games. Presented and to appear in ACML 2022, Hyderabad India
- Multi-Agent Natural Actor-Critic Reinforcement Learning Algorithms. Appeared in Dynamic Games and Applications, 2022

Publications, presentations, and award wins by Manoj Kumar under Prof. Narayan Rangaraj

- "Choice of Intraoperative ultrasound adjuncts for brain tumor surgery." Journal of Medical Informatics and Decision Making, 2022
- Presented "Data-driven treatment policies for Dialysis Patients" at *International Conference on Operations Research - OR 2022 at Karlsruhe Institute of Technology, Germany (September 6-9, 2022)*
- Poster presentation "Decision Policy for Intraoperative Ultrasound Imaging for Brain Cancer Surgery" at ICORES - 2023 at Lisbon, Portugal (February 19 - 21, 2023)
- Commendable paper award 'An innovative modeling framework for freight consolidation in transportation planning' at BAICONF 2022, at IIM Bangalore.

The academic year 2022- 2023 has been a fulfilling year for the Ph.D. students with multiple publications, presentations, conference attendances, and award wins.

Some of the highlights from the Ph.D. students' successful run of the year is presented here.

INSIGHTS FROM PH.D.

PH.D. STUDENTS SHARE THEIR LEARNING EXPERIENCE AND ACHIEVEMENTS

We ask the students how their research work has progressed in IEOR and what are their achievements.

How has your research evolved since you first started your program?

"I started to work on some computational aspects for a general purpose global optimization solver focused on robustness of solver and numerical issues. Then I delved deeper into working on cutting planes thus deriving a novel class of cutting planes that can be used for general purpose Quadratically Constrained Problem (ergo the conference presentation and paper writing in progress). I am planning to now pursue certain branching related decisions to be made for a solver of this type and devise novel computational strategies to obtain smaller branch and bound trees. Overall I have done computational and theoretical work which shaped my understanding of the research area well and gave me more profound idea about solver development and quadratic optimization."

Mustafa Vora

Research Area: Global Optimization of Mixed Integer Quadratically Constrained Quadratic Problems
Guide: Prof. Ashutosh Mahajan

"At the start of my research journey, the main focus was quite narrow as I was looking into results based on operator-valued kernels which could be extended based on existing work available in the literature. A considerable time was spent in identifying research gaps which broadened my knowledge. This has enabled extensions for functional regression problems incorporating graphical structure on a set of inputs and addresses domain adaptation for functional regression problems."

Akash Saha

Research Area: Supervised Learning with Functional Data
Guide: Prof. P. Balamurugan

INSIGHTS FROM PH.D.

PH.D. STUDENTS SHARE THEIR LEARNING EXPERIENCE AND ACHIEVEMENTS

We ask the students how their research work has progressed in IEOR and what are their achievements.

How has your research evolved since you first started your program?

"In the initial days, my research was like a snake and ladder game. But it was an interesting game to be a part of. I enjoyed reading, learning, and discussing new ideas with my supervisor. I am thankful to my supervisor Prof. N. Hemachandra for his immense support and guidance. It was his guidance and inspiration that I started working in Multi-Agent Reinforcement Learning (MARL). I picked a lot of skills and started working on smaller parts of each problem, and the rest followed."

Prashant Trivedi

Research Area: Multi-Agent Reinforcement Learning and Decision Making

Guide: Prof. N Hemachandra

"My research has focused on solving real world problems by exploring the intersection of data science and healthcare. I was always fascinated by the potential of data-driven solutions to directly impact society, and through my interactions with medical professionals, I have developed a keen interest in brain cancer surgery and dialysis management. However, working in healthcare presents a unique set of challenges. Data in this domain is often messy and incomplete, which makes it difficult to make reliable data-driven decisions. Despite these obstacles, my research has shown promise in developing innovative solutions that can address these challenges and improve patient outcomes. Through my work, I hope to continue to the growing field of healthcare data science, and ultimately make a positive impact on the lives of patients and healthcare providers."

Manoj Kumar

Research Area: Sequential Decision making & Other Models for Healthcare Applications

Guide: Prof. Narayan Rangaraj

INSIGHTS FROM PH.D.

PH.D. STUDENTS SHARE THEIR LEARNING EXPERIENCE AND ACHIEVEMENTS

We ask the students how their research work has progressed in IEOR and what are their achievements.

Can you share a recent research finding that you are particularly proud of?

"I have developed a general purpose cutting planes that are computationally cheap for Quadratically Constrained Problems and at the same time are guaranteed to cut off an infeasible solution. I am proud of this research because it is simple yet effective and presents an "MILP way" to look at nonconvex optimization problems."

Mustafa Vora

Research Area: Global Optimization of Mixed Integer Quadratically Constrained Quadratic Problems

Guide: Prof. Ashutosh Mahajan

"The novel game theoretic concept namely, "Equilibrium Cycle."

Tushar Shankar Walunj

Research Area: Pricing, competition and market segmentation in ride hailing

Guide: Prof. Veeraruna Kavitha

"We proposed a method to discriminate protein sequences from two protein families with a common ancestor, using linear SVM and Shapley value based feature subset selection algorithm."

Pranav Vinod Machingal

Research Area: Machine Learning in Protein Bioinformatics

Guide: Prof. N Hemachandra

INSIGHTS FROM PH.D.

PH.D. STUDENTS SHARE THEIR LEARNING EXPERIENCE AND ACHIEVEMENTS

We ask the students how their research work has progressed in IEOR and what are their achievements.

Can you share a recent research finding that you are particularly proud of?

"All the problems that I have worked with have enriched my understanding, the recent findings that have made me inquisitive (not exactly proud) have been the role of sparsity in graphical structure of inputs driving a functional regression problem and understanding domain adaptation from the perspective of regression based problems."

Akash Saha

Research Area: Supervised Learning with Functional Data

Guide: Prof. P. Balamurugan

"My recent work on multi agent congestion cost minimization, i feel is one of the most fundamental contribution I made towards the Operation research and Machine learning community. This work generalizes the stochastic shortest path problem for the multi agent setting with the cost of taking a link by an agent is congestion dependent as well as private, hence not known to other agents. The algorithm we propose learns the sub-optimal path with high confidence."

Prashant Trivedi

Research Area: Multi-Agent Reinforcement Learning and Decision Making

Guide: Prof. N Hemachandra

"One of the research findings is that always using the advanced technology is unnecessary and leads to longer operative time, additional personnel, and more cost. Our findings shows the personalized treatment plan for dialysis as well brain cancer patients."

Manoj Kumar

Research Area: Sequential Decision making & Other Models for Healthcare Applications

Guide: Prof. Narayan Rangaraj

INSIGHTS FROM M.SC.- PH.D.

M.SC.- PH.D. STUDENTS SHARE THEIR INTERESTING PROJECTS/RESEARCH IN
IEOR

We ask the students what research or course project they found interesting

- Music Source Separation using Deep Learning
- Survival Analysis with XGBoost

Abhishek Gupta
M.Sc.-PH.D. 2nd Year

implemented an end-to-end trainable deep learning based weakly supervised model for object detection and image level classification tasks

Rupesh Yadav
M.Sc.-PH.D. 2nd Year

"Image Caption Generator Using Deep Learning."

In this project, a convolutional neural network (CNN) is utilized to process images, while an attention mechanism and Word2Vec are employed to embed words into the images. The resulting model is constructed using a long short-term memory (LSTM) network for generating captions.

Aakash Roy
M.Sc.-PH.D. 2nd Year

Cooperative Learning in Multiplayer Multiarmed Bandits with collision dependent reward function

Riya Sultana
M.Sc.-PH.D. 2nd Year

Game theory / minority games/
coalition formation games

Yannick Furtado
M.Sc.-PH.D. 2nd Year

- Extraction of independent component from a mixed signal,
- Optimization of parameters of Gaussian mixture model by using Expectation maximization algorithm

Shivam Mishra
M.Sc.-PH.D. 2nd Year

"Developing a learning agent for Castle Clobber"

I have worked on this project with Prof. Urban Larsson where we have devised a new game by modifying the existing ruleset of Clobber. We developed a learning agent by using the Weighted Average Algorithm. Currently, we are trying to optimize the agent so it can learn to play on larger boards.

Shoaib Ahmad
M.Sc.-PH.D. 2nd Year

Machine Learning, Online Learning and Bandit Algorithms

Srija Mukherjee
M.Sc.-PH.D. 2nd Year

INSIGHTS FROM M.TECH.

M.TECH. STUDENTS SHARE THEIR INTERESTING PROJECTS/RESEARCH IN IEOR

We ask the students what are the areas of their thesis work research

"With the advancements in the medical field, biomedical literature is growing exponentially, and so is keeping a record of these advancements. It is now beyond the human brain's capacity to absorb significant knowledge by reading the records that are published regularly. With the advancement of text analytics, this process can be automated.

Our main aim is to develop an end-to-end deep learning model that can give details of research on drugs based on patients' characteristics. A large number of clinical trials are being conducted nowadays on various diseases. For this project, we took the task of giving details of research for kidney disease: IgA Nephropathy from the clinical trials data."

Vaibhav Singh Panwar
M.Tech. 2nd Year
Guide: Prof. P. Balamurugan



INTERNSHIP 101

INTERNSHIP HIGHLIGHTS 2022-23

HIGHLIGHTS

Abhishek Gupta
Operations Research
Scientist I
ORMAE LLP

Yannick Furtado
Data Analytics
Accenture

Aakash Roy
Data Scientist
Legato Health Technologies

Riya Sultana
Summer Intern
Reserve Bank of India

Srija Mukherjee
Model Analyst
Citibank

INTERNSHIP 101

M.SC. STUDENTS GIVE YOU THE ULTIMATE INTERNSHIP GUIDE

What were the major skills/ subjects of IEOR department that helped you during internship or course project?

- Machine Learning, Deep Learning, Optimization
- Optimization
- All. As IEOR majorly focuses on Optimization, Probability-Statistics, Machine Learning techniques, Python etc., so it enhances both the understanding and skills of a student to work in Data Science domain.
- Probability and Stochastics, Engineering Statistics, IEOR Lab
- The subjects I have been taught at IEOR have been very diverse ranging from probability and statistics to game theory. It helps me to view a problem from different perspectives and hence look for better solutions on the way. The lab courses in my first year exposed me to enough programming that my coding skills have improved significantly to work on a project such as the one mentioned above.

PLACEMENT 101

THE DEPARTMENT PLACEMENT COORDINATORS SHARE THEIR JOURNEY AND MESSAGE FOR IEOR PLACEMENTS

I was the Department Placement Coordinator for the session 2022-23. As a DPC I coordinated with the Institute Placement Team to ensure maximum opportunities for the students and ensure maximum placement for the department. Besides that, I conducted placement preparation activities such as mock tests, buddy talks, resume making sessions etc. I believe all my efforts gave fruitful results at the end and we ended up having a great placement season even when the companies backed out due to the market conditions at the moment. This role helped me develop a sense of responsibility and improved my time management skills.

Abhishek Gupta
Department Placement Coordinator

Remember, success is not final, failure is not fatal. It's the courage to continue that counts. So, don't give up, keep trying and keep preparing.

Harshit Yadav
Department Placement Coordinator

ALUMNI HALL OF FAME

WE ASK THE FOLLOWING ALUMNI TO SHARE THEIR EXPERIENCE POST IEOR

Khyati Thakkar, M.Tech. 2020

Assistant Manager: Data Science

Unilever PLC

Responsibilities: End to end data science related project development and execution

Ravi Kant Rai, M.Sc.-Ph.D. 2021

Postdoctoral Research Associate

University of Liverpool

Harshit Gupta, M.Tech. 2018

Consultant: Supply Chain Analytics

General Mills Pvt. Ltd.

Abhishek Panigrahi, M.Tech. 2021

Data Science Analyst

Accenture AI

Abijith PY, M.Tech. 2022

Data Scientist

Exxonmobil

Bikram Majumdar, M.Tech. 2022

DHL Pvt. Ltd.

Kunal Apurva, M.Tech. 2021

DevOps SRE

Mercedes-Benz RnD India

Skills or courses gained in IEOR that have been most valuable to career according to alumni

- Statistical and Multivariate Data Analysis, Machine Learning & Deep Learning
- Game theory, Optimization, Probability
- Communication, Optimization, Supply Chain
- Supply chain management, Machine Learning, Data Analysis and Exploration
- NLP, Operations, Mathematical modelling
- Python, Optimization, ML
- Python, Deep Learning, Machine Learning

ALUMNI HALL OF FAME

WE ASK THE FOLLOWING ALUMNI TO SHARE THEIR EXPERIENCE POST IEOR

An example of project/ assignment from your time in IEOR that helped in your career

M.Tech. thesis on "Condition based vehicle health monitoring using anomaly detection techniques" helped in understanding practical nuances of data and modeling which helped a lot in professional projects as well as cracking roles for future roles."

Khyati Thakkar, M.Tech. 2020

Assistant Manager: Data Science, Unilever PLC

Probably everything.

Ravi Kant Rai, M.Sc.–Ph.D. 2021

Postdoctoral Research Associate, University of Liverpool

Applied cutting stock problem for warehouse optimization project last week, network design project helped clear the job interview

Harshit Gupta, M.Tech. 2018

Consultant: Supply Chain Analytics, General Mills Pvt. Ltd.

KEC project in Supply Chain Management course by Prof. Jayendran Venkateswaran sir helped me a lot in my current project which is based on Supply Chain Control Tower.

Abhishek Panigrahi, M.Tech. 2021

Data Science Analyst, Accenture AI

Load levelling. This basically had to do with distributing work orders by company throughout the month so that it won't get crowded in the beginning of the month. Courses like operation analysis, quantitative supply chain helped me a lot.

Abijith PY, M.Tech. 2022

Data Scientist, Exxonmobil

Routing of Bus Fleet

Bikram Majumdar, M.Tech. 2022

DHL Pvt. Ltd.

Neutral architecture search

Kunal Apurva, M.Tech. 2021

DevOps SRE, Mercedes-Benz RnD India

ALUMNI HALL OF FAME

WISE WORDS FROM IEOR ALUMNI

"Focus on the problem-solving approach rather than results and get as much hands-on experience by executing projects in diversified domains."

Khyati Thakkar

Do your best at your course work. They are most important. Do it sincerely. Its going to help you a lot in the long run, irrespective of your ambition in academics or industry.

Ravi Kant Rai

Be curious & open to learn.

Harshit Gupta

Apart from the courses, learn any of the Data visualization BI software skills like Power BI, Tableau which is used heavily in data science companies. Whenever you are doing any project, focus most of the time on understanding the raw data, as in industries 90% of the time is spent on data exploration and analysis. Explore the data to get insights, then apply any model to get results.

Abhishek Panigrahi

The courseworks here will help you get a good grasp on fundamentals. These courses helps you understand the mathematics behind many standard practices in the industry which help you understand and modify and even develop new methods and models when required You should make sure that you are clear with the fundamentals of each subject and this is what every company is looking for. You should also look forward to developing your soft skills and try to learn as much as possible while in the institute.

Abijith P Y

Focus on the field you want to be in rather than subjects

Kunal Apurva

DEPARTMENT COUNCIL

2022 - 2023



Shivam Mishra
**Department General
Secretary**

Riti Newa
**Joint Secretary
(Library &
Publications)**



Rohit Soni
**Joint Secretary
(Academic)**

Shailendra Namdev
**Joint Secretary
(Sports-Boys)**



Riya Sultana
**Joint Secretary
(Cultural)**

Anwasha Roy
**Joint Secretary
(Sports-Girls)**



Joshi Meet Anilkumar
Joint Secretary (H.R.)

Auhona Ghosh
**Joint Secretary
(Cultural)**



Madhu Dhiman
**Department
Coordinator - PH.D.**

DEPARTMENT COUNCIL

WORDS FROM THE COUNCIL

"If everyone is moving forward together, then success takes care of itself". This string of words by Henry Ford was just a quote for me a year ago, but now after almost a year of working as the Department General Secretary these words resonate with me. I had the privilege of having the best team I could ask for who always cooperated and even in times where our opinions differed we were able to come to a solution without any complications. I would also like to thank the Head of Department Prof. JV, who was always there to guide us. I believe together we as a council performed our best and I can proudly say I can see differences in the department from the past year. My message to the team who succeeds us would just be that always remember the responsibility you have taken and take decisions accordingly, always remember the words by Henry Ford I have mentioned and always look forward to the positive changes that you can bring and your work will become more enjoyable and meaningful."

Shivam Mishra

Department General Secretary 2022-23

DEPARTMENT COUNCIL

HIGHLIGHTS

The Department Council are responsible for handling and overseeing all the department activities for the elected tenure. This involves coordinating with faculty and staff to organize formal and semi-formal events, initiating networking activities such as sports and cultural activities and improving the overall rapport among the members of the department.

Here are few highlights of the department council 2022-23.

HIGHLIGHTS

Renovation of Ph.D. Lab

Department council was able to initiate and execute the renovation process of Ph.D. Lab in coordination with lab incharge, Kritika Karwasra.

Introduction of Coffee Machine

The department council initiated the process for introducing coffee machine in the department building in coordination with faculty and staff.

Publication of Yearbook

Department council introduced "Yearbook" publication for graduating seniors in coordination with students.

Revival of Department Magazine

Department council revived the department magazine publication post 2019 issue.

DEPARTMENT ACTIVITIES

DEPARTMENT COUNCIL 2022-23

Reunion Convocation : Reunion of batch 2020 and 2021

A mini convocation was held on 6th August, 2022 for the graduating batch of the year 2020 and 2021 A.D. The ceremony was conducted in the Victor Menezes Convention Centre (VMCC), Indian Institute of Technology Bombay. Prof. Jayendran Venkateswaran, Head of Department addressed the graduates and congratulated them on their degree completion.



IEOR Department Convocation 2022 60th Institute Convocation

The IEOR Department Convocation was held on 20th August, 2022 for the graduating batch of 2022 A.D. The ceremony was conducted in Room 32, Victor Menezes Convention Centre (VMCC), Indian Institute of Technology Bombay.

The department chief guest for the event was Mr. Pradeep Mishra, Sr. Vice President – New Product Development & Head, Eicher Power Solutions, VE Commercial Vehicles Ltd, India. The chief guest awarded degree completion certificates to 40 graduates from the IEOR department.



DEPARTMENT ACTIVITIES

DEPARTMENT COUNCIL 2022-23

IEOR Department Trip

The IEOR department trip to Lonavala was held on 14th August, 2022. The department students participated in a trekking journey to the Lonavala Lohagad Fort. The trip included trekking, fun games, photo sessions and other engaging activities. The trip was the initiative of the department council to improve interaction among the IEOR department family



IEOR Department 2022 Yearbook Launch

The IEOR Department 2022 Yearbook was launched during the convocation ceremony in 20th August, 2022. The department yearbook was launched by the chief guest, Mr. Pradeep Mishra, Sr. Vice President – New Product Development & Head, Eicher Power Solutions, VE Commercial Vehicles Ltd, India. The yearbook was an initiative of the department council to provide a sweet farewell to the graduating batch.

IEOR Chess Tournament

The IEOR chess tournament was organized on 4th September, 2022 in the teaching lab, IEOR department. The students participated in the competition along with faculty member, Prof. Urban Larsson. The tournament winners were selected for the PGGC chess team to play at the institute level.

DEPARTMENT ACTIVITIES

DEPARTMENT COUNCIL 2022-23

Teacher's Day Celebration

The IEOR department celebrated Teacher's Day on 5th September, 2022 to express gratitude to IEOR faculty and staff members.

The celebration was marked by a cake cutting ceremony and a group photo session.

Professor. Ashutosh Mahajan was awarded the Institute Departmental Award for Excellence in Teaching on the occasion of Teacher's Day. He was felicitated during the ceremony.



Open House

The Open House was conducted on 24th September, 2022 in lecture hall complex LH 101. The open house was a knowledge sharing activity to address the concerns of the recent batch and discuss on department related activities (academic, infrastructure, resource access, management concerns).



The one-hour session was moderated by Prof. Jayendran Venkateswaran, Head of Department along with the department council members.



Board Games Night

The IEOR department had a board game night on 12th March, 2023 at meeting lounge, IEOR building. The students played famous board games – qwirkle, ticket to ride, and dobble. The board games night was an initiative of department to provide brief reprieve to students in between hectic academic life.

DEPARTMENT ACTIVITIES

DEPARTMENT COUNCIL 2022-23

Dusshera Celebration

The Dusshera was celebrated in the IEOB department on 4th October, 2022 at the teaching lab in IEOB building. The festival was marked by Durga Puja attended by the IEOB faculty, staff and students. The ceremony was followed by aarti and prasad distribution along with snacks.



Diwali Celebration

The Diwali festival was celebrated by the IEOB family on 24th October, 2022 in the IEOB building. All the members donned traditional attire and celebrated the festival of lights by painting diyas and making rangolis. The students participated in a rangoli making competition and decorated the department floor with beautiful rangoli.



After brief snack break and photo sessions, Diwali puja was carried out followed by joyful lighting of fireworks to commemorate the festival of lights.



Holi Celebration

The IEOB department celebrated Holi on 6th March, 2023 with a colorful feast. The festival was celebrated in the IEOB building terrace, where people took a break from their busy schedules and applied colors to friends and IEOB family. The celebration was followed by snack break and photo session.

2022-23 ISSUE

APRIL 2023



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