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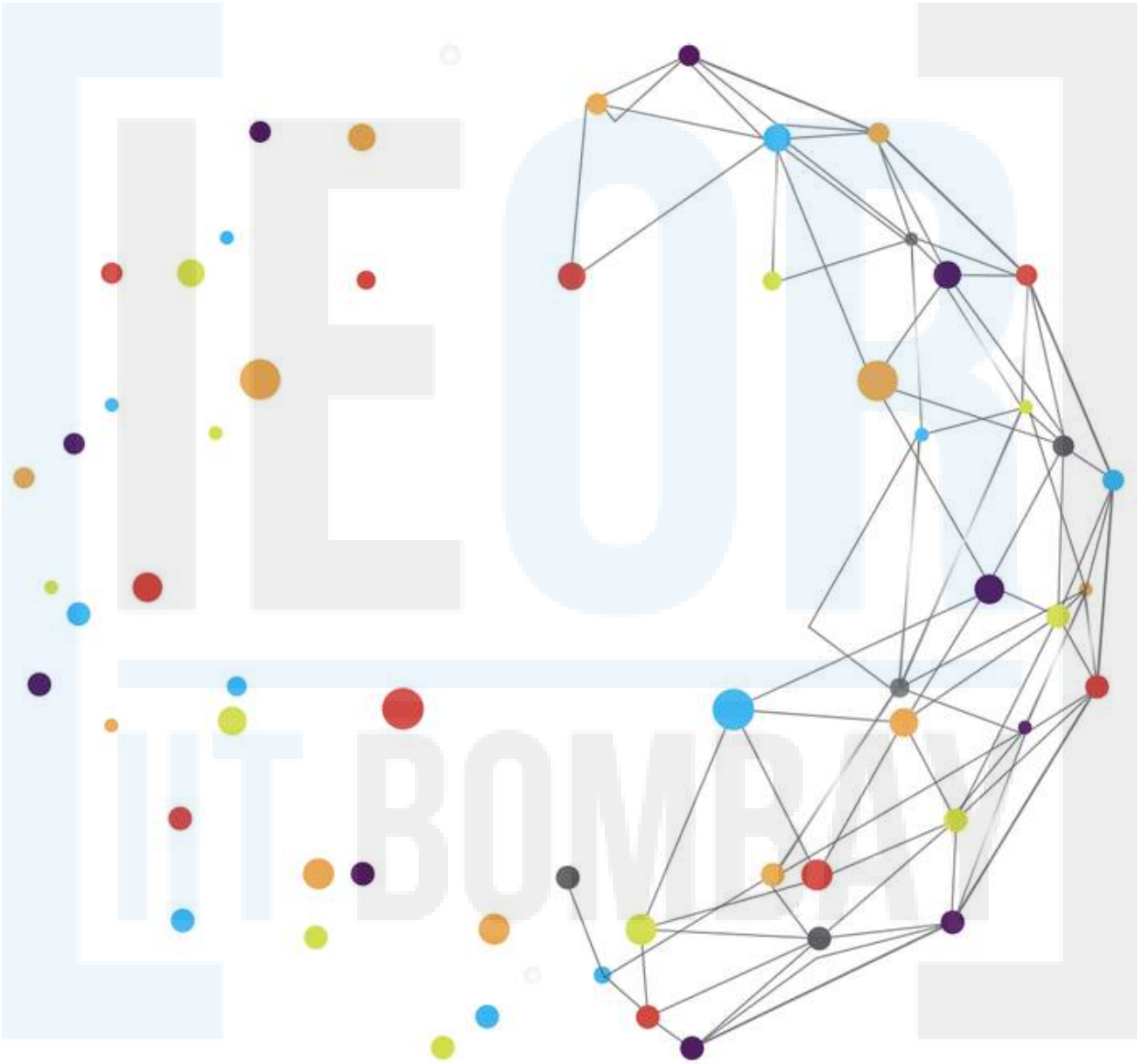

INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

Message to the Reader

Magazine Team

Disha Bansal

Aastha Jaiswal

Dear Optimystic Readers,

As we unfold the pages of yet another edition of Optimystic, we take pride in continuing the rich legacy that has defined our department's spirit. This magazine stands as a testament to the unwavering dedication and brilliance of our students.

Within these pages, you'll discover the culmination of our students' hard work in research, academic pursuits, and the vibrant tapestry of extracurricular activities. It's a celebration of the diverse talents that thrive within our department, showcasing not only the intellectual endeavors but also the moments of respite that offer a breath of fresh air amidst hectic schedules.

We extend our heartfelt gratitude to all the students who volunteered their time and energy, contributing to the success of this magazine. May this edition of Optimystic inspire, and resonate with each reader, serving as a reflection of the dynamic community of our department.

Happy Reading!

Best Regards,
Disha Bansal
Joint Secretary (Library and Publications)

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Overview of IEOR

The Department of Industrial Engineering and Operations Research (IEOR) provides a comprehensive and rigorous engineering education with a focus on practical applications in various industries. Students are equipped with the skills and knowledge to tackle complex challenges in fields such as data science, manufacturing, finance, retailing, supply chains, healthcare, and other service sectors.

The department offers a diverse range of courses covering key areas of industrial engineering and operations research such as:

1. Optimization: Models, theory, and algorithms: This course explores mathematical modeling techniques, theoretical foundations, and algorithmic approaches for optimizing decision-making processes..

2. Stochastic Models: Students delve into the study of random processes and uncertainty. Stochastic models are essential for understanding and managing variability in systems, making predictions, and optimizing decision-making under uncertain conditions.

3. Simulation Modeling and Analysis: This course introduces students to the methodology of simulation for modeling and analyzing complex systems. Simulation is a powerful tool for studying real-world processes and understanding their behavior under different conditions.

4. Artificial Intelligence-based Methods: Students explore the application of artificial intelligence (AI) techniques in solving industrial engineering and operations research problems. This may include machine learning algorithms, optimization using AI, and data-driven decision-making.

5. Game Theory: Game theory is applied to study strategic interactions among decision-makers. This course examines how decisions and strategies of one party affect others in competitive or cooperative settings, with applications in various industries.

6. Service and Infrastructure This course focuses on the efficient management of logistics and transportation systems. Topics may include route optimization, inventory management, and overall supply chain efficiency.

7. Supply Chain Analysis and Inventory Planning: Students learn to analyze and optimize supply chain processes, including inventory planning, demand forecasting, and distribution strategies. The goal is to enhance the overall performance and resilience of supply chains.

8. Financial Engineering: This course applies engineering principles to financial markets. Students study mathematical modeling and quantitative methods to understand and manage financial risks, design financial products, and optimize investment strategies.

9. Healthcare Systems: This course explores the application of IEOR principles to healthcare systems. Topics may include healthcare process optimization, resource allocation, and decision-making in healthcare settings.

Meet the Faculty

Core Faculty

P. Balamurugan, Ph.D., Indian Institute of Science, 2015
Email address: balamurugan.palaniappan@iitb.ac.in

Recent courses: Machine Learning, Deep Learning, Advanced Topics in Deep Learning, Modeling & Computation Lab, Linear Systems, IEOR Lab.

Research interests: Theoretical & practical aspects of Machine Learning, Data mining, Optimization for data science, Longitudinal Data Analysis & applications.

Ph.D. Students

1. **Akash Saha**
Research Area: Operator-valued Kernel and DNN Models for Regression with Functional Data.

2. **Bheeshm Sharma**
Research Area: Deep Learning for Medical Image Analytics
Conference Attended: The 4th International Conference on Medical Imaging and Computer-Aided Diagnosis (MICAD2023), Cambridge, United Kingdom.

3. **Rahul Vaishnav**
Research Area: Understanding domain and measurement shifts in few-shot learning

Meet the Faculty

Core Faculty

Manjesh K Hanawal, Ph.D., INRIA & University of Avignon, France, 2013
Email address: mhanawal@iitb.ac.in

Recent courses: Engineering Statistics, Online Machine Learning & Bandit Algorithms, Probability & Stochastic Processes I, IEOR Lab.

Research interests: Communication Networks, Machine Learning, Cybersecruity

Ph.D. Students

1. Debamita Ghosh
Research Area: Machine Learning in Next-Generation Wireless Network

2. Divya Jyoti Bajpai
Research Area: Early Exits in Deep Neural Networks
Conference Attended: AIMLSystems 2023, Bengaluru, India

Meet the Faculty

Core Faculty

Veeraruna Kavitha , Ph.D., Indian Institute of Science, 2007
Email address: vkavitha@iitb.ac.in

Recent courses: Probability & Stochastic Processes I and II, Advanced Stochastic Processes, Markov Decision Processes, Topics in IEOR.

Research interests: Stochastic processes, Performance Analysis, Optimal control, Markov decision processes, Game theory, Stochastic approximation, Wireless communications, Queuing Theory, Polling systems.

Ph.D. Students

1. Tushar Shankar Walunj
Research Area: Game theory, Reinforcement learning, Stochastic processes
Conferences Attended: 13th International Conference on Operations Research and Enterprise Systems (ICORES)
56th Annual Convention of Operational Research Society of India (2023-ORSI)

2. Gurkirat Wadhwa
Research Area: Cooperative Game Theory, Mechanism Design, Supply Chain
Conferences Attended: 56th Annual Convention of Operational Research Society of India

3. Raghupati Vyas
Research Area: Stochastic approximation, Dynamical systems, Probability & Stochastic Processes

4. Riya Sultana
Research Area: Cooperative Game Theory, Learning Algorithms, Probability and Stochastic Process

Meet the Faculty

Core Faculty

Ashutosh Mahajan , Ph.D., Lehigh University, 2009
Email Address: amahajan@iitb.ac.in

Recent courses: Operations Analysis, Integer Programming, Mathematical Optimisation Techniques, IEOR for Health Care.

Research interests: Theory, Algorithms and Software for Mixed-Integer Linear and Nonlinear Optimization.

Ph.D. Students

1. Vora Mustafa Makbul
Research Area: Nonconvex Optimization, Software and Algorithms for Optimization, Combinatorial Optimization

2. Simran Lakhani
Research Area: Application of OR to Healthcare, Simulation Modelling and Analysis, Mathematical models for handling uncertainties in service systems
Conferences Attended: EUROSIM Congress 2023, Amsterdam, The Netherlands (online)
SOM 2023–XXVI Annual International Conference of the Society of Operations Management
POMS India International Conference 2023, XLRI Jamshedpur

3. Nitish Kumar Dumoliya
Research Area: Modeling and Optimization in Water Distribution Networks

4. Debanjan Gangopadhyay
Research Area: Network flow models for airline transportation and cargo logistics

Meet the Faculty

Core Faculty

Narayan Rangaraj , Ph.D., Johns Hopkins University, 1990
Email Address: narayan.rangaraj@iitb.ac.in

Recent courses: Quantitative Models for SCM, Computer Programming Lab, Introduction to Financial Engineering, Operations Analysis, Service Systems.

Research interests: Application of Operations Research to Logistics, Supply Chain Management, Manufacturing, Railway Operations, Transportation, Health Care.

Ph.D. Students

1. Kritika Karwasra
Research Area: Operational Analysis of Freight Transport
Conference Attended: 16th World Conference on Transport Research in Montreal Canada

2. Santosh Palaskar
Research Area: Time Series Forecasting
Conferences Attended: SOM-2023 and AAAI-24

3. Sachin Yadav Bodke
Research Area: Health care management: decision models based on spatial and demographic data
Conferences Attended: "International Symposium on Locational Decisions" (ISOLDE) in Kaiserslautern and Baden-Baden, Germany
XXVI Annual International Conference of The Society of Operation Management" (SOM-2023) in Shillong, Meghalaya, India

4. Misal Singh Khundia
Research Area: Capital allocation decisions and their impact on long term profitability and sustainability

Meet the Faculty

Core Faculty

Jayendran Venkateswaran, Ph.D., The University of Arizona, 2005

Email Address: jayendran@iitb.ac.in

Recent courses: Simulation Modeling & Analysis, Quantitative Methods in SCM, Systems Dynamics, Operations Analysis.

Research interests: Modeling and analysis of complex socio-economic systems using OR tools, systems simulation (System dynamics, Agent based modeling, Discrete event simulation, AR/VR), supply chain sustainability.

Ph.D. Students

1. Rishav Deval
Research Area: Sustainable Supply Chain Management
Conferences Attended: EUROSIM Congress 2023, Amsterdam, The Netherlands (In-person) International System Dynamics Conference 2023, Chicago, USA (On-line)

2. Sanket Mishra
Research Area: Startups and SMEs Modeling: Business Dynamics Approach
Conferences Attended: SOM 2023–XXVI Annual International Conference of the Society of Operations Management

3. Avi Roy Chowdhary
Research Area: Mathematical Modeling of Antibiotics Resistance emergence

4. Bhavya Gupta
Research Area: Operations research Models for sustainable supply chain and greener logistics
Conference Attended: 56th Annual Convention of Operational Research Society of India (2023-ORSI)

Meet the Faculty

Core Faculty

Vishnu Narayanan, Ph.D., University of California, Berkeley, 2008
Email Address: vishnu@iitb.ac.in

Recent courses: Mathematical Optimisation Techniques, Linear Systems, Topics in IEOR, Computer Programming Lab, Convex Analysis, Integer Programming.

Research interests: Integer Programming, Convex Optimization, and Polyhedral Theory.

Ph.D. Students

1. Abhishek Pathapati
Research Area: Mixed integer optimisation and semi definitive programming
Conference Attended: 56th Annual Convention of Operational Research Society of India (2023-ORSI)

2. Hritiz Gogoi
Research Area: Max Cut Problem

Meet the Faculty

Core Faculty

N. Hemachandra, Ph.D., Indian Institute of Science, 1997
Email Address: nh@iitb.ac.in

Recent courses: Markov Decision Processes, Learning Algorithms, IEOR Lab, Networks, Games & Algorithms, Probability & Stochastic Processes II.

Research interests: Operations Research, Machine Learning, Reinforcement Learning, Neural Networks, Markov decision models, Queueing models, Game theory, Supply chains, Financial Engineering, Logistics, Power systems.

Ph.D. Students

1. Pintu Kumar
Research Area: Representation learning, Graph representation learning

2. Pranav Vinod Machingal
Research Area: Learning Theory, Deep Learning, Protein Bioinformatics

3. Madhu
Research Area: Optimal Control Theory, Dynamical systems, Branching processes, Stochastic approximation, Probability & Stochastic Processes

Meet the Faculty

Core Faculty

K. S. Mallikarjuna Rao, Ph.D., Indian Institute of Science, 2002
Email Address: mallik.rao@iitb.ac.in

Recent courses: Probability & Stochastic Processes I, Game Dynamics, Decision Analysis & Game Theory, Quantitative Models for SCM, Optimization Models.

Research interests: Game theory, Stochastic Control, Probability, Partial Differential Equations, Viscosity Solutions.

Postdoctoral Fellows

Arnab Bhabak, Ph.D., Indian Institute of Technology Guwahati,

Research interests: Game problems (discrete and continuous time setup), continuous-time Markov and semi-Markov Zero-sum games under probability criterion.

Divya Murali, Ph.D., Indian Institute of Technology Madras

Research interests: Game Theory, Stochastic games, Dynamic stability in evolutionary games, replicator dynamics.

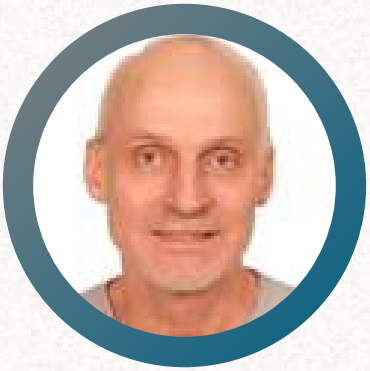
Ph.D. Students

1. Prem Kant
Research Area: Combinatorial game theory
Conference Attended: Combinatorial Games at Mumbai

2. Anand Kumar
Research Area: Problems with Vanishing Constraints

Meet the Faculty

Core Faculty



Urban Larsson, Ph.D., Chalmers University of Technology, 2013
Email Address: larsson@iitb.ac.in

Recent courses: Combinatorial Game Theory, Decision Analysis & Game Theory, Computer Programming Lab.

Research interests: Combinatorial Game Theory, Discrete Mathematics, Number Theory, Combinatorics, Cellular Automata, Mechanism Design, and Algorithms.

Ph.D. Students

1. Anjali Bhagat
Research Area: Combinatorial Game Theory
Conference Attended: Combinatorial Games at Mumbai 2023

Meet the Faculty

Core Faculty

Avinash Bhardwaj, Ph.D., University of California Berkeley, 2015
Email Address: abhardwaj@iitb.ac.in

Recent courses: Optimization Models, Convex Analysis, IEOR-1, Introduction to Optimization, Integer Programming.

Research interests: Linear & Non Linear Mixed Integer Optimization, Convex Optimization, Polyhedral Combinatorics, Optimization under uncertainty, Approximation Algorithms, Computational Optimization.

Associated Faculty

Madhu Belur
Email Address: belur@iitb.ac.in

Research interests: 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 U. Nair
Email address: jayakrishnan.nair@ee.iitb.ac.in

Research interests: Modeling, Performance evaluation, Design issues in Online Learning, Queueing Systems and Communication Networks, Stochastic Modelling, Game Theory, Optimization, and Control Theory.

Office Staff

Mr. Amlesh Kumar, Admin. Superintendent

Mr. Abasaheb Molavane, Jr. Asst.

Ms. Anita Kharat, Asst. Project Manager

Mr. Siddhartha Salve, Sr. Project Asst.

Mr. Pramod Pawar, Attendant

Some Faculty Highlights 2023-24

Prof. Ashutosh Mahajan

- Appointed as the first Professor Incharge of newly established IITBombay-FedEx Center for Advanced Logistics and Analytics.
- He was one of the faculties in 10-days "GIAN Course on Advances in Mixed Integer Nonlinear Optimization" conducted by IEOR, IIT Bombay.

Prof. Manjesh Hanawal

Awarded the "Research Excellence Award", endowed by the class of 1973.

Prof. Narayan Rangaraj

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

Research at IEOR

Systematic Analysis of High Gradient Rail Section: Case Study of Lonavala-Karjat Ghat Section in India

By Kritika Karwasra

The first problem concerns increasing the capacity of a rail section with high gradients. According to the topography of India, to access ports either on the west or east sides, we need to pass through sections with high gradients (known as the ghat section in India). Operations at these sections are quite different from regular rail operations like speed limitation, brake testing of freight trains, and extra banker requirements for pushing trains. Also, operations and resource usage differ for passenger and freight trains while ascending and descending these high-gradient sections (also known as ghat in India). This creates an unbalanced resource usage, which makes the ghat operations more complex. Due to this, freight trains halt for extended hours on these sections, restricting the total capacity of the network. My research focuses on a systematic study of operations and resource usage at the ghat section to increase the throughput of freight trains. A discrete event-based simulation model is used to analyze the different scenarios by implementing a few operational and tactical-level techniques. To understand the ghat operation better, we analyze the Lonavala-Karjat (LNL-KJT) (also known as Bhor Ghat) section of the Mumbai division of Central Railway India, which has become a bottleneck for freight trains. LNL-KJT is a critical section for the traffic coming from the southern and middle parts of the country. Traffic consists of passenger trains, daily mail express trains, freight trains carrying bulk commodities such as cement, and container intermodal trains to and from Mumbai City and Mumbai ports. It has a steep gradient of 1:37, meaning that for every 37 meters, there is a 1-meter climb. Managing operations of the LNL-KJT section with high passenger and rising freight traffic and complicated topography has become challenging. The simulation model depicts the actual scenario, which helps to understand the section's limiting resources and operations. The model's time horizon is ten days, and 10,000 simulation runs are carried out to guarantee the validity of the results. The model takes passenger schedules, random freight schedules (generated according to past data), section details like the number

of track lines in-between, the number of a different set of bankers present at the section, the number of holding lines present to hold trains as inputs, and gives these output: average freight train delay, average passenger train delay, number of empty banker movement, number of freight trains scheduled in both direction and segregation of freight train delay into due to 1) path unavailability, 2) banker unavailability, and 3) passenger schedule. Different scenarios that are evaluated are: allowing small delays to passenger trains, implementing optimal empty banker movement policy and impact of adding limiting resources such as new track lines, locomotives, holding area, and crew.

This work is done in coordination with the Mumbai division of Central Railway. Over the last year, there have been the following major changes in the operating regime of the LNL-KJT section: One additional set of bankers has been added, and the requirement of bankers for certain types of empty movements in the downhill direction has been waived after suitable safety checks.

This study was presented at the 16th World Conference on Transport Research (WCTR) held in Montreal, Canada from 17-21 July 2023. WCTR conference is held every 3 years for almost 50 years. The conference aims to bring together experts in all areas of transport research from all parts of the world and to stimulate the exchange of ideas in transport policy and practice.

Research at IEOR

Modeling and Analysis of Sustainable Supply Chain Management

By Rishav Deval

My thesis tackles challenges in achieving sustainable supply chains under dynamic environmental pressures. It proposes a novel framework, the Emission-based Production and Inventory Control System (EPICS), that integrates emission information into decision-making, ensuring a balance between service level, cost, and environmental impact. Additionally, it analyzes and mitigates the "green bullwhip effect" hindering collaborative sustainability efforts. Finally, it addresses the gap between operational and strategic choices by integrating capacity up-gradation and innovation modules into the framework. This research offers practical tools for navigating the complexities of sustainable supply chain management (SCM) in a dynamic environment.

Recently, we presented our work titled 'Emission-based Production and Inventory Control System: A Stability Analysis for System Cost and Service Level,' a paper co-authored with Prof. Jayendran Venkateswaran at the 11th EUROSIM CONGRESS 2023 held at Amsterdam University of Applied Sciences, Amsterdam, the Netherlands, organized by the Dutch Benelux Simulation Society (DBSS) from July 3 to July 5, themed 'Simulation for a Sustainable Future.' We observed presentations from over 35 countries with over 100 posters and presentations. The organizing committee also organized a technical trip to the European Space Agency to familiarize conference participants with the agency's technological advancements at their aircraft testing site.

Research at IEOR

Adaptive Inference in Pre-trained Language Models

By Divya Jyoti Bajpai

In recent years Pre-Trained Language models (Large Language models) such as BERT, GPT, ELMO, etc., have grown significantly in size to enhance Natural Language Processing (NLP) tasks. These models possess extensive knowledge transferable to diverse downstream tasks. Despite their remarkable performance, large scale PLMs suffer from high inference latencies. With millions or even billions of parameters, these models become computationally very expensive, which restricts their deployment in industrial scenarios with low computational resources. Examples could be general search engines or online medical consultation services generally process millions of requests per minute.

Also, PLMs are stacked with dozens of stacked Transformer layers, which make them overparameterized for simpler tasks, leading to overthinking problems. That is, for many input samples, the shallow representations at the initial layers are enough to make a correct classification. In contrast, the final layer's representations may be overfitting or distracted by irrelevant features that do not generalize. Overfitting affects the model in both ways, it affects the accuracy and wastes computation.

To address these challenges and expedite the inference process of Pre-trained Language Models (PLMs), several approaches have emerged. Conventional techniques encompass network pruning, knowledge distillation, weight quantization, and adaptive inference. Notably, adaptive inference has garnered significant interest. Recognizing that real-world datasets often comprise both 'easy' and 'hard' samples, adaptive inference focuses on leveraging only a fraction of the PLM for processing straightforward examples. This targeted approach accelerates inference speed without compromising accuracy.

Early exiting is one of the input adaptive methods that perform inference by attaching exits after every layer of the PLM. The inference is made if the confidence in the prediction at an exit point is above a predefined threshold (this threshold models the accuracy-efficiency trade-off). It exits easier samples that gain sufficient confidence early from the initial layers, speeding up the inference. These exits could be understood as classifiers similar to the one at the final layer of the PLM. Early exits show a very minimal drop in performance and sometimes perform better than the final layer. In this way, early exit as an input adaptive method can be used to improve performance as well as inference speed.

In our work, we try to make early exits more efficient by appropriately choosing the thresholds required for deciding an early exit as well as extending the idea to other tasks such as image captioning, language generation, etc.

Research at IEOR

Transdisciplinary Research through IE & OR

By Deepika Santhanakrishnan

Operations Research techniques can be used to solve problems in individualistic pursuits, as well as in social pursuits, and if you have already guessed where this article is leading to: questions that transcend from individuals to collective can very well be addressed through tools in IE&OR. For that matter, if one wishes to become a moral philosopher, a possible route is via operations research, as has been the case in the past. We provide an example here.

Designating moral responsibility for (undesirable) outcomes in collective decision making is hard. In view of this, there are two kinds of arguments within economics' circles. One says that, even though the group has to take responsibility as a whole for the outcome, none of the individual members can be made accountable for the responsibility. This is called the problem of no hands. Second, many of the individual members, a sub-group may be, are morally responsible and hence, they collectively are responsible for the bad outcomes. This is called the problem of many hands. And economists conclude that which of the two is appropriate depends on the case at hand.

However, moral philosophers have a different take on the issue. To motivate their perspective, (Braham et al., 2012) takes an example of the 'tragedy of commons' game in game theory. It goes like this: There are 'n' farmers in a village, which has a common pasture for the cows to feed on the grass. Every farmer knows that the more cow he has, the more milk they produce and hence more revenue; but if every farmer does this, then fertility of land goes down and the land is exploited of its ability to produce any more. In such an event, economists blamed the 'marginal' farmer, the farmer whose actions turned fertile land into exploited land at the margin.

Whereas, moral philosophers say that if an individual had taken an action, the absence of which wouldn't have resulted in disastrous outcomes, yet the agent didn't undertake that action, then that individual(s) is to be held morally responsible.

Let's now turn to how to account for moral responsibility in individual choices. (Binder et al., 2015) have spoken about the 'agency paradox', wherein, even when an agent chooses his best possible action, it may still be not possible to make him responsible. To circumvent this problem, they used (Baigent et al., 1996) characterization of 'Never choose the uniquely largest' element in saying that when an agent's objective is to choose the second-best alternative in his choice set, then we may be able to make the agents morally responsible. It is at this juncture one transcends to tools from IE&OR to solve such optimization problems. Be it in solving issues pertaining to poverty to deep epistemological issues concerning the role of collective in a society (Roemer, 2015), transdisciplinary research through IE&OR is pushing its boundary to answer questions that are at the very core of human existence.

References:

Baigent and Gaertner (1996), "Never choose the uniquely largest: A characterization".
Binder and van Hees (2015), "Moral responsibility and individual choice".
Braham and van Hees (2012), "An anatomy of moral responsibility".
Roemer (2015), "Kantian optimization: A microfoundation for cooperation".

Departmental Highlights

Games at Mumbai Workshop

Prof. Urban Larsson, Prof. Mallikarjuna Rao, along with Anjali Bhagat and Prem Kant from IEOR, IIT Bombay organized a 5 day workshop which served as a platform to foster understanding and interest in the emerging field of Combinatorial Game Theory

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System Dynamics Theory and Practice Workshop

This workshop was conducted by Prof. Jayendran Venkateswaran jointly with few other professors from different institutes aimed at building a "Systems Thinking" ecosystem in India

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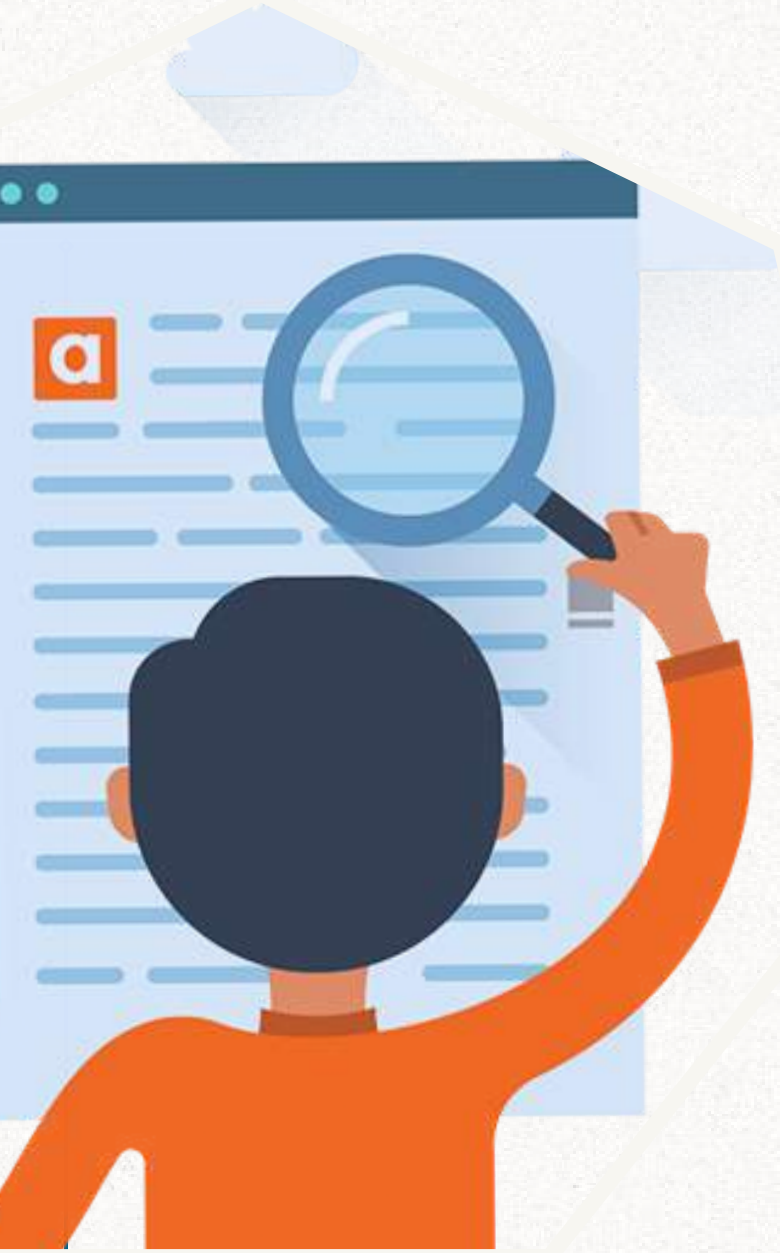
GO playing sessions

Prof Urban Larsson sometimes hosts GO sessions in the teaching lab, IEOR dept. People from all over Mumbai and all ages come to attend these sessions. Since GO is a prolonged game, smaller variants are also taught like Capture GO and variants of GO played on smaller boards.

IEOR Student Programme

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.
involves foundation courses, advanced courses and project work for those interested in acquiring skills in engineering / interdisciplinary areas

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

Students' Highlights

Ph.D. Highlights

- 10 research scholars successfully defended their Ph.D. thesis.
- Bhavya Gupta, Rahul Vaishnav and Riya Sultana were awarded Prime Minister's Research Fellows (PMRF) fellowships in the 2023 cycle.
- Prem kant., Santosh Palaskar and Pintu won Gold in Squash PGGC jointly with electrical department.

Post Graduate Highlights

- Ankit Tatawat and Tarun Bisht presented their research work at Wissap 2023 IIT Kanpur.
- Aastha Jaiswal, Priyank Agarwal, Sohan Lal Yadav and Vivek Kumar Trivedi have each contributed to well-known journals with their research publications.
- Ankit Tatawat, Kiran Prakash, Tarun Bisht, Viplove Kannaujia and Vivek Kumar Trivedi presented their research work at Techfest 2023, IIT Bombay.

Internship Experience 2023

Aastha Jaiswal

Internship Company: L&T Finance

Experience: I did not have any idea about optimization before joining IEOR. During my course I realized how optimization is a building block of data science world. The course combination in IEOR helped me a lot during my internship project i.e., **Customer Risk Profiling**. It was all about machine learning algorithms. Since IEOR had already equipped me with mathematics behind **algorithms**(which is crucial for identifying errors) with the help of optimization and ML courses, my internship made it worth with a real-world application of those learnings.

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Anwesha Roy

Internship Company: Axtria

Experience: Having a background in mathematics and then transferring to an applied field like Operations Research helped me get an analyst internship which I later converted into a **pre placement offer**. OR curriculum offers a mix of both **theoretical** and **applied** courses which familiarised me with algorithms I ended up using during my internship and it was easy to follow up on things I had already learnt because of the strong foundation OR courses build. Certain course **presentations** and **seminars** also moulded me into a more confident person so I was able to breeze through my internship whether it was presenting my work in front of senior managers or having conversations with mentors and colleagues alike.

Disha Bansal

Internship Company: Accenture Strategy and Consulting

Experience: Being a Statistics graduate I always wanted to explore the data science world. I was fortunate enough that I landed up in Accenture as a Data Science Analyst Intern. The **Optimization** techniques learnt during my first year at IEOR, IITB helped me in the foundation of my internship project **Location Strategy Builder**. The Lab work and **Machine Learning** course helped me with the proficiency in python and handling large data. Overall the IEOR curriculum makes us ready for the corporate world before even diving in.

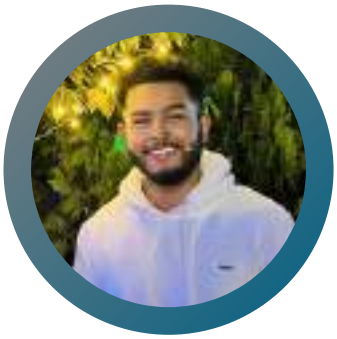
Internship 2023-24

We asked the first year students: "How did IEOR curriculum help them get internship offer?"

Nisarg Jain

Internship Company: Logitech Engineering & Designs India Pvt. Ltd.
Experience: My background in Operations Reasearch from IEOR, IIT Bombay equipped me with essential skills in **data science, optimization, and supply chain management**. These capabilities along with support from my peers were instrumental in demonstrating my proficiency during the interview process for the **Planning and Analytics** Internship at Logitech. By applying these methodologies, I showcased my ability to tackle real-world supply chain challenges, ultimately securing the position and leveraging my academic knowledge in a practical setting.

Tanmay Nath



Internship Company: Michelin India Pvt. Ltd.
Experience: Being a Maths grad, I always had interest in implying my **mathematical skills** in real life, which seemed to be possible as soon as I joined IEOR, IITB. The courses taught here made me realize that all the theoretical Maths I studied these many years, had actual **implementation**. With this realization IEOR helped me to mold my skills which were required for being an industrial professional as well, it introduced me with very useful tools and resources which helped me grab an internship opportunity at Michelin India Pvt. Ltd.

T Karthik Rajendran

Internship Company: TCS R&D.
Experience: The courses that are part of the MSc Operations Research curriculum have been pivotal to developing my problem solving skills and knowledge of simulation. I learnt how to model and solve optimization problems in Python. I was taught about concepts in probability and optimization, which most people use on a regular basis without even realising it. The teaching is great and the professors are very friendly..

Placements 2023-24

Message from Department Placement Coordinators about the placements 2023-24

Reflecting on my tenure as Department Placement Coordinator fills me with pride amid challenging market conditions. Despite uncertainties, the majority of our students secured promising job opportunities, a testament to resilience and dedication. Our diverse preparatory activities, from aptitude tests to role sessions, played a pivotal role. To those still on their journey, discouragement has no place here; we're actively creating more opportunities for success. This role provided me with a fruitful experience, allowing me to thrive in a collaborative team environment and manage various activities seamlessly. In commemorating our journey, let's embody the spirit of perseverance and unity, inspiring one another to reach for excellence. United, we stand resilient and prepared for the opportunities that await us in the future.

Sohan Lal Yadav
Department Placement Coordinator(MSc)

To those who have secured their placements, your triumph is a testament to your perseverance and dedication. For those still navigating their path, remember, setbacks are simply stepping stones to success. Your journey is not defined by the opportunities you've secured, but by the resilience you display in the face of challenges. Keep believing, keep striving, for your moment of triumph awaits, inspiring both your peers and the generations to come.

Anshul Choudhary
Department Placement Coordinator (MTech)

Placements 2023-24

We asked the final year students: "How did IEOR curriculum help them in their placements?"

Ayush Srivastava

Placed at: KLA Tencor as Product Development Engineer

The curriculum at IEOR is well designed to not only introduce students to a variety of algorithms and heuristics widely utilized and practiced in industry, but also to develop a keen eye for detail. The assessment process adopted by KLA comprised of analyzing the pros and cons of an algorithm and to evaluate it's adaptability, which is something students at IEOR are accustomed to.

Kiran Prakash

Placed at: Honda R&D as Data Analyst

I was always interested in learning about maths, operations research, data analysis, machine learning, and deep learning. The courses in IEOR, like Engineering Statistics, Mathematical Optimization Techniques, Probability and Stochastic Processes, Simulation Modeling and Analysis, Linear Systems, and Machine Learning: Principles and Techniques, helped me build a strong foundation in operations and data analysis. Because of this, preparing for job interviews was easier for me. I could comfortably answer all the questions asked during the interview.

Priyank Agarwal

Placed at: Accenture Operations as Senior Data Science Analyst

Having done Bachelor's in Mathematics, I only got exposure to the pure side of it. After being admitted to IEOR, I not only got the taste of applied mathematics that I was looking for but was also exposed to the use of Statistical Data Analysis which is very important in today's data-driven world. Probability and Statistics seemed quite a challenge to me in the beginning. Still, my friends, seniors, and teachers helped me a lot to excel in those subjects academically as well as in my placements. The variety of courses offered in the department is very relevant to the industry and they helped me a lot in getting a placement offer at Accenture as a Senior Data Analyst.

Placements 2023-24

We asked the final year students: "How did IEOR curriculum help them in their placements?"

Romesh

Placed at: Western Digital as OR Scientist

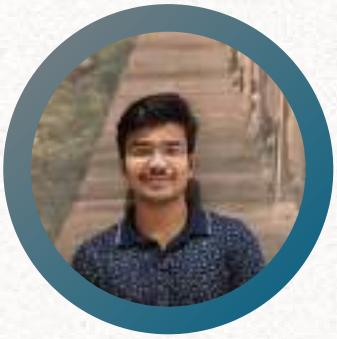
The IEOR department at IITB provided me with a comprehensive foundation in Mathematical Optimization Techniques, Simulation Modeling & Analysis, Operations Analysis, and Integer Programming. These courses, coupled with opportunities to tackle real-world problems during my master's thesis project, equipped me with invaluable skills and insights. Thanks to this solid academic background and practical experience, I successfully navigated the job interview process and secured a job offer.

Swpnil Engla

Placed at: Air India as Mathematics Analyst

Industrial Engineering and Operations Research (IEOR) is like being a behind-the-scenes problem solver. It's about making things run smoothly, like figuring out the best way to schedule flights or manage resources. After learning the basics at IIT Mandi, IEOR at IIT Bombay helped me dive deeper into optimization concepts, making my understanding more rigorous. It's like adding extra layers of precision to my problem-solving toolkit, allowing me to tackle complex challenges with confidence.IEOR played a significant role in securing my placement by equipping me with advanced analytical skills.

Vishal



Placed at: Micron Technology, Inc. as PDPE Engineer

IEOR department have been instrumental in preparing me for the challenges and opportunities ahead. From rigorous coursework to practical projects, each aspect of the curriculum equipped me with a strong foundation in optimization, analytics, and decision-making. The preparation sessions, workshops, and mentorship offered by the department equipped me with the confidence and skills needed to land an offer with Micron.

Placements 2023-24

Student	Company
Aastha Jaiswal	Accenture AI
Anshul Choudhary	Air India
Anuj Birani	Computer Age Management Services
Anwesha Roy	Axtria
Ashish Kumar Pandey	Air India
Ayush Srivastava	KLA Tencor
Bishal Kumar Prabhat	General Mills
Disha Bansal	Accenture AI
Isha Yadav	Michelin India Pvt. Ltd.

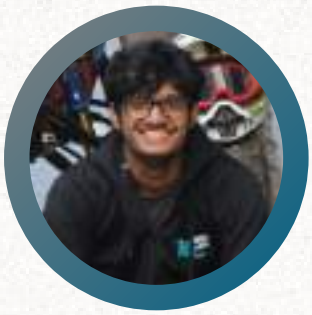
Student	Company
Joshi Meet Anilkumar	Air India
Kiran Prakash E C	Honda R&D
Krushna Sanjay Salunke	Air India
Neeraj Kishor Naik	Air India
Peddi Madhav	Air India
Priyank Agarwal	Accenture Operations
Romesh Anil Bhavsar	Western Digital
Sachin Patel	Caliper Solutions
B S V Sri Teja	United Airlines

Placements 2023-24

Student	Company
Sohan Lal Yadav	Air India
Suvam Das	Air India
Swpnil Engla	Air India
Viplove Kanaujia	Wissen Technolgy Private Limited

Student	Company
Vishal	Micron Technologies Operation India LLP
Vivek Kumar Trivedi	Accenture Operations
Vivek Seth	Wissen Technolgy Private Limited

Department Council 2023-24



Neeraj Naik
Dept General Secretary

Disha Bansal
Joint Secretary
(Library & Publications)

Vivek Kumar Trivedi
Joint Secretary(Academics)

Pooja Patel
Joint Secretary(Culturals)

Priyank Agarwal
Joint Secretary(H.R.)

Viplove Kanaujia
Joint Secretary(Culturals)

Ankit Kumar Tatawat
Joint Secretary(Sports)

Moumita Saha
Joint Secretary(Sports)

Departmental Activities 2023-24

The department council organizes various events round the year. A short glimpse of few of them is presented here

Department Orientation

Department Convocation

Teachers' Day Celebration

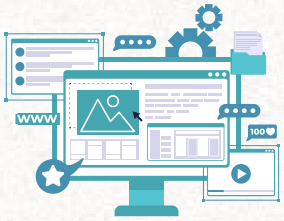
Departmental Activities 2023-24

Dussehra Celebration

Diwali Celebration

Fresher's 2k23

Python Workshop



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