Deepanshu

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Objectives

- To enrich learning and contribute to research domain of data-driven optimization and related applications
- To address real-world problems involving human-informed optimization and criteria-based decision-making

Education

Indian Institute of Technology Madras, Chennai — Tamilnadu, India
Direct Ph.D. in Engineering Design | **CGPA: 9.01/10** — 2019–Present
Mentors: Prof. Palaniappan Ramu, IIT Madras & Prof. Kalyanmoy Deb, Michigan State University USA

National Institute of Technology Kurukshetra — Haryana, India
B.Tech. in Mechanical Engineering | **CGPA: 9.56/10** — 2012–2016

Course Work

- Optimization in Engineering Design
- Linear Algebra and Random Processes
- Computational Methods in Design
- Applied Statistics
- Numerical Methods & Scientific Computing
- Introduction to Machine Learning
- Data-driven Modeling for Process Systems
- Parameter and State Estimation

Course Projects

- Bayesian Online Change-point Detection (Course Project, 2021)
- Identification of Approximate Models for LTI Multi-scale Systems (Course Project, 2020)
- Text Document Classification Using Self-Organizing-Maps (Research Project 2021)
- Likelihood Ratios for Out-of-Distribution (OOD) Detection (Course Project, 2020)

Teaching

- **Teaching Assistant** at Department of Engineering Design, IIT Madras — Jul-Nov 2021
  Optimization in Engineering Design (ED6002): **HW and Quiz preparation, Tutorials, Evaluations**
- **Teaching Assistant** at Department of Engineering Design, IIT Madras — Jan-May 2022
  Computational methods in Design (ED5015): **HW and Quiz preparation, Tutorials, Evaluations**
- **Teaching Assistant** at Department of Engineering Design, IIT Madras — Jan-May 2023
  Computational methods in Design (ED5015): **HW and Quiz preparation, Tutorials, Evaluations**

Research Interests

- **Decision Making:** Visualization-aided interactive and informed multi-criteria decision making (MCDM), evolutionary multi-objective robust optimization and decision-making
- **Machine Learning:** Applied Statistics, basics of Machine Learning and Deep Learning techniques
- **Visual Analytics:** Design space exploration, Pareto front exploration, region of interest (RoI) identification, interpretable self-organizing maps (iSOM), PCP, RadViz, etc.
- **Uncertainty Quantification:** Extreme events, reliability-based design, probabilistic techniques
- **Optimization:** Gradient-based and heuristics-based algorithms, evolutionary algorithms, single-objective, multi-objective, and many-objective optimization

Academic Collaborations

- **COINLab: Computational Optimization and Innovation Laboratory** 2021-current
  Headed by: *Prof. Kalyanmoy Deb, Koenig Endowed Chair Professor, Electrical and Computer Engineering, Michigan State University, USA* (**1 Journal publication, 3 Conference proceedings**)
- **IDO: Innovative Design Optimization Laboratory** 2021-2022
  Headed by: *Prof. Ikjin Lee, Department of Mechanical Engineering, Korea Advanced Institute of Science & Technology (KAIST), Daejeon, South Korea* (**1 Journal publication**)
- **TOBB University of Economics and Technology** 2021-2022
  Headed by: *Prof. Erdem Acar, Department of Mechanical Engineering, TOBB University of Economics and Technology, Ankara, Turkey* (**1 Journal publication**)

Publications

1. Lee, I., Lee, U., Ramu, P., **Yadav, D.**, Bayrak, G., & Acar, E. (2022). Small Failure Probability: Principles, Progress and Perspectives. *Structural and Multidisciplinary Optimization, 65(11), 326.*

2. **Yadav, D**., Nagar, D., Ramu, P., & Deb, K. (2023). Visualization-aided Multi-criteria Decision-making Using Interpretable Self-organizing Maps. *European Journal of Operational Research, 309(3), 1183-1200.*

3. Pannerselvam, K., **Yadav, D.**, & Ramu, P. (2022). Scarce Sample-Based Reliability Estimation and Optimization Using Importance Sampling. *Mathematical and Computational Applications, 27(6), 99.*

4. **Yadav, D**., Ramu, P., & Deb, K. (2023). Visualization-aided Multi-criteria Decision-making Using Interpretable Self-organizing Maps (iSOM) Following Pareto Race. *Applied Soft Computing.* **Under Review**

5. **Yadav, D**., Ramu, P. (2023). iSOM Visualization-enabled Adaptive Sampling for Estimation of Small Probability of Failure. *Structural and Multidisciplinary Optimization.* **Under Preperation**

Conference Proceedings

1. **Yadav, D.**, Ramu, P., & Deb, K. (2022, December). Visualization-aided Multi-criterion Decision-making Using Reference Direction Based Pareto Race. In *2022 IEEE Symposium Series on Computational Intelligence (SSCI) (pp. 125-132). IEEE.*

2. **Yadav, D**., Ramu, P., & Deb, K. (2023, July). Finding Robust Solutions for Many-Objective Optimization Using NSGA-III. In *Congress on Evolutionary Computation (CEC 2023). IEEE.* **Accepted**

3. **Yadav, D**., Ramu, P., & Deb, K. (2023, July). Multi-objective Robust Optimization and Decision-Making Using Evolutionary Algorithms. In *The Genetic and Evolutionary Computation Conference (GECCO 2023).* Association for Computing Machinery (ACM). **Accepted**

Conference/Seminar Presentations

1. **Yadav D.** & Ramu P. (2023), "Multi-Criteria Decision-making (MCDM) using interpretable Self-organizing Maps (iSOM)", In International System Realization Partnership (ISRP) 2023 Symposium, Design Engineering in the Age of Industry 5.0, *Cranfield University.* **Symposium**

2. **Yadav D.**, Ramu P. (2023), "A Novel Sensitivity Analysis Method Using Self Organizing Maps (SOM)", In 15^{th} *World Conference of Structural and Multi-disciplinary Optimization (WCSMO-15).* **Conference**

3. **Yadav D.** (2021), "iSOM Enabled Targeted Sampling for Extremes Prediction", 2^{nd} *International Symposium on Data Analytics Risk & Technology, RBCDSAI, IIT Madras.* **Symposium**

4. **Yadav D.**, Ramu P. (2021), "iSOM Enabled Targeted Sampling for Tail Modeling ", 4^{th} *National Conference on Multidisciplinary Design, Analysis, and Optimization, IIT Madras.* **Conference**

Industrial Experience

Vedanta Aluminium Limited — Jharsuguda, India
Graduate Engineer Trainee, Assistant Manager (O&M, Aluminium foundry) — 2016–2018

Mercedes Benz R&D — Bangalore, India
Student Intern, Product Design and Development Department, Suspension team — Summer 2015

Bharat Pumps & Compressors Limited — Allahabad, India
Student Trainee, Industrial visit and inspection of Manufacturing Unit — Summer 2014

Industrial Projects

- Modification of '*airlift hatch*' locking arrangement (Kaizen Project) — 2017
- Design and fabrication of '*forklift attachment*' for lowering the load/machine (Kaizen Project) — 2018
- Design and fabrication of '*locking arrangement in feed pipe*' to reduce the alumina wastage (5S Project) — 2018

Academic and Professional Achievements

- Qualified **JEE mains (then AIEEE)** exam (among top 0.6%) — 2012
- Awarded for securing the overall **highest GPA (10/10)** in a semester (8^{th}), NIT Kurukshetra — 2012–2016
- Secured overall **3rd** rank in Mechanical Engineering Department, NIT Kurukshetra — 2012–2016
- Qualified **Graduate Aptitude Test in Engineering (GATE)** Exam (among top 2.0%) — 2016, 2018
- Awarded as **Innovative Employee of the Month** for Kaizen project '*Modification of Airlift Hatch locking arrangement*' at Vedanta Aluminium Ltd. — 2017
- Awarded with **Student Travel Grant** for the outstanding paper by *IEEE Computational Intelligence Society (CIS) to attend SSCI IEEE, 2022* — 2022
- Awarded with **International Immersion Experience (IIE) Travel Grant** by IIT Madras — 2023
- Awarded with **Student Travel Grant** for the outstanding paper by *Association of Computing Machinery (ACM) to attend GECCO, 2023* — 2023

Competitions

- **Bright Optimizer: International Student Competition in Structural Optimization (ISCSO)** — 2021
  - ***Goal:*** *To optimize the design of a truss structure by minimizing the weight under stress and deflection constraints*
  - *Given space truss structure was optimized (∼ 75% of the winner's weight) using mixed integer GA*
- **Shell.ai Hackathon for Sustainable and Affordable Energy: EV charging Network Challenge** — 2022
  - ***Goal:*** *To Optimally locate the EV charging stations based on charging supply information and forecast the demand for the year 2023*
  - *Formulated a Mixed Integer Non-liner Programming (MINLP) problem and solved it using MINLP solver*

Extra-curricular Activities

- QC leader of the team '*Confluence*' at Vedanta Aluminium Ltd. — 2016–2018
  - *Identified 20+ improvement projects and categorized them as 'Kaizen, A, B, and C' type projects*
  - *Our team has implemented 2 Kaizen projects and 1 QC project*
- Member of 5S team at Vedanta Aluminium Ltd. — 2016–2018
  - *Conducted technical and safety training for onsite workers*
  - *Participated in 5S activities and implemented the same in the workplace*
- Student Member IEEE, Student Volunteer GECCO — 2022–current
- Student Volunteer at Genetic and Evolutionary Computation Conference — 15-19 July 2023
- Swimming, creative writing