PMRF-ISSS Teaching Programme

Prime Minister Research Fellowship students' teaching requirement
facilitated by the Institute of Smart Structures and Systems

Module PMRF-ISSS079/II/2024

Convex Optimization & Submodular Methods

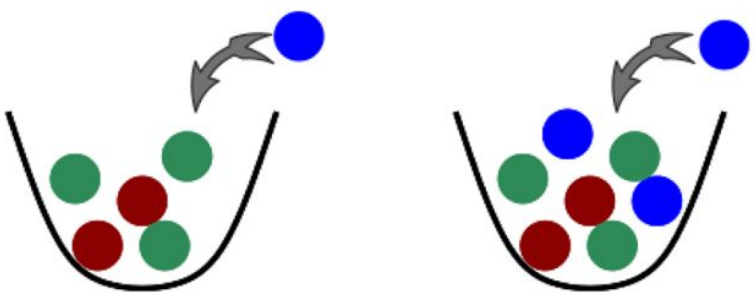
Name of the PMRF student

Prateek Chanda

Required background of the students taught

Students from all backgrounds of engineering discipline who want a keen understanding of optimization techniques in machine learning, particularly focusing on convex optimization and submodular optimization.
The course is open to all engineering disciplines, graduate students as well as working professionals.

$$f(A \cup v) - f(A) \geq f(B \cup v) - f(B), \text{ if } A \subseteq B$$



$f = \#$ of distinct colors of balls in the urn.

Details of the content of the module

We will divide the course into two halves: First we will discuss basics of convex optimization followed by second half on submodular optimization. :
List of Lectures:

1. Lec-1: Introduction
2. Lec-2: Motivation - Continuous Optimization
3. Lec-3: Continuous Optimization Examples
4. Lec-4: Discrete Optimization
5. Lec-5: Convexity: Sets, Functions, Calculus
6. Lec-6: Directional Derivatives, Quasi-convexity
7. Lec-7: Epigraphs, First, Second Order Conditions
8. Lec-8: Subgradient, subdifferential
9. Lec-9: Q-convergence
10. Lec-10: SGD:Adam,RMSprop and variants
11. Lec-11: Generalised Gradient Descent
12. Lec-12: Convergence of Accelerated GD
13. Lec-13: Convergence of Projected GD
14. Lec-14: Submodular Function methods
15. Lec-15: Concavity vs Submodularity
16. Lec-16: Family of Submodular: Facility Location
17. Lec 17: Family of Submodular: Diversity based
18. Lec 18: Primer on Linear/ Logistic Regression
19. Lec 19: Primer on Maximum Likelihood Estimate
20. Lec 20: Properties of Submodular functions
21. Lec 21: Proofs of Submodularity: Diversity+Coverage
22. Lec 22: Research paper readings on submodularity
23. Lec 23: Cont.d online submodular learning
24. Lec 24: Submodular Function compositions
25. Lec 25: Neural Estimation of Submodular Functions

Schedule of the module

2 classes/week,
2 hours/class,
Friday, Saturday at 3:30 - 5:30 pm.

Starts from 31st May

Meeting link : **Teams Link**
Contact email ID: isss.forum@gmail.com

Registration link: **Google Form Link**