

Course	College/University	Year	CGPA/%
Ph.D in Federated Learning	IIT, Dharwad	2020-25	8.33
M.Sc in Mathematics	Banaras Hindu University	2016-18	7.78
B.Sc (Hons.) in Mathematics	University of North Bengal	2012-15	50.88%
Intermediate/+2	A.V.M School, Banarhat	2012	67.2%
High School	U.L.H School (H.S)	2010	76.25%

## PUBLICATIONS

1. **Sumit Sah** and B. N. Bharath, "Online Learning with Non-convex Losses: New Condition to Achieve Small Dynamic Regret," IEEE Int. Conf. on Acoustics, Speech and Sig. Proc. (**ICASSP**), Hyderabad, India, 2025.

**Abstract:** We study online learning with non-convex, time-varying loss functions. We show that Online Gradient Descent (OGD) can achieve dynamic regret comparable to the strongly convex case, under a novel condition defined within a ball of radius  $\rho$  around the initialization. This condition incorporates gradients, losses, and temporal variation to reflect the online nature of the problem. Under this assumption, OGD attains dynamic regret scaling sub-linearly with variation. Experimental results support our theory.

2. **Sumit Sah**, Shruti P Maralappanavar, B. N. Bharath and Prashant Khanduri, "Generalization of FedAvg Under Constrained Polyak-Łojasiewicz Type Conditions: A Single Hidden Layer Neural Network Analysis,". (**Submitted**)

**Abstract:** We study the FedAvg algorithm in Federated Learning, focusing on its optimization and generalization performance. Under new constrained conditions, we show that FedAvg converges linearly and applies to certain neural networks with sufficient width. We also prove that its generalization error improves optimally with more data and benefits further from having more clients.

3. **Sumit Sah**, Bharath B N, "Localized Growth Conditions for Decentralized FedAvg: Convergence to Global Optimal Points". (**Submitted**)

**Abstract:** We prove the first linear convergence guarantee for Decentralized Federated Averaging (D-FedAvg) under a local PL-type growth condition, far weaker than standard global assumptions. This setting requires neither data homogeneity nor global minimizers—these properties emerge naturally as iterates stay in a bounded region. Our analysis introduces new drift-dynamics bounds to control consensus error, and experiments on diverse datasets confirm the theory.

## SKILLS & INTERESTS

- **Programming Languages:** MATLAB, Python.
- **Tools & Libraries:** Scipy, Numpy, Pandas, Seaborn, Matplotlib, TensorFlow, PyTorch,  $\text{\LaTeX}$
- **Interests:** Develop theories for applied machine learning, Data Analytics.

## RELEVANT COURSES

- **Statistical Pattern Recognition | Probability Theory and Random processes | Measure Theory | Optimization Theory and Application | Information Theory** [IIT Dharwad]
- **Advanced Real Analysis | Foundation of Optimization | Convex Analysis | Linear Algebra | Functional Analysis | Operator Theory | Partial Differential Equation | Algebra | Topology** [Banaras Hindu University]
- **Machine Learning (Andrew NG)** [Coursera]

## SCHOLASTIC ACHIEVEMENTS

- Qualified Gate Mathematics(MA), **Rank** 857 [2019]
- Qualified CSIR-NET (LS), Mathematical Sciences [2019]

## PROJECTS

- **DST-SERB Project: R/Dev/P-07/682 | Principal Investigator : Dr. Anupam Priyadarshi** [July'19-Aug'20]
  - I worked on a project titled "**Closure Approach using Higher Central Moment in Mathematical Ecology: Influence of Fluctuating Environment in Ecosystems**," which introduced me to Mathematical Biology. I developed mathematical models of ecosystems with multiple food chains and used MATLAB for bifurcation analysis to study the dynamics of the system. The project also improved my problem-solving skills, familiarity with LaTeX, and research writing skills.

## Conference, Summer School and Talks Attended

- 2025 IEEE International Conference on Acoustics, Speech, and Signal Processing.
- VIVRITI '2024: 3<sup>rd</sup> Annual 3-Minute Research Seminar.
- 2023 Joint Telematics Group/IEEE Information Theory Society Summer School on Signal Processing, Communications, and Networks. Indian Institute of Science(IISc) Bangalore.
- Artificial Intelligence Summer School, 2023. Indraprastha Institute of Information Technology Delhi.
- 35th Annual Conference of the Mathematical Society- Banaras Hindu University(BHU) on "Advancement in Mathematical Analysis and their Applications" 2019.
- Summer Outreach Program, National Institute of Science Education and Research, 2018 | *Supervised by:* Dr. Sutanu Roy.

## POSITIONS OF RESPONSIBILITY

- **Senate Student Member (Academics) | IIT Dharwad** [May'24-May'25]
  - Contributed to institute-level academic policy discussions and decisions.
  - Represented postgraduate student concerns at the Senate meetings.
  - Collaborated with faculty and administration to support academic reforms and student-centric initiatives.
- **General Secretary Academic Affairs (PG) | IIT Dharwad** [May'23-May'25]
  - Coordinated the availability and maintenance of research equipment.
  - Engaged in regular meetings with the Director and Dean to improve the campus research environment.
  - Addressed and resolved academic and administrative grievances of research scholars on campus.
  - Facilitated the inclusion of new courses aligned with researchers' academic needs.
  - I was a member of "**Anti-Ragging Squad (ARS)**" IIT Dharwad.
- **DPGC Member | Department of Electrical Engineering, IIT Dharwad** [March'22-March'23]
  - Participated in departmental academic committee meetings, providing constructive feedback.
  - Represented Ph.D./M.S. students, addressing concerns and ensuring timely resolutions through coordination with faculty and administration.

## EXTRACURRICULAR ACTIVITIES

- Playing Badminton, Cricket, Chess, Volleyball.
- Cooking
- Reading Novels and story books.