

# Avi Amalanshu

Undergraduate Researcher

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## About

Undergrad at IIT Kharagpur, one of the most competitive engineering schools in the world. I build ML systems that are scalable and democratic. I am also interested in exploiting the stochasticity of ML for efficient & secure systems.

## Interests

**Statistical Learning** Unsupervised Learning, Information Theory  
**ML for Systems** ML for Security, ML for Resource Allocation  
**Systems for ML** Distributed and Pipelined ML Systems

## Skills

**Programming Languages** C, C++, Python, MATLAB, JavaScript, Assembly (8051, x86)  
**Frameworks** PyTorch (+ Lightning & PyG), OpenCV, Gym, scipy; Ghidra, radare2, angr

## Education

Bachelor and Master of Technology, **Indian Institute of Technology Kharagpur** (2020-2025)

- B.Tech *Electronics & Electrical Communication Engineering*. Minor in Computer Science
- M.Tech *Vision & Intelligent Systems*. Cumulative GPA (7 semesters): 8.86/10

## Publications

- Entity Augmentation for Efficient Classification of Vertically Partitioned Data. **Avi Amalanshu** et al *Under submission*. **2024**
- Decoupled Vertical Federated Learning for Practical Training on Vertically Partitioned Data. **Avi Amalanshu** et al *Under submission*. Preprint available at arxiv:2403.03871, **2024**.
- Internet Learning: Preliminary Steps Towards Highly Fault-Tolerant Learning on Device Networks. S.Ganguli, **A.Amalanshu**, A.Ranjan, D.I.Inouye in *ICML Workshop on Localized Learning (LLW)*, **2023**.
- (RE) From Goals, Waypoints & Paths To Long Term Human Trajectory Forecasting. A.Shukla, S.Roy, Y.Chawla, **A.Amalanshu**, et al in *ML Reproducibility Challenge 2021 (Fall Edition)*, **2022**.

## Highlights

- 2 peer-reviewed publications (2 more submitted)
- Selected for MITACS Globalink 2024, Purdue Univ. SURF 2023, IITGn SRIP 2023.
- Seasoned programmer and skilled engineer with broad coursework.

## Experience

- Purdue University** (May-Aug '23)  
**Summer Undergraduate Research Fellow**
  - Guided by Prof. David Inouye, Probabilistic & Understandable ML Lab.
- Autonomous Ground Vehicle** (Jun '21-)  
**Deep Learning Team Leader** (Aug '23-)
  - Responsible for directing DL research efforts
  - Working on multi-agent classification and inverse RL.
- Deep Learning Team Member** (Jun '21-Aug '23)
  - Worked on semantic segmentation and motion prediction.

## Key Coursework

\* indicates graduate-level.  
**ML** Deep Learning\*, Vision & Visualization\*, Foundations of Learning Theory\*, Pattern Recognition & Machine Intelligence\*, Reinforcement Learning\*, Image & Video Processing\*  
**Systems** Information & System Security\*, Advanced Operating System Design\*, Computer Architecture, Information Retrieval\*, Computational Foundations of Cyber-Physical Systems\*  
**Theory** Algorithms, Programming & Data Structures  
**Math** Probability & Statistics, Linear Algebra & Optimization

## Recent Projects (more at avi-amalanshu.github.io)

- Distributed Inference under Communication Constraints** (ongoing)  
**Guide: Prof. Jithin R, Indian Institute of Technology Kharagpur**
  - Asymptotics for distributed detection with two inferring agents.
  - Algorithmic analysis for hypothesis tests and multi-armed bandits.
- Entity Augmentation for Learning on Vertically Partitioned Data** (Mar '24)  
**as Deep Learning Team Leader, Autonomous Ground Vehicle**
  - Proposed a new algorithm eschewing entity alignment in vertical federated learning.
  - Developed experiments showing it performs better than VFL on classification.
- Domain Adaptation in Breast Cancer Detection** (Jan '23)  
**Guide: Prof. Chetan Arora, Indian Institute of Technology Delhi**
  - Wrote internal scripts and analyzed data to investigate poor domain adaptation performance of MRT (Zhao et al, ICCV '23) on Indian mammograms.
  - Devised appropriate masking strategy and helped switch from attention to focal modulation for more robust short-range semantics.
- Decoupled Vertical Federated Learning** (Dec '23)  
**Bachelor Thesis. Guides: Prof. David Inouye, Purdue Univ.; Prof. Jithin R.**
  - A greedy strategy for ANN training on vertically partitioned data.
  - Immune to inference attacks, graceful performance degradation with crash faults.
  - Comparable to SplitNN under perfect conditions. Can leverage weak supervision.