Pratham Sunkad

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Education

Georgia Institute of Technology Atlanta, GA
Masters in Computational Science and Engineering (College of Computing), GPA: - *Aug. 2026 – May 2028*
Coursework: Algorithms, Vision Language Models, Machine Learning Systems, Modeling & Simulation

Indian Institute of Technology Madras Chennai, India
B.Tech in Mechanical Engineering with a Minor in Machine Learning, CGPA: 8.65/10 *Aug. 2021 – May 2025*
Coursework: Probability and Statistics, Machine Learning, Deep Learning, Multi-Armed Bandits, Reinforcement Learning, NLP, Finite Element Analysis, Computational Fluid Dynamics, Vibrations

Experience

American Express July. 2025 – July. 2026
Credit Risk Analytics | Python, SQL, Bigquery, Pandas, LLMs, Risk Management *Bengaluru, India*

- Designed a credit decisioning framework leveraging probability of default models, line models, and risk metrics to determine loan amounts and credit card limits, driving a net PTI of $10M.
- Backtested and enhanced risk management strategies to ensure through-the-cycle profitability; implemented operational risk controls and maintained Management Information Systems for regulatory compliance.
- Automated enterprise-wide Management Information Systems reporting via a custom-built tool, eliminating 50+ manual person-hours monthly; developed Custom-GPTs to streamline analyst productivity workflows.

Weierstrass Institute for Applied Analysis and Stochastics, Berlin Apr. 2024 – Dec. 2024
Research Intern : Scientific Machine Learning | VPINNs, Python, Pytorch, PDEs, Finite Elements *Berlin, Germany*

- Developed a Variational Physics-Informed Neural Network (VPINN) framework inspired by Streamline Upwind Petrov-Galerkin (SUPG) stabilization in Finite Elements to solve convection-dominated PDEs.
- Integrated an SUPG stabilization term into the loss function and engineered an adaptive hard-constraint mechanism for Dirichlet boundary conditions, achieving a significant improvement in solution accuracy.

Indian Institute of Science, Bangalore Dec. 2023 – Dec. 2024
Research Intern : Computational Data Science | VPINNs, Tensorflow, Optimization, Ablation Tests *Bengaluru, India*

- Contributed to developing FastVPINNs, a robust tensor-based deep learning framework for solving PDEs using hp-Variational Physics-Informed Neural Networks (hp-VPINNs).
- Leveraged optimized tensor operations to achieve a 100x reduction in median training time per epoch over traditional hp-VPINNs; conducted hyperparameter tuning to further optimize loss function convergence.

Publications

Improving hp-Variational Physics-Informed Neural Networks for Convection-Dominated Problems
Computer Methods in Applied Mechanics and Engineering
Thivin Anandh, Divij Ghose, Himanshu Jain, **Pratham Sunkad**, Sashikumaar Ganesan, Volker John
https://www.sciencedirect.com/science/article/abs/pii/S0045782525000696

FastVPINNs: Tensor-Driven Acceleration of VPINNs for Complex Geometries
SIAM Journal on Scientific Computing
Thivin Anandh, Divij Ghose, Himanshu Jain, Sashikumaar Ganesan | **Acknowledged for performing numerical studies**
https://epubs.siam.org/doi/10.1137/24M1658620

Projects

Neural Contextual Bandits with UCB Based Exploration | *Neural Networks, Multi-Armed Bandits*

- Analyzed stochastic contextual multi-armed bandits with rewards from an unknown function and additive noise
- Implemented NeuralUCB, leveraging neural networks to construct an upper confidence bound (UCB) on rewards
- Showed that cumulative regret is sub-linear and beat baseline models with increasing number of rounds

NeRF: Neural Radiance Fields for View Synthesis | *COLMAP, 3D Geometry, Image Reconstruction*

- Implemented Neural Radiance Field+ for view synthesis, autonomously gathering data for model training.
- Employed COLMAP to extract camera poses used to train a Neural Network to estimate pixel color and opacity.
- Rendered images from different spatial locations (x, y, z) and viewing directions (θ, ϕ) to generate the 3D scene.

EM Algorithm - Mixture Models | *GMMs, Unsupervised Learning, Log likelihood*

- Developed the Expectation-Maximization (EM) algorithm for Bernoulli and Gaussian Mixture Models.
- Analyzed convergence properties by evaluating log-likelihood values over multiple iterations and initializations.
- Compared the performance of GMM, BMM, and K-Means using log-likelihood and K-Means objective function

Enhanced Information Retrieval with LSA, Doc2Vec, and BM25

- Designed an IR system using TF-IDF, then enhanced it with LSA, Doc2Vec, and BM25 on the Cranfield dataset
- Improved document ranking by capturing semantic context i.e higher MAP & nDCG scores vs baseline

Medical Image Segmentation | *Deep Learning, CNN, Pytorch, Image Processing*

- Implemented U-Net CNN architecture to segment Stomach, Large Intestine and Small Intestine from MRI slides.
- Utilised MRI slices to come up with 2.5-D images instead of the usual resource intensive 3-D images

Wavelet Basis for PDEs | *Finite Element Method, Linear Algebra*

- Implemented numerical methods for solving PDEs using multi-scale finite elements and wavelet bases.
- Recreated and debugged codes for wavelet transforms and multi-scale element-based PDE solutions in Python.
- Conducted studies on numerical stability, computational efficiency, and convergence of multi-scale finite elements.

Lattice Boltzmann Method for linear elastic displacement fields | *Lattice Boltzmann Method, Solid Mechanics*

- Implemented Lattice Boltzmann Method to model linear displacement fields with dirichlet boundary conditions.
- Applied Chapman-Enskog analysis to separate dynamics across time scales and recover macroscopic equations.
- Constructed equilibrium distribution functions with higher-order moment accuracy to model deformation & stress.

Achievements

- Achieved an **All India Rank 1866** in IIT JEE Advanced 2021, placing in the top 0.2% among 1 Million+ candidates nationwide.
- Achieved an **All India Rank 1227** in Kishore Vaigyanik Protsahan Yojana (KVPY) 2020 among 200k+ candidates, awarded a research scholarship by the Department of Science and Technology, Govt. of India.
- Qualified for the Indian National Physics Olympiad (INPhO), selected among the **top 200** candidates nationwide from the competitive qualifier exam.

Technical Skills

Languages: C, C++, Python, SQL, Fortran, Java, LaTeX
Frameworks & Libraries: Tensorflow, Keras, Pytorch, Scikit-Learn, Pandas, NumPy, OpenCV, HuggingFace, Github, Linux, GCP. Scipy, Agentic AI
Domains: Machine Learning, Deep Learning, Reinforcement Learning, Natural Language Processing, Computer Vision, Agentic AI, Numerical Methods, Scientific Machine Learning
Data Science and Backend: Tableau, Power BI, Excel, Apache Spark, Hadoop, Flask, Django, FastAPI

Teaching and Leadership

Academic Mentor Dec. 2021 – Dec. 2022

Avanti Fellows – Non-profit organization supporting underprivileged JEE aspirants

- Personally mentored 2 underprivileged students in Pondicherry for the **JEE Advanced** exam, both of whom secured admission to **IITs** for their undergraduate studies.
- Made regular visits to Pondicherry to conduct tutoring sessions and design practice exam papers to strengthen their preparation.

Public Relations Strategist May 2023 – Mar. 2024

Sponsorship & PR Team, Saarang – Annual Cultural Festival of IIT Madras

- Founded **Panacea**, a social awareness campaign promoting health and hygiene during the COVID-19 pandemic.
- Led a team of **14 volunteers** to manage Saarang's social media presence and coordinate Public Relations events.
- Negotiated and closed corporate sponsorship deals totalling **INR 500K** for Saarang.