Swathi Shree Narashiman

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EDUCATION

- **Indian Institute of Technology Madras** - B.Tech in Electrical Engineering & Minor in Computing
  CGPA: 9.71/10.0 *Aug '22 – Present*
- **DAV Group of Schools, Vellore** - Science Stream (CBSE)
  Class 12: 498/500 **Class 10:** 493/500 *Jun'20 – Jul'22*

SCHOLASTIC ACHIEVEMENTS

- Recipient of S. Subramaniam Award (1^{st} year), M. Saradha & Sankariah Scholarship & Jayanth Baliga Scolarship (2^{nd} year) for securing **highest CGPA** in B.Tech IIT Madras.
- One among the **100 Opjems Scholars** in India for the year 2024 (issued by O.P. Jindal Group)
- Secured All India Rank **759** in JEE Advanced 2022 and All India Rank **606** in JEE Main 2022
- Was issued **KVPY Fellowship** by IISc Bangalore for securing All India Rank **475** in KVPY-SX 2022
- One among the **National Toppers** in CBSE Class 12 examinations

PUBLICATIONS

1. S. Hussein, J. Guan, **Swathi Shree Narashiman**, *et al.*, "3d shape reconstruction from autonomous driving radars," in *The Thirty Sixth British Machine Vision Conference*, 2025
2. D. Panda, **Swathi Shree Narashiman**, J. K. Joe, *et al.*, *Fine-grained control over music generation with activation steering*, 2025. arXiv: 2506.10225 [cs.SD]
3. **Swathi Shree Narashiman** and N. Chandrachoodan, *Alphazip: Neural network-enhanced lossless text compression*, 2024. arXiv: 2409.15046 [cs.IT]
4. **Swathi Shree Narashiman**, V. A, D. Joshi, *et al.*, *Chiplets on wheels: Review paper on holistic chiplet solutions for autonomous vehicles*, 2024. arXiv: 2406.00182 [cs.AR]

RESEARCH & EXPERIENCE

- **Summer@EPFL Research Internship** *May '25 – present*
  Mentor: Prof. Nicholas Flammarion, TML Lab, EPFL *Lausanne, CH*
  - Researched **Mechanistic Interpretability** in transformers, focusing on In-Context Learning and Induction Heads
  - Investigated theoretical guarantees and empirical results for **Markovian prediction** in Large Language Models
  - Established that transformers approximate finite-length Markov chains using weighted unigram and bigram counts
- **Adversarial Attacks in Large Language Models** *Sep '24 – present*
  Mentor: Prof. Nambi Seshadri, UC San Diego *Remote*
  - Investigated **error propagation** in neural networks via logit-space attacks on open-source LLMs
  - Analyzed the impact of injected noise and channel erasures on BLEU, Perplexity, and Semantic Similarity metrics
  - Verified that LLMs are robust to noise, while BLEU scores vary by $\sim 30\%$, preserving linguistic semantics [Report]
- **Music Interpretability via Activation Steering** *Apr '24 – May'25*
  Club: AI Club, Center for Innovation, IIT Madras *Chennai, India*
  - Used **steering** and **residual stream analysis** for controllable **fusion music generation** via generative models
  - Enabled genre, instrument, and pitch transfer efficiently by training $<0.005\%$ parameters on <1K samples
  - Published results & findings on Fine-grained control over music generation on Arxiv (submitted to JMLR) [Paper]
- **Summer@EPFL Research Internship** *May '24 – Aug '24*
  Mentor: Prof. Haitham Al Hassanieh, SENS Lab, EPFL *Lausanne, CH*
  - Selected among the **top 1.6% globally** to conduct research on **3D reconstruction** from **autonomous driving radars**
  - Enhanced the reconstruction using PCN and KL-based knowledge transfer, achieving a Chamfer distance below 7
  - Conference paper submitted & accepted to the British Machine Vision Conference (BMVC) 2025, Sheffield, UK
- **Neural Network-Enhanced Lossless Text Compression** *Aug '23 – Sep '24*
  Mentor: Prof. Nitin Chandrachoodan, IIT Madras *Chennai, India*
  - Leveraged LLMs in rank-based predictive compression, achieving ***4.5***$\times$ compression on the **Gutenberg corpus**.
  - Analyzed diverse neural architectures coupled with information-theoretic frameworks like Huffman, Gzip etc.
  - Conducted empirical evaluations on domain-specific LLMs and published findings on arXiv [Preprint]

TECHNICAL PROJECTS

- **CS6170: Randmized Algorithms Course Project** *Jan '25 – May '25*
  Instructor: Prof. Yadu Vasudev, IIT Madras | Report | Video *Chennai, India*
  - Explored **Online algorithms** for **AdWords** & **bipartite matching** under adversarial & stochastic models
  - Surveyed primal-dual & perturbation-based techniques including recent improvements over the classical $1 - \frac{1}{e}$ bound
- **EE6180: Advanced Topics in AI Course Project** (with Immerso.ai startup) *Jan '25 – May '25*
  Instructor: Prof. Pravin Nair, IIT Madras | Report | Github *Chennai, India*
  - Trained Stable Diffusion models via **Textual Inversion** ($<$ 1M params) to learn movie characters from 5-10 images
  - Designed prompt templates and token strategies to improve realism and control in few-shot generation
- **EE6150: Stochastic Modeling Course Project** *Jan '25 – May '25*
  Instructor: Prof. Avhishek Chatterjee, IIT Madras | Report *Chennai, India*
  - Studied Glauber dynamics in sparse Ising models with near-linear mixing via graph decomposition
  - Examined Log-Sobolev methods and structural partitioning for efficient sampling in community detection

SKILLS

Python, C, C++, PyTorch, TensorFlow, LLMs, OpenCV, Git, Verilog, Xilinx Vivado, ARM, Arduino IDE, Altium Designer (PCB)

RELEVANT COURSEWORK

- **Machine learning & AI :** Advanced Topics in AI; Stochastic Modeling & Theory of Queues
- **Algorithms & Computing :** Randomized Algorithms; Quantum Algorithms; Computer Organization; Cryptography
- **Mathematics & Theoretical Foundations :** Linear Algebra, Convex Optimization, Probability, Control Systems, Information Theory, Multivariable Calculus, Series & Matrices

TEACHING EXPERIENCE

- **Teaching Assistant for Computer Organization** *Jul '25 – Nov '25*
  Instructor: Prof. Janakiraman Viraraghavan, IIT Madras *Chennai, India*
  - Undergraduate course on Computer Organization: Evaluated examination scripts & conducted tutorial sessions.
- **Avanti Mentor** *Nov '22 – Jul '23*
  Club: *Avanti Fellows, IIT Madras* *Chennai, India*
  - Provided one-on-one mentorship for underprivileged students to assist them in IIT-JEE preparation

POSITIONS OF RESPONSIBILITY

- **Project Lead of AI Club** *Apr '24 – May '25*
  AI Club, Center for Innovation, IIT Madras *Chennai, India*
  - As a core team member, led a team of 40 enthusiasts in the development fusion music generation using AI
  - Presented at the **Open House** event, attracting 500+ attendees and multiple media outlets
- **Core member of EE Research Club** *May '24 – present*
  EE Research Club, IIT Madras *Chennai, India*
  - Leading 30-member EE Research Club focused on cultivating a research mindset and building a scientific community
  - Ideated, organized, and hosted events to foster research engagement like socials, professor interviews, tech talks, etc.
- **Powertrain Engineer of Raftar Formula Racing** *Apr '23 – Mar'24*
  Raftar Formula Racing, Center for Innovation, IIT Madras *Chennai, India*
  - Designed and tested key EV circuitry in the Low Voltage Subsystem of IITM's Formula Student electric race car
  - Team secured **Runners-up** position at **Formula Bharat 2024** with an international-level vehicle build
- **Press Correspondent** *May '25 – present*
  The Fifth Estate, IIT Madras *Chennai, India*
  - Contributed articles to the official student press, covering diverse aspects of campus life and student affairs
- **Contingent** *Oct '23 – Dec'23*
  Inter IIT Tech Meet 12.0 *Chennai, India*
  - Proposed a chiplet-based solution to Jaguar Land Rover's High Prep problem as institute representative
  - Published on arXiv a cost-efficient SoC-to-chiplet design optimizing die size, interconnects, and architecture [Preprint]