# Naren Doraiswamy

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## Education

**University of Michigan** — **Ann Arbor, MI**
*Master of Science in Electrical and Computer Engineering, Computer Vision Track* — **Apr 2023**
**Relevant courses:** Computer Vision, Machine learning, Matrix methods for ML, **Advanced Computer Vision**, Optimization in ML, ML system design , **GPU programming**, Deep learning Theory, **Large Language Models (LLMs)**

**Visvesvaraya Technological University** — **Bangalore, India**
*Bachelor of Engineering in Electronics and Communication Engineering* — **Jun 2016**

## Skills

**Languages:** Python, C, C++, Matlab, Julia, SQL, Bash, HTML, LaTeX

**Frameworks/Tools:** Pytorch, CUDA, TensorFlow, Scikit-Learn, NumPy, Pandas, OpenCV, SciPy, Docker, Git, AWS, ONNX, Kubernetes, MLFlow, LangChain, CUTLASS, cuBLAS, Triton

## Work Experience

**University of Michigan** — **Ann Arbor, MI**
***Research Associate & Lecturer*** — **Aug 2023 - Present**

- Devising novel algorithms for eliciting adversarial robustness & adapting diffusion models for dense prediction tasks.
- Developing novel **visual grounding**, **interleaved text-image generation**, & **spatial awareness** algorithms using **vision language models** (VLMs).
- Developed the advanced Deep Learning graduate course from scratch covering topics like **pre-training, post-training, Mixture of Expert, inference optimization techniques** for LLMs & generative modeling with Diffusion models.
- Conduct weekly lectures for Machine Learning and Advanced Programming graduate coursework.

**Bosch Centre for Artificial Intelligence** — **Pittsburgh, PA**
***Machine Learning Scientist - Intern*** — **May 2022 - Aug 2022**

- Formulated a new algorithm for few-shot object segmentation task using self-attention module increasing the accuracy over the state-of-the-art (SOTA) by over **4%**.
- Increased the accuracy of existing SOTA unsupervised segmentation method by **2%** using multi-scale features.
- Implemented and presented final research findings to cross-functional research teams across Germany and USA.

**Indian Institute of Science** — **Bangalore, India**
***AI Research Associate*** — **Aug 2018 - Nov 2020**

- Developed one of the first weakly-supervised few-shot object segmentation algorithms which achieved **5%** improvement over the prior state of the art. (Published at **IJCAI** and **ICLRW**)
- Designed a new active learning based domain adaptation algorithm that improved over the prior state of the art by **2%**. (Published at **CVPRW**).
- Devised a real-time, low-latency (**60 fps**) semantic segmentation algorithm tailored for Indian road conditions that was integrated into Wipro's autonomous mobility solutions.

**Robert Bosch, India** — **Bangalore, India**
***Machine Learning Engineer*** — **Aug 2016 - Jun 2018**

- Piloted the shift of over **20** physics based models to data based machine learning models in a span of 2 years to establish a new engine management system.
- Saved **$500k** in licensing costs over **9** years by developing the in-house models that overcame the reliance on external software tools for simulation testing.
- Initiated the development of a prediction model for cylinder fill correction factor using calibrated data and improved accuracy by **10%** over its predecessor models.
- Built machine learning models for estimating crucial engine parameters like turbocharger lag and common rail pressure and achieved over **97%** accuracy in performance.

## Publications [Google Scholar]

- **In-context learning using visual semantic prompting for few-shot meta-learning models. - Under Preparation**
- **Unsupervised hierarchical Image segmentation with the aid of superpixelation. - Under Preparation**
- **Evaluating Adversarial Robustness for Semi-supervised domain adaptation - Under Preparation**
- **Improving semi-supervised domain adaptation using effective target selection and semantics.** [arXiv]
  **Naren Doraiswamy***, Anurag Singh*, Sawa Takamuku, Megh Bhalerao, Titir Dutta, Soma Biswas, Aditya Chepuri, Balasubramanian Vengatesan, Naotake Natori **- CVPR L2ID 2021**
- **Weakly supervised few-shot object segmentation using co-attention with visual and semantic embeddings.** [arXiv:2001.09540]
  Mennatullah Siam*, **Naren Doraiswamy***, Boris Oreshkin*, Hengshuai Yao, Martin Jagersand **- IJCAI 2020**
- **One-shot weakly supervised video object segmentation.** [arXiv:1912.08936]
  Mennatullah Siam*, **Naren Doraiswamy***, Boris Oreshkin*, Hengshuai Yao, Martin Jagersand **- ICLR PML4DC 2020**

## Projects

- **Query-Efficient Preference-Based Reinforcement Learning (RLHF) using Active Learning.** [Report]
  Composed a preference based reward function which is query efficient through various active learning methodologies. We show its effectiveness in overcoming the requirement of domain-specific knowledge to model the reward function.
- **Evaluation of adversarial robustness for semi-supervised domain adaptation (SSDA) networks.** [Report]
  First method to evaluate the robustness of semi-supervised domain adaptation models. Proposed an adversarial robust SSDA model suitable for real world deployment of such models. Increased robust accuracy by over $\tilde{4}0\%$.
- **On the role of Neural Collapse in Meta Learning based Few-shot Learning** [Report]
  Investigated the presence of the neural collapse (NC) phenomenon in meta learning frameworks and showcased the existence of the four NC properties in few-shot learning methods
- **Real-time deployment of scene segmentation model using AWS.**
  Designed and created a web application for deploying scene segmentation models using AWS cloud and ONNX . Hosted the web application on Heroku to infer semantic segmentation results.
- **Approaching semi-supervised domain adaptation from two perspectives** [Report]
  Proposed the usage of a combination of mutual information maximization using Jenson Shannon divergence and a modified adversarial loss with thresholding to develop a new method for semi-supervised domain adaptation.

## Honors, Awards and Travel Grants

- Carnegie Travel Grant from UM School of Information for attending CVPR **2024**
- University of Michigan Inclusive Teaching Grant **2024**
- International Science Olympiad finalist **2012**
- Ministry of Human Resource Development (MHRD) Scholarship, Government of India **2012**
- Jnanamitra Pratibha Puraskara award for outstanding performance in $10^{th}$ Board Exams **2010**

## Professional Activities

- **Reviewer:** CVPR 2025, AISTATS 2025, ICLR 2025, NeurIPS 2024, ECCV 2024, IJCAI 2024-2025, WACV 2021-2025, ACML 2022-2024, CVPRW 2022-2024, TMLR, TMM.
- **Teaching:** Teaching Assistant for **SI 671: Data Mining** & **SI 568: Introduction to Applied Data Science.**
- **Deep Learning Mentor**: Coached & provided 1:1 mentoring to 45 students at **Udacity nanodegree** programs.
- **AI Bootcamp Instructor**: Designed and instructed AI lectures at **AI Saturdays Bangalore Bootcamp**.
- **Bosch CSR:** Taught STEM classes for underprivileged high school students with a class size of 60 students.
- **STEM fellowship Mentor:** Mentored 4 high school students interested in pursuing Computer Science college degrees.