# 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 Machine learning, Advanced Computer Vision, Optimization in ML, ML & DS design, Adversarial Machine learning, Science of deep learning, Large Language Models (LLMs)

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

## Skills

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

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

## Work Experience

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

- Devising novel algorithms for eliciting adversarial robustness & adapting diffusion models for dense prediction tasks.
- Researching algorithmic methods to assess in-context learning in language models **(LLMs)** & vision models **(LVMs)**.
- Conduct weekly lectures for Machine Learning and Advanced Programming 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 **2%**.
- Increased the accuracy of existing SOTA unsupervised segmentation method by **1.5%** 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 low-latency real-time (**60 fps**) semantic segmentation algorithm specifically for Indian roads conditions. The algorithm was incorporated as part of autonomous mobility solutions by Wipro.

**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 over **$1.3M** in licensing costs 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 and Awards

- Ministry of Human Resource Development (MHRD) Scholarship, Government of India **2012-2016**
- International Science Olympiad finalist **2012**
- Jnanamitra Pratibha Puraskara award for outstanding performance in $10^{th}$ Board Exams **2010**

## Professional Activities

- **Reviewer:** ECCV 2024, IJCAI 2024, WACV 2021-2024, ACML 2022-2023, CVPRW 2022-2023, 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.