

# Devaganthan S S

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Education	<b>Indian Institute of Technology, Madras</b> Dual Degree (BTech+MTech) in Electrical Engineering CGPA: 8.08	Aug, '19 – Jul, '24
	<b>Politecnico di Milano, Milan</b> Semester Exchange Program, Master's in Computer Science and Engineering	Jan, '22 – Jul, '22
Courses	<ul style="list-style-type: none"><li>• Modern Computer Vision</li><li>• Natural Language Processing*</li><li>• Probability and Statistics</li><li>• Internet of Things</li><li>• Data Structures and Algorithms</li></ul> <p>* - Courses in Progress</p> <ul style="list-style-type: none"><li>• Deep Learning for Imaging</li><li>• Machine Learning</li><li>• Linear Algebra</li><li>• Advanced Computer Architecture</li><li>• Digital Signal Processing</li><li>• Analog Systems</li></ul>	
Research Experience	<b>Pothole and Road Crack Detection Under Night/Foggy Conditions</b> Project, Under Prof. Kaushik Mitra, IIT Madras	Mar, '23 - Present
	<ul style="list-style-type: none"><li>• The project aims to devise and implement an algorithm for Autonomous vehicles to detect Potholes and Road Crack at Night/Foggy conditions and also considering glare/glow from light sources like post lamps, other vehicles</li></ul>	
	<b>Unsupervised Extreme Low Light Image Enhancement</b> Mini Project, Under Prof. Mansi Sharma (Adjunct Faculty, IIT Madras)	Aug, '22 – Dec, '22
	<ul style="list-style-type: none"><li>• Read and understood various existing approaches for Low Light Image Enhancement with a greater focus on Unsupervised Methods</li><li>• Worked in a team, exploring GAN-based Methods for Low Light Image Enhancement</li></ul>	
Relevant Course Works	<b>Deep Learning for Imaging</b> Key Skills/Theory – PyTorch, NumPy, MLP, CNN, RNN, Auto-encoders, GAN	Aug, '22 – Dec, '22
	<ul style="list-style-type: none"><li>• Implemented a 3 Layered MLP from scratch using only NumPy ()(without using machine learning frameworks) for MNIST image classification, achieved a test accuracy of 97%</li><li>• Built an MNIST Image classifier using CNN in PyTorch and achieved a test accuracy of 98%. Performed Occlusion analysis, generated Adversarial Examples by Adding noise, Targeted and Non-targeted Attacks to understand the learnings of the trained Network</li><li>• Created and tested a Binary String Adder using RNN Cells</li><li>• Implemented an RNN model that can remember the number at a particular index in a given number sequence, achieved a test accuracy of 75% (under the set hyperparameters)</li><li>• Built an MNIST Image Classifier using RNN and LSTM cells, with 95% and 84% test accuracy, respectively (under the set hyperparameters). Each cell takes in a row of pixel values</li><li>• Implemented Sparse, Convolutional, and Denoising Autoencoders, trained on MNIST Data</li></ul>	
	<b>Modern Computer Vision</b> Key Skills/Theory – OpenCV, Canny Edge Detector, SIFT, SURF, Harris Corner Detection	Aug, '22 – Dec, '22
	<ul style="list-style-type: none"><li>• Designed a CIFAR-10 Image Classifier using MLP and CNN models</li><li>• Implemented Canny Edge Detector using OpenCV and NumPy</li><li>• Hybrid Images<ul style="list-style-type: none"><li>▪ Wrote an image convolution function (image filtering) and used it to create hybrid images—a technique published in a paper at SIGGRAPH. Hybrid Image is the sum of a low-pass-filtered version of an image and a high-pass-filtered version of another image. A hybrid Image is perceived differently at different distances</li></ul></li><li>• Panoramic Stitcher</li></ul>	

- Developed an algorithm for stitching a panorama from overlapping photos which amounts to estimating a transformation that aligns one Image to another by computing SURF features in both images and matching them to obtain correspondences.
- A homography is estimated from these correspondences and used to stitch these in a common coordinate system. Extended this algorithm to stitch multiple images as well

## Projects

### Natural Language Processing

*Key Skills/Theory – VSM, ESA, LSA, IR System, Spell Check*

**Feb, '23 - Present**

- Built an Information Retrieval System Cranfield Dataset that retrieves top 5 relevant document for a given query for using Vector Space Model.
- Achieved a precision of 39%, recall of 29%, F-score of 30%, MAP of 69% and nDCG of 44%
- Looking at ESA/LSA to improve the IR System by handling Synonym and Polysemy

### Smart Bracelet

*IoT Course Project under Prof Matteo Cesana, Polimi | TinyOS, MQTT, COOJA, NodeRed*

**Jun, '22 – Dec, '22**

- Designing and implementing a software prototype for a smart bracelet that is to be worn by a child that allows their parent to keep track of the child's position and trigger alerts when a child goes too far
- Acquainted with the Communication Stack, with the initial implementation of sending data
- Loaded a TinyOS application in a simulated node in Cooja, sent data periodically to a ThinkSpeak Server via MQTT, using Node-red

### Hardware Accelerated JPEG decoder for Image Compression

*Computer Organization Course Project under Professor Nithin Chandrachoodan | Verilog*

**Nov, '22 – Dec, '21**

- Implemented a Hardware Accelerator in Verilog for the JPEG Decoding algorithm for Image Compression
- Reduced the number of clock cycles from max cycles of 5100 to 18 Cycles for a single iteration of row/column IDCT (Inverse Discrete Cosine Transform)
- Understood the JPEG decoding algorithm for image compression from a top-level

## Other Course Works

### Computer Organization

*Key Skills/Theory – CPU Performance Equation, I/O, Peripherals, Interrupts, Pipelining*

**Jul, '21 – Dec, '21**

- Implemented a Synthesizable 8-Bit Sequential Multiplier in Verilog HDL
- Implemented all instructions of the RV32I in Verilog set to make a synthesizable single-cycle CPU

### Microprocessor

*Key Skills/Theory – Assembly Programming,*

**Jul, '20 – Dec, '20**

- Implemented 5-Tap and 32-Tap versions of bandpass FIR filter in AVR Atmega8 microcontroller, using Atmel AVR Studio 7 for design and debugging
- Implemented 8-bit Multiplier, without using MUL instruction in AVR Atmega8 microcontroller using Atmel AVR Studio

### Applied Programming Lab

*Key Skills/Theory – Python, Scikit, NumPy, PyLab*

**Jan, '21 – May, '21**

- Circuit Solver – Developed a Python Program that accepts a liner circuit as . netlist file and outputs the Nodal Voltages and Current
- Fitted data to Model, computed Mean Square Error, represented the data graphically, using python Libraries (NumPy, SciPy, PyLab)
- Employed Integration and Least Squares methods to find Fourier Coefficients
- Simulated a 1-Dimensional Model of a Tube Light to understand the Light

Intensity, Electron Density as a Function of Position

- Analyzed LTI Systems with Signals Toolbox
- Plotted DFT Spectrum of Periodic and Non-Periodic discrete Signals, using Fast Fourier Transform Algorithm (fft()) from NumPy)

## Achievements

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|---|-------------|
| • Cleared PRE-Regional Mathematical Olympiad (RMO) and qualified for RMO in Rajasthan Region  | <b>2017</b> |
| • Secured 7 <sup>th</sup> rank in Tamil Nadu state in Mathematical Genius Award   | <b>2014</b> |
| • Bagged 1 <sup>st</sup> rank at the school level in a Computer-Based Brain Skill Competition, presented by Horlicks Pro Mind and Sakthi Masala | <b>2013</b> |
| • Cleared District and School level, qualified for State-level in Wordsworth International Spell Bee  | <b>2013</b> |
| • Awarded Meritorious Certificates in school for academic excellence  |             |
| • Cleared Preliminary English Test (PET), conducted by British Council, University of Cambridge   | <b>2015</b> |