

RAHAVI SELVARAJAN

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PROFILE

Passionate and organized graduate student in the Department of Electrical and Computer Engineering. Highly engrossed in fields like Data Science and AI in healthcare. Mastered the skills like analytical thinking, and problem solving by doing various research internships. These experiences and projects strengthened my knowledge on Machine Learning/ Deep Learning and Medical Image processing and also enhanced my skills on team management and scientific writing.

EDUCATION

Master of Engineering in Electrical and Computer Engineering 2021 - 2023

University of Toronto, Canada.

CGPA : 3.8/4.0

Courses: Introduction to Machine Learning (ECE1513), Big Data Science (MIE1628H), AI in Finance (APS1052H), Trustworthy ML (ECE1784), Algorithms and Data Structures (ECE1762H), Decision Support Systems (MIE1513H)

Bachelor of Engineering in Electronics and Communication Engineering 2016 - 2020

Anna University, India.

CGPA : 3.73/4.0 (First Class with Distinction)

Courses: Object-Oriented Programming, Algorithms and Data Structures, Programming Languages.

SKILLS

Software Python, R, Pytorch, Keras, Tensorflow, MATLAB, C, Hadoop, Spark, Windows Powershell, Azure, LABView, Xilinx Vivado, Latex, MS Office, Linux, Git, SQL, Java

EXPERIENCE

MS Intern - AID4MH-CAMH Apr 2022 - Present

AI in Mental Health

- Working in collaboration with Vector Institute and 4YouandMe in a study called BUMP.
- The study is related to analyzing the emotions of women during pregnancy until tri-semester using AI.
- Responsible for developing a ML pipeline for video/audio-based emotion detection.

Research Trainee - Dalla Lana School of Public Health, Toronto Jan 2022 - Present

AI in Healthcare

- Working in collaboration with Shiphrah Biomedical Inc, Toronto and advised by Dr.Elham Dolatabadi.
- Working on a project at the intersection of Artificial Intelligence, Medicine, and Engineering.
- Our team is trying to solve one of the biggest challenges during pregnancy: sleep.

Intern - JACOB-Center for Applied Artificial Intelligence, Montreal Jan 2022 - Present

Anomaly detection and classification in 3D-images of sewer channels using transfer learning

- Working on the detection and classification of anomalies in sewer channels.
- Estimating the key characteristics of the defects present in the structured data and unstructured data obtained from the 3D camera.
- Transferring the knowledge learnt from the structured data to unstructured data.

Graduate Research Intern- Multimedia Laboratory, University of Toronto Oct 2020 - Dec 2021

Computational Pathology

- Developed an unsupervised deep learning network architecture which incorporated probabilistic modelling for multi-label image classification.

- Visualized the feature representations learnt by the network using AI visual explanation techniques.
- Worked with various statistical models and public biological datasets.

Research Intern - Indian Institute of Technology, Madras

Dec 2019 - Mar 2020

Implementation of Digital Pre-Distortion Module using Xilinx Vivado on FPGA board

- Implemented the DPD IP design in Xilinx Vivado
- Wrote Verilog Testbench for the DPD IP
- Optimized the DPD IP core for achieving low Adjacent Channel Leakage Ratio
- Programmed the ZCU111 FPGA board with the synthesized design

Summer Research Intern - Indian Institute of Technology, Palakkad

May 2019 - June 2019

Mathematical Modeling of Non-Linear Communication Channels and its Estimation using Deep Learning

- Simulated non-linear channels using Volterra, Wiener and Hammerstein Models in MATLAB
- Added random polynomial equations of higher orders as a non-linearity
- Trained a deep learning network for the estimation of non-linear polynomial co-efficients.

TEACHING EXPERIENCE

Graduate Teaching Assistant - University of Toronto

Jan 2022 - Apr 2022

MIE253H1 - Data Modelling

- Preparing assignments/labs on Data loading, accessing and SQL.
- Grading assignments and exams.
- Responsible for setting question paper for mid term and final exam.

PUBLICATIONS

Supervised Multilabel Contrastive Learning for Computational Pathology

Submitted to CVPR 2022

Prediction of Cardiovascular Disease from Retinal Fundus image using Neural Networks

[\[paper\]](#)

International Journal of Advanced Science and Technology, 2020

Health Monitoring of Soldiers using Efficient MANET Protocol

[\[paper\]](#)

IEEE Recent Advances in Intelligent Computing Systems, 2020

PROJECTS

Bosch Future Mobility Challenge

(On-going)

- Extracted the video captured from the camera module attached to the micro-controller for computer vision applications.
- Implemented object detection algorithm - YOLO and Canny Edge detection algorithm for recognizing the obstacles and the road signs in front of the bot.

IMI Big Data and Artificial Intelligence Case Competition (Scotiabank)

- Developed a credit risk prediction model for the Scotiabank dataset.
- Used basic data science approaches to do exploratory data analysis on the dataset.
- Performed both binary classification and multi-class classification on the dataset provided by the Scotiabank.

Deep Query Attacks: A Reinforcement Learning Approach

[\[link\]](#)

- We proposed a reinforcement learning framework which combined differential querying and structured grouping (tiling) of pixels.

- Utilized historical knowledge from previous queries in the training stage to learn more query-efficient attack strategies.
- Designed an RL agent which requires an attack dataset for training which need not be representative of the training dataset of the target model.

Netflix Movie Recommendation System

- Developed the movie recommendation engine using PySpark.
- Worked on the data from Netflix and performed data manipulation tasks like loading, cleaning, slicing and mapping.
- Used Alternating Least Squares (ALS) algorithm for the recommender system and optimized the algorithm with various parameter values.

Breathe EZ

- This project is funded by the U of T Student Engagement Award.
- Breathe EZ is website which acts as a virtual coach to Covid-19 recovering patients and helps in regaining their lung capacity through exercises.
- We used MediaPipe for the pose estimation of the various exercises.

Prediction of risk of Neuro-Degenerative Disease using Gait features

- Used Azure Studio for the ML pipeline.
- The dataset was cleaned and pre-processed for the training phase.
- Visualized the dataset using EDA techniques to understand the relationship between various attributes.
- Worked with various algorithms and compared their performance.

Creation of PyTorch library for wide range of augmentation techniques

[\[link\]](#)

- The library contains a wide range of spatial and colour augmentation techniques.

PyTorch Implementation of HistoNet on ADP

- HistoNet is a deep learning network architecture trained on histopathology datasets.
- "Atlas of Digital Histopathology" dataset was used to train HistoNet and an accuracy of 94% was achieved.

Detection of Covid-19 from Chest X-Rays

[\[link\]](#)

- Used ResNet18, a neural network architecture to train the COVID 19 radiography dataset published in Kaggle.
- Performed various data augmentation techniques like spatial and color augmentation techniques on the dataset.
- The model is trained to classify the images into covid-19, pneumonia and normal.

Handwritten Digits Classification using Pytorch

[\[link\]](#)

- The handwritten digits' images from the MNIST Handwritten Dataset were fed into a simple Neural Network model for classification. The accuracy of the model is 96%.

Blood Vessel Segmentation from Retinal Fundus Images

[\[link\]](#)

- The retinal blood vessels from the retina fundus images were extracted using morphological operations.
- CLAHE algorithm is used to enhance the contrast of the fundus images.

Simulation of 5G OFDM Transmitter using Python

[\[link\]](#)

- This project is the simulation of a downlink OFDM signal assuming single port output i.e., no MIMO.
- For a chosen channel bandwidth and subcarrier spacing, the OFDM data is generated for 100 frames and the Peak to Average power ratio(PAPR) is calculated and plotted for QPSK, 16-QAM, and 64-QAM modulation techniques.