

Achint Soni

Senior Undergraduate

+91 8529761926 • achint@iitk.ac.in • trickyjustice.github.io

Education

- **Bachelor of Technology GPA: 8.3/10** **Indian Institute of Technology Kanpur**
Major: Electrical Engineering, Minor: Machine Learning, Theory of Computing (expected) June 2023
- **Grade XII: 95.0/100** **Sir Padampat Singhania School, Kota**
Stream: Science July 2019

Publications

- **Social Media Analytics for tracking COVID-19 vaccination demand** **EJIS**
Achint Soni and Faiz Hamid, Manuscript submitted 2022
 - Proposed a novel method to predict the demand information for COVID-19 vaccinations in a tweet by utilizing semi-supervised learning with recurrent neural networks (RNN).
 - Designed a mathematical model that calculates the likelihood of demand information of a tweet at a particular time.
- **Energy efficient time table scheduling for metro systems using machine learning** **2022**
Achint Soni and Faiz Hamid, Manuscript in preparation
 - Coordinated the arrivals and departures of all trains located within the same electricity supply interval using Long Short Term Memory (LSTM) models to utilize the energy generated by braking trains to accelerate trains.
 - Implemented NSGA-II algorithm with real-world speed profiles to minimize the trains' energy consumption with the dwell time obtained from the machine learning model.

Work Experience

- **Mobility data to address public health decision making post COVID-19** **Manuscript in prep.**
Mentor: Sahar Saeed, Queen's University, Canada Jun. 2022 –Ongoing. 2022
 - Evaluated the viability of monitoring mobility data to specific points of interest in Canada in order to continue informing post-COVID-19 pandemic public health decision making.
 - Accessed the representativeness of SafeGraph mobility data in Canada by comparing the number of sampled devices with Census population counts at different geographic levels.
 - Described the temporal patterns of visits to healthcare institutions at several epochs and contrasted these patterns across provinces and Material Deprivation Indices by utilising a quasi-Poisson hierarchical generalised additive model.
 - Estimated the utilization patterns of each facility during the pandemic using geographic catchment analytical methods.
 - The ratio of expected and observed healthcare utilization over time for each census block group was used to construct an inequity map.
- **Student Research Associate**
Department of Biotechnology, Government of India Sept. 2021 – Nov. 2021
 - Developed a fully manual and assisted real-time voice based control and GUI based tactile control in a team of two to automate BCI controlled wheelchair for motor-impaired support.
 - Deployed a classification model involving deep learning that can detect motor imagery brain signals using an open-source brain-computing interface electroencephalogram (OpenBCI-EEG) headset.
 - Implemented intelligent EEG artefacts removal such as eye and tongue movements, electrode and sweat artefacts by Autoregressive-Deep Variational Autoencoder model.
- **Undergraduate Research Programme- SURGE'21, IIT Kanpur**
Mentor: Laxmidhar Behera, IIT Kanpur Jun. 2021 – Sept. 2021
 - Built a lightweight keyword spotting system that can recognize multiple different short speech commands.
 - Calculated Mel-Frequency Cepstral Coefficients (MFCC) to extract spectral features and gain more perceptually-relevant representation of speech audio.
 - Deployed a classification model involving deep CNN that can detect speech commands based on their mel spectrograms.
 - Assembled the model on unmanned mine safety inspection vehicle and tested on English and Hindi language speakers.

Projects

Document Image Classification with Intra-Domain Transfer Learning

- Prof. Tushar Sandhan, *Image Processing (EE604A)* Sept. 2022 – Oct. 2022
 - Implemented a region-based DCNN framework for document structure learning on RVL-CDIP dataset.
 - Separated the image into four different regions and applied transfer learning using Vgg16 architecture trained on ImageNet.
 - Combined the predictions from individual base deep neural network using a stacking generalisation based ensembling.
 - Achieved a maximum mean F1-Score of 79.5% on test and 92% on train dataset and secured an All India Rank 21.

Fast and accurate bayesian polygenic risk modelling using variational inference

- Prof. Sahir Bhatnagar, *McGill University, Montreal, Quebec, Canada* May. 2022 – Jul. 2022
 - Implemented fast and efficient Bayesian polygenic risk score method that approximates posteriors for the effect sizes of genetic variants on the phenotype using variational inference techniques.
 - Conducted comprehensive set of experiments using simulated and real traits to assess the predictive ability of the model in comparison with some of the most popular Bayesian and non-bayesian methods.
 - Observed fast model convergence enabled by variational inference algorithm in contrast to stochastic MCMC approaches implemented by other methods.

Acoustic Event Detection

- Prof. Vipul Arora, *Advanced topics in Machine learning (EE698R)* Apr. 2022 – May 2022
 - Identified onset, offset times and labels of multiple acoustic events present in audio clips on millisecond level by extracting mel-spectrogram features.
 - Employed CNNs, RNNs, hybrid CRNNs, LSTM, and HMM based models to detect audio events and achieved 0.91 F1 score
 - Implemented various statistical methods including Gibbs sampling, Importance and Rejection sampling, Monte-Carlo sampling and Normalizing Flows.
 - Implemented Generative Adversarial Networks(GANs) and Variational Auto Encoders from scratch using neural networks for Gaussian Mixture Models.

Carbon footprint reduction using plastic bag price optimization

- Prof. Faiz Hamid, *IIT Kanpur* Jan. 2022 – Apr. 2022
 - Derived a mathematical model that takes into account the profits of supermarkets and the carbon footprint of plastic to find the optimal price of plastic bags.
 - Devised an optimal reward policy that reduced the carbon footprint of plastic bags at constant levels of sale.

Twitter Sentiment Analysis

- Prof. Faiz Hamid, *Data mining and Knowledge Discovery (IME672)* Aug. 2021 – Oct. 2021
 - Designed and implemented an information retrieval and classification system for sentiment analysis on Twitter.
 - Cleaned, parsed and segmented tweets content; counted most frequent words, ngrams and hashtags.
 - Used TF-IDF and GloVe pretrained Word Embeddings to obtain vector representations for words.
 - Modeled Support Vector Machine and Naive Bayes algorithm to determine sentiment polarity of data set.
 - Implemented a Bidirectional LSTM model using Tensorflow to classify the tweets into appropriate categories of sentiment.

Technical Projects

Deep learning approaches for COVID-19 detection based on chest X-Ray images

- Self project Jul. 2020 – Sept. 2020
 - Designed a deep learning system to extract features and detect COVID-19 from chest X-ray images.
 - Automatized the process of analyzing X-ray images with high accuracy using deep Convolutional Neural Networks (CNNs).
 - Three powerful networks, namely ResNet50, InceptionV3, and VGG16, were fine-tuned on an enhanced dataset.
 - Implemented transfer learning to train a ResNet50 model on the same data to achieve an accuracy of **96.32%** on train data and **94.53%** on validation data

Deep-Into-CNN

- Programming Club, *IIT Kanpur* May. 2020 – Jul. 2020
 - Deployed deep convolutional neural network(CNN) architecture to train on MNIST dataset and achieved maximum accuracy of 98%.
 - Implemented VGG-16, ResNet50, LeNet and Alexnet architecture from scratch using PyTorch.
 - Examined regularization, weight initialization and optimization methods such as Gradient descent variations, Adam, and RMS algorithms.
 - Trained an Autoencoder model to create a low-dimensional representation of images, and then used different clustering methods to determine optimal groupings for these images based on their encoding.
 - Used Davies Bouldin score and Silhouette score to test the validity of the clusters generated by clustering algorithms.

Coursework

Computer Science: Data Structure and Algorithms, Mathematics for Computer Science , Fundamentals of Computing, Theory of Computing, Signals Systems and Networks, Advanced topics in Machine learning, Machine learning for signal processing, Data mining and knowledge discovery

Mathematics & Statistics: Probability and Statistics , Partial Differential Equations, Linear Algebra & ODE, Real Analysis & Multivariate Calculus, Complex Analysis

Electrical Engineering: Microelectronics, Digital Electronics, Power Electronics, Electromagnetic Theory, Principles of Communication, Power Systems, Classical Control System

Technical Skills

Programming Skills: C++, Python, C, HTML, CSS, JS, Haskell

Frameworks:: PyTorch, Tensorflow, Keras, OpenCV

Software and Utilities:: Tableau, MATLAB, Linux, Git, Autocad, \LaTeX

Machine Learning and Deep Learning:: Computer Vision, Natural Language Processing, OpenCV, Sklearn, Pandas, Numpy, Matplotlib

Language Skills

English: Full Professional Proficiency

Hindi: Native Proficiency

Gujarati: Native Proficiency

Scholarships

- MITACS Globalink Graduate Fellowship (CAD 15,000, 2022)
- Summer Undergraduate Research Grant for Excellence (SURGE) IIT Kanpur. (INR 24000, 2021)

Achievements and Accolades

- National top 0.05% in JEE Advanced (2019) among the 230k shortlisted candidates
- National top 0.1% in JEE Mains (2019) among 1.6 million candidates
- Among the top ten recipients of the INFORMS Scholarship, 2022.
- Academic Excellence Award for exceptional performance in Mathematics and Science.
- National top 50 out of 60k shortlisted candidates in Undergraduate examination conducted by IIIT Hyderabad.
- Qualified for Indian National Astronomy Olympiad (INAO) organized by Indian Association of Physics Teachers

Management and Leadership Skills

Captain – Table Tennis team: During the 2021-22 academic year, led the IIT Kanpur Table Tennis team in multiple contests and camps.

Secretary – Cultural Festival: Successfully guided 50+ universities participating in the cultural festival of IIT Kanpur from all over India