Achint Soni

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Education

- **Bachelor of Technology GPA: 8.2/10** — **Indian Institute of Technology Kanpur**
  Major: Electrical Engineering, Minor: Theory of Computing, Machine Learning — *(expected) July 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** — **Under Review: EJIS**
  Achint Soni *and Faiz Hamid* — *July 2022*
  - Proposed a novel method to predict the demand for COVID-19 vaccinations that utilizes semi-supervised learning with recurrent neural networks.
  - A new data dictionary is derived with words that show the feeling of support and request, which increases the robustness of the model to temporal losses and long term dependencies.
  - The result is compared with other neural network based control to demonstrate the superiority of the proposed technique.
- **Energy efficient time table scheduling for metro systems using machine learningUnder Review: Transportation Re**
  Achint Soni *and Faiz Hamid*
  - Coordinated the arrivals and departures of all trains located within the same electricity supply interval 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

- **Harnessing mobility data to address public health decision making post COVID-19** — **MITACS GRI**
  Mentor: Sahar Saeed, Queen's University | Sahir Bhatnagar, McGill University, Canada — *May. 2022 –Jul. 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 utilising a quasi-Poisson hierarchical generalised additive model.
- **Student Research Associate**
  Department of Biotechnology, Government of India — *Jun. 2021 – Oct. 2021*
  - Developed 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 exploiting features such as bandwidth, spectral power density and amplitude of these waves with the help of deep neural networks.
- **Undergraduate Research Programme- SURGE'21, IIT Kanpur**
  Mentor: Laxmidhar Behera, IIT Kanpur — *Jun. 2021 – Oct. 2021*
  - The aim of the project is to develop spacecraft constellation controlled using solar sail.
  - Designed and tested an unmanned vehicle in a team of five, which can lead to safer mining practices.
  - Developed a speech recognition software based on M11 model architecture to be used in vehicles' navigation systems.
  - The speech recognition software comprised of deep convolutional neural networks that directly used time-domain waveforms as inputs.
  - Designed a Web UI that displays live camera feed, gas sensor data and sound classification output in real time, enabling remote control of the vehicle within a range of 3 kilometres.
  - Installed a speech recognition software in the UI for navigating the vehicle remotely using voice commands. Communication between the vehicle and the UI occurred using UDP sockets.

Research Projects

Fast and accurate bayesian polygenic risk modelling with variational inference
Prof. Sahir Bhatnagar, McGill University, Montreal, Quebec, Canada *Jan. 2022 – Apr. 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 comparision 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.

Should supermarkets charge for plastic bags?
Prof. Faiz Hamid, IIT Kanpur *Jan. 2022 – Apr. 2022*
- As part of a team of three, coordinated the arrivals and departures of all trains located within the same electricity supply interval 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.

Twitter Sentiment Analysis **[Report]**
Prof. Faiz Hamid, Data mining and Knowledge Discovery (IME672) *Jan. 2022 – Apr. 2022*
- A recently developed trajectory tracking control system for a wheeled mobile robot is presented in this study, which includes hierarchical sliding mode and backstepping control algorithms
- The closed-loop stability and zero tracking error are guaranteed by the backstepping hierarchical sliding mode tracking control. The method's usefulness and aptitude for practical applications are demonstrated by numerical simulation results.

Document Classification with deep convolutional neural network **[Report]**
Prof. Tushar Sandhan, Image Processing (EE604A) *Aug. 2021 – Dec. 2021*
- The optimal convergence of the tracking error and an optimal error dynamics that achieves this optimal pattern as well as guarantees the finite-time convergence for guidance law design is proposed.
- Developed laws will be compared with proportional navigation and guidance (PNG) and sliding motion control (SMC) to comapare results and illustrate performance.

Acoustic Event Detection **[Report]**
Prof. Vipul Arora, Advanced topics in Machine learning (EE698R) *Dec. 2019 – May. 2020*
- Identified onset, offset times and labels of multiple acoustic events present in audio clips on millisecond level by extracting mel-spectrgram features.
- Employed CNNs, RNNs, hybrid CRNNs, LSTM, and HMM based models to detect audio events and achieved F1 score of 0.91
- 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.

Technical Projects

Deep-Into-CNN **[Github]**
Programming Club, IIT Kanpur *Apr. 2020 – Dec. 2020*
- Developed biologically inspired robot that mimics structure and behaviour of Cats under obstacle-avoidance team.
- Implemented and tested a new method of Advanced Fuzzy Potential Field Method (AFPMF) which solved the problem of local minimum field disturbances at low computation.

Deep learning approaches for COVID-19 detection based on chest X-Ray images **[Report] [Github]**
Robotics Club, IIT Kanpur *May. 2020 – Jul. 2020*
- Implemented and tested GPS and ArUco-marker based navigation on Mars environment in Gazebo using OpenCV and ROS.
- Developed a new and efficient algorithm of combining Depth maps and A* algorithm for obstacle avoidance.

Coursework

Core Aerospace Engineering: Space Dynamics[g], Flight Mechanics, Incompressible Aerodynamics*, Compressible Aerodynamics, Aerospace Structures, Air Breathing Propulsion, Solar System Mechanics[g], Introduction to Robotics

Control Systems: Classical Control System, Basics of Modern Control Systems[g], Non-linear Systems *[g], Optimal Control and Reinforcement Learning[g]

Mathematics: Partial Differential Equations*, Linear Algebra & ODE, Real Analysis & Multivariate Calculus, Complex Analysis

: Awarded A grade for exceptional performance, [g]: Graduate level Course

Technical Skills

Programming Skills: C/C++, Python, Bash

Robotics : ROS, basilisk, OpenCV, Gazebo, Rviz

Utilities: MATLAB, Simulink LabView, Linux, Git, Autocad, Arduino IDE, LaTeX

Framework: PyTorch, NumPy, MatPlotLib

Language Skills

English: Full Professional Proficiency

Hindi: Native Proficiency

Achievements and Accolades

- National top 0.1% 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.

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