

# Achint Soni

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📄 Achint Soni

## Education

- **Research Masters (MMath Thesis), University of Waterloo** **Ontario, Canada**  
Major: Computer Science Sep'23 - Jun'25 (Expected)
- **B.Tech, Indian Institute of Technology Kanpur** **Kanpur, India**  
Major: Electrical Engineering | Minor: Machine Learning, Theory of Computing | GPA: 3.57/4 Jul'19 - May'23

## Research Interests

Image and Video generation, Vision-Language models, Foundation models for decision making (Generative world models), Representation learning, Probabilistic ML

## Publications

(\*: equal contribution)

- **VideoAgent: Self-Improving Video Generation** [paper][website]  
Achint Soni\*, V. Sreyas\*, Abhramil Chandra\*, Sebastian Fischmeister, Percy Liang, Bo Dai, Sherry Yang  
Preprint - Submitted to ICLR, 2025
- **VIDEOSCORE: Building Automatic Metrics to Simulate Fine-grained Human Feedback for Video Generation** [paper][website]  
Xuan He\*, Dongfu Jiang\*, Ge Zhang, Max Ku, Achint Soni, ..., Bill Yuchen Lin, Wenhui Chen  
EMNLP Main, 2024
- **Why do VAEs really promote disentanglement** [paper][code]  
Pratik Bhowal, Achint Soni, Sirisha Rambhatla  
ICML, 2024

## Research Internships

- **Mobility data for public health decision-making post-COVID-19** **Mentor: Prof. Sahar Saeed**  
Queen's University, Canada Jun'22 - Dec'22
  - Analyzed SafeGraph mobility data across Canada to support decision-making in post-pandemic public health strategies.
  - Assessed mobility data representativeness by comparing sampled devices with Census counts across geographic levels.
  - Modeled healthcare visit patterns across provinces using a quasi-Poisson model, examining disparities in visits.
  - Estimated healthcare facility utilization during the pandemic using geographic catchment analysis to assess regional demands.
  - Constructed an inequity map by comparing expected and observed healthcare utilization across Census Block Groups.
- **Fast and accurate Bayesian Polygenic Risk Modelling using Variational Inference** May'22 - Jul'22  
MITACS GRI, McGill University, Canada
  - Implemented a Bayesian polygenic risk score method using variational inference to estimate posterior effect sizes from genome data, ensuring efficiency, accuracy, and scalability for large datasets and various genetic architectures.
  - Reproduced results on real and simulated traits, validating predictive performance on datasets with over 9.6 million SNPs.
  - Showed efficiency by comparing to MCMC methods, highlighting speed and accuracy in polygenic risk estimation.
- **Student Research Associate** Sep'21 - Nov'21  
Department of Biotechnology, Government of India
  - Deployed a classification model to detect motor imagery brain signals using an open-source OpenBCI-EEG headset.
  - Implemented a Variational Autoencoder to disentangle and remove distinct EEG artifacts, such as eye movements, tongue movements, and electrode noise, improving signal quality for downstream tasks.
- **Undergraduate Research Associate - SURGE'21, IIT Kanpur** [code]  
Intelligent Systems and Controls Lab, IIT Kanpur Jun'21 - Sep'21
  - Developed and trained a CNN-based system using mel spectrograms for real-time speech command recognition.
  - Optimized the model to improve accuracy and response time, making it suitable for practical voice-controlled applications.
  - Extracted spectral features using Mel-Frequency Cepstral Coefficients (MFCC) for relevant speech audio representation.
  - Integrated the model into an unmanned mine inspection vehicle, successfully testing it on both English and Hindi speakers for voice-activated control.

## Research Projects

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- **Novel Noise Warping Method for Temporal Correlation in Video Generation** **Mentor: Wenhua Chen**  
*Tiger AI Lab, University of Waterloo* *Jan'24 – May'24*
  - Developed a noise warping approach for accurate, distribution-preserving transport of Gaussian noise in video generation.
  - Utilized integral noise, reinterpreting individual noise samples in diffusion models as continuously integrated noise fields.
  - Derived a noise transport equation and designed a method to enhance temporal correlation while preserving noise properties.
- **Acoustic Event Detection** **Mentor: Prof. Vipul Arora**  
*Machine Analysis of Data for Human Audition and Vision lab, IIT Kanpur* *Apr'22 – May'22*
  - Detected acoustic event onset, offset, and labels in audio clips with millisecond precision using mel-spectrogram features.
  - Utilized models such as CNNs, RNNs, CRNNs, LSTMs, and HMMs, achieving a 0.91 F1 score for accurate event detection.
  - Applied techniques like Gibbs sampling, Monte Carlo sampling, and Normalizing Flows to improve analysis robustness.
  - Developed Generative Adversarial Networks (GANs) and Variational Autoencoders (VAEs) to model Gaussian Mixture Models, enabling detailed exploration of acoustic event distributions and improving the generation of realistic event patterns.
- **Optimizing Plastic Bag Pricing for Carbon Footprint Reduction** **Mentor: Prof. Faiz Hamid**  
*IIT Kanpur* *Jan'22 – Apr'22*
  - Developed an optimization model to find the best pricing strategy for plastic bags, balancing profits and carbon footprint.
  - Developed a reward policy to reduce plastic use while maintaining sales, balancing environmental impact and profitability.
- **Forecasting COVID-19 Vaccination Demand Using Twitter** **[code]**  
*IIT Kanpur - in collaboration with University of Hull* *Sep'21 – Jan'22*
  - Developed a semi-supervised learning approach using RNNs to predict COVID-19 vaccination demand from tweets.
  - Designed a mathematical model to calculate the likelihood of demand based on tweet timing and content.
  - Built a data dictionary to capture supportive and request words, enhancing model robustness to temporal dependencies.
  - Demonstrated the model's superiority over other neural network-based approaches in forecasting accuracy.

## Projects

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- **Document Image Classification with Intra-Domain Transfer Learning**  
*Mentor: Prof. Tushar Sandhan, IIT Kanpur* *Jan'23 – Mar'23*
  - 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.
- **Twitter Sentiment Analysis**  
*Independent course project, IIT Kanpur* *Aug'21 – Oct'21*
  - 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.
- **Deep learning approaches for COVID-19 detection based on chest X-Ray images**  
*Independent course project, IIT Kanpur* *Jul'20 – Sep'20*
  - Designed a deep learning system to extract features and detect COVID-19 from chest X-ray images.
  - Automated 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.
  - Utilized transfer learning with ResNet50, achieving 96.32% accuracy on training data and 94.53% on validation data.

## Technical Skills

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**Programming Skills:** C/C++, Python, CUDA, L<sup>A</sup>T<sub>E</sub>X

**Libraries:** PyTorch, Jax, Tensorflow, HuggingFace, Keras, Einops, OpenCV, Sklearn

**Tools & OS:** Git, VS Code, MacOS, Linux(Ubuntu)

## Achievements and Accolades

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- Received MITACS Graduate Fellowship for aiding my graduate research
- Top 0.05% in JEE Advanced 2019, outperforming 230,000 candidates nationally in India
- Top 0.1% in JEE Mains (2019), among 1.6 million candidates nationally in India
- Among the top ten recipients of the INFORMS Scholarship, 2022.