

# MUSKAN GOYAL

720-313-5502 | Email: muskan.goyal@colorado.edu | Portfolio: muskan-goyal6.github.io | LinkedIn: linkedin.com/in/Muskan-goyal6/ |  
Google Scholar | Github: github.com/Muskan-goyal6

## EDUCATION

- University of Colorado Boulder, USA** | Master of Science (Computer Science) August 2022 – May 2024
- Design & Analysis of Algorithms, NLP, Software Engineering, ML, Data Mining, Big Data Architecture | **GPA:3.88/4**
- Maharaja Agrasen Institute of Technology, Delhi, India** | B. Tech (Computer Science and Engineering) August 2017 – June 2021
- Applied Mathematics, Operating Systems, Object Oriented Programming, DBMS | **CGPA:8.31/10**

## TECHNICAL SKILLS

**Languages:** Java, Python, HTML/CSS, Javascript, SQL, C/C++

**Tools & Frameworks:** Numpy, Pandas, Matplotlib, SciKit, Spacy, NLTK, TensorFlow, Keras, PyTorch, Hugging Face transformers & datasets, LLMs, Git, Colab, PostgreSQL, MySQL, Tableau, Google Data Studio, Vue.js

**Cloud Services:** AWS (EC2, S3, RDS, Lambda)

**Other Skills:** GitHub Actions, Jupyter Notebook, Android Studio, Apache Spark

**Technical:** Computer Vision, Deep Learning, Machine Learning, Data Analysis, Data Visualization, Agile Methodologies, Web Development.

## WORK EXPERIENCE

- Machine Learning Intern | Arbol Inc., NY, USA** July 2022 – Present
- Deployed Google Dynamic World model and Google earth model on Sentinel-2 dataset for improved classification of forest, land, and water, as compared to our existing model. Used **Python** libraries including **geemap**, **rasterio**, and **google earth engine** to facilitate the implementation.
  - Partitioned and downloaded the resulted Sentinel tiles in sections of 256x256 pixels. Then, reconstructed the downloaded parts into a singular tile to enable visualization with **QGIS** effectively.
  - Developed a comprehensive modular function in **TensorFlow** that accepts a Sentinel-1 ID as input and provides a corresponding Dynamic World TIF file with pixel-level alignment to the Sentinel-2 tile. Reduced manual intervention and streamlined the workflow by **up to 80%**.
  - Currently, building GANs for SAR to optical image transformation and SAR image denoising in PyTorch.

- Research Assistant | Indraprastha Institute of Technology, Delhi, India** September 2021 – July 2022
- Collaborated with a team of 5 members to conduct a detailed research analysis on types of privacy attacks on machine learning and deep learning models (model extraction, model inversion, membership inference, and property inference).
  - Reviewed literature on various defensive measures to protect the privacy and confidentiality of models against different attacks.
  - Reproduced black-box model attacks on ML Systems using techniques like ActiveTheif and Knockoff Nets in **PyTorch**.
  - Proposed a technique to build a shadow model that helps in black-box model explanations to explore and understand the behavior of any black-box model in different feature spaces with **PyTorch**.

- Research Engineer Intern | University of Fortaleza, Brazil** March 2020 – May 2020
- Created the chest x-ray dataset for training and evaluation pipeline using techniques such as resizing, normalization, and image hashing algorithm for removing the duplicates.
  - Engineered a CNN architecture by adding custom layers to VGG16 model for Covid-19 detection. Designed and executed an Auxiliary Classifier Generative Adversarial Network (AC-GAN) based model called CovidGAN that generated synthetic chest x-ray images in **Keras and TensorFlow**.
  - Result:** The addition of synthetic images produced by CovidGAN increased the accuracy of CNN for Covid-19 detection from 85% (F1-score 0.83) to 95% (F1 score 0.95). Published in IEEE Access.

- Research Engineer Intern | Center Edge Hill University, Lancashire, England** Sept 2019 – Dec 2019
- Trained and evaluated 4 established CNN architectures for corn leaf disease classification: VGGNet, XceptionNet, EfficientNet, NASNet.
  - Performed Model Compression and developed an optimized DenseNet model for corn leaf disease identification with **Keras and TensorFlow**.
  - Proved that its performance was close to the established CNN architectures with significantly fewer parameters and computation time.
  - Used Grid Search method to find the optimal hyperparameter values and analyzed the models' performance through rigorous simulations.
  - Result:** The proposed DenseNet was computationally cost-effective with 98.06% accuracy, 0.07 million parameters and it took 3 minutes per epoch. Paper published in Computers and Electronics in Agriculture, Elsevier.

## PUBLICATIONS

- "Domain-Controlled Title Generation with Human Evaluation"**. In Proceedings of The International Conference on Innovative Computing and Communications (pp. 461-474), Springer, Singapore.
- "CovidGAN: Data Augmentation using Auxiliary Classifier GAN for improved Covid-19 Detection"**. Published in IEEE Access, volume 8.
- "An optimized dense convolutional neural network model for disease recognition and classification in corn leaf"**. Published in Computers and Electronics in Agriculture, Elsevier.

## SELECTED PROJECTS

- Excel Clone:** This web application clone of MS Excel is created using **HTML, CSS, and JavaScript** entirely. It has a completely responsive design with features like text formatting, address bar, formula evaluation, multiple sheet handling functionality, and two-way binding for cell properties. It also has cycle detection algorithm and color tracking for formula cycle validation.

- **White-Board:** Built an Open Board web application where we can make real-time 2D graphical drawings with **Canvas API and web sockets**. This board has options like draw, erase, undo/redo, sticky notes, and downloading functionality. Created Undo-Redo features for the board using arrays as stack by storing positions, color, and width of the pen and eraser.
- **Camera-Gallery:** Developed a Camera with Gallery application that heavily utilized **browser APIs** including Media Stream, Media Recorder, Media Devices, **IndexedDB** (client-side storage), and Canvas. This web application is equipped with features like image capturing with filters, video recording, and a gallery with in-browser storage.
- **Budget-Based Recommendation System:** Engineered a **SPA using Vue.js**, integrating with 3+ services like S3, Weather API, and GoogleMapsAPI. Implemented 7+ unique features, including user based tailored activity suggestions, itinerary planning, and real-time metrics related to trip. Deployed with a **CI/CD pipeline via GitHub actions**, cutting deployment times by 25%.
- **Flipkart Phone Sales Analysis:** Categorized the dataset of phone models according to the market segments, namely, budget, midrange and flagship. Plotted various bar graphs and box plots in **Colab** to study the brand, rating, color, and selling price of various models. Designed a 2-page dashboard in **Google Data Studio** to provide a high-level summary of Flipkart phone sales with the ability to drill down and reveal deeper information. Dashboard can also monitor the phone specifications like total memory and storage capacities, prices, and the selling value per segment for each brand.
- **Foreign Direct Investment (FDI) Case Study:** Created a Dashboard on **Tableau** to visualize the behavior and variation of investment in various service sectors. Examined the projection of FDI over the years, as well as the trend and growth of FDI.
- **Sentiment Analyzer:** Conducted **Exploratory Data Analysis** and built a Sentiment Analyzer for Amazon reviews and IMDB dataset (total 64000 reviews). Analyzed the stopwords, frequency of words, distribution of rating scores, and the results. Cleaned the dataset and experimented with various models (Naive Bayes, XGBoost, MLP, RNN, BERT) for comparative insights. BERT gave the highest accuracy with 89% on IMDB and 95% on Amazon dataset.

## **ACHIEVEMENTS and SERVICES**

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- Grand Finalist in Smart India Hackathon 2019.
- Volunteer at the International Conference on Innovative Computing and Communication 2020 (ICICC 2020).
- Collaboration story of CovidGAN appeared in WTT Ventures' study "From Pelotas to Boa Vista: scientific partnerships to face the pandemic".