# Kushagra Mahajan

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## Education

**Carnegie Mellon University, School of Computer Science** *Pittsburgh, PA*
*Master of Computational Data Science — GPA: 4.05/4.00* Aug. 2021 – Dec. 2022
- *Coursework*: Machine Learning, Machine Learning for Large Datasets, Natural Language Processing, Cloud Computing, Visual Learning and Recognition, Multilingual NLP, Multimodal ML, **Best Capstone Solution Award**

**Indraprastha Institute of Information Technology Delhi (IIIT Delhi)** *Delhi, India*
*Bachelor of Technology in Computer Science — GPA: 8.78/10.00* Aug. 2014 – Dec. 2018
- Coursework: Computer Vision, Probabilistic Graphical Models, Data Mining, Collaborative Filtering, Machine Learning (Teaching Assistant - Fall '18), Data Structures and Algorithms, Compiler Design, Database Systems, Operating Systems.

## Experience

**Amazon** *Seattle, WA*
*Software Engineer — AWS S3* Aug. 2023 – Present
- Working on an asynchronous task scheduling and submission sub-system for **scheduling ML workloads**. It accepts model training and inference requests from clients, and guarantees high throughput execution while maintaining customer fairness.

**Carnegie Mellon University** *Pittsburgh, PA*
*Meta AI Sponsored Research Assistant — Advisor: Prof. Louis-Philippe Morency* Feb. 2023 – Aug. 2023
- Worked with **Meta AI** on **multimodal user satisfaction estimation for VR/AR glasses** (Quest Pro) using several modalities like 3D head and body pose, IMU data, facial expressions, eye gaze, language, acoustic, and physiological modalities. Used multimodal representation learning techniques like HighMMT, and personalization through Neural Mixed Effect Models.

*CMU Capstone — Advisor: Prof. Yonatan Bisk* Jan. 2022 – Dec. 2022
- Built state-of-the-art systems for navigation, localization, mapping and interaction of a **virtual robot** based on user-assigned real-world tasks in collaboration with **Amazon Alexa AI**.

**TCS Research and Innovation Labs** *Delhi, India*
*Machine Learning Engineer — Computer Vision Team | Advisors: Dr. Lovekesh Vig & Dr. Gautam Shroff* Feb. 2019 – April 2021
- Designed a **meta-learning** based framework for **skin lesion** and **chest x-ray classification**, and **segmentation** of medical and natural scene images. Published **3 papers** [2, 3, 4] and built **2 products**.
- Explored **disentangling biological signals** from noise in **cellular images** using **CNNs and ArcFace loss** and achieved top-5 percentile in NeurIPS 2019 challenge with test accuracy 96.06%. Used **distributed computing** to parallelize the algorithms.
- Built an end-to-end **alignment and information extraction** system for document images using a novel **keypoint extraction algorithm**. Product sold to the Landmark Group. Published **1 paper** [5] and filed **1 patent** [1].

**Intel Corporation** *Bangalore, India*
*Machine Learning Intern | Advisor: Mr. Tigi Thomas* Aug. 2017 – Dec. 2017
- Created a highly optimized **sensor-based gesture detection and recognition** model for **on-device** deployment surpassing benchmarks for memory constraints and output latency. Tested by deploying model on laptop hardware.

**CVML Lab, IIIT Delhi** *Delhi, India*
*Machine Learning Intern | Advisor: Prof. Chetan Arora* Aug. 2016 – Dec. 2018
- Used texture descriptors **(Gabor filters)** to improve clothing segmentation **(DeepLabV2, FCN)** by 3% for **visual fashion image and attribute search** systems. Exploited **pose structure** to enhance SoA **fine-grained classification** performance by 2-3% using CNNs across standard FGVC datasets. Published **2 papers** [6, 7].

## Projects

**Twitter Cloud Native Web Service with Microservices** *Spring 2022*
*Course Project: Cloud Computing | Advisor: Prof. Majd Sakr*
- Created an **ETL pipeline using Spark** for processing **1.2TB Twitter data**, and a **microservice** based architecture using **Kubernetes** for data retrieval and running analytic jobs in a **cost constrained** setting.

**Multimodal Image to Recipe Generation** *Fall 2022*
*Course Project: Multimodal ML | Advisor: Prof. Louis-Philippe Morency*
- **Transformer based** recipe generation from food images using a novel approach comprising **co-learning** ingredients, **component-aware embeddings**, **contrastive loss** for semantic similarity, and **improved evaluation metrics**. [Report]

**Natural Language Inference for Code-Switched Hinglish** *Spring 2022*
*Course Project: Multilingual NLP | Advisor: Prof. Alan Black*
- **Improved SoA** on GLUECoS benchmark by **6%** for **code-switched Hindi-English** by translating to matrix or embedded language, and adaptation of language models to the code-switched domain using **transformer models XLM-R, mBERT, mT5** etc. [Report]

## Patents and Publications


[1] **K. Mahajan**, M. Sharma, L. Vig, Tata Consultancy Services Limited. "Method and System for Keypoint Extraction from Images of Documents". Filed at the Indian Patent Office. Number: 201921035983 (PCT filed. Number: WO2021044447A2)

[2] **K. Mahajan**, M. Sharma, L. Vig. "Meta-DermDiagnosis: Few-Shot Skin Disease Identification using Meta-Learning". IEEE International Conference on Computer Vision and Pattern Recognition 2020 Workshops (CVPRW). [PDF]

[3] **K. Mahajan**, T. Khurana, A. Chopra, I. Gupta, C. Arora, A. Rai. "Pose Aware Fine-Grained Visual Classification Using Pose Experts". 25th IEEE International Conference on Image Processing (ICIP) 2018. [PDF]

[4] T. Khurana, **K. Mahajan**, C. Arora, A. Rai. "Exploiting Texture Cues for Clothing Parsing in Fashion Images". 25th IEEE International Conference on Image Processing (ICIP) 2018. [PDF]

[5] A. Pandit, **K. Mahajan**, S. Kunde. et. al. "Data-Efficient Training of High-Resolution Images in Medical Domain". 29th European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning (ESANN) 2021. [PDF]

[6] **K. Mahajan**, M. Sharma, L. Vig. et. al. "CovidDiagnosis: Deep Diagnosis of COVID-19 Patients Using Chest X-Rays". IEEE International Workshop on Thoracic Image Analysis, MICCAI 2020. [PDF]

[7] **K. Mahajan**, M. Sharma, L. Vig. "Character Keypoint-based Homography Estimation in Scanned Documents for Efficient Information Extraction". CBDAR workshop at the 15th IEEE International Conference on Document Analysis and Recognition (ICDAR) 2019. [PDF]


## Skills & Achievements

**Programming Languages, FrameWorks and Tools**: Python, C, C++, Java, SQL, Tensorflow, Pytorch, Keras, Spark, PySpark, Caffe, OpenCV, Scikit, NumPy, Pandas, SciPy, EspNet, Kafka, Samza, HBase, MongoDB, AWS, Azure, Kubernetes, Docker, Git
**Achievements**: Best Capstone Solution Award (MCDS at CMU), *Travel Grant*: AICTE-INAE for ICIP 2018, *Dean's List*: 2017-2018.