Kushagra Mahajan

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Education

Carnegie Mellon University, School of Computer Science — **Aug. 2021 – Present**
Master of Computational Data Science — GPA: 4.06/4.00 — *Pittsburgh, PA*
- *Coursework*: Machine Learning, Machine Learning for Large Datasets, NLP, Cloud Computing, Visual Learning and Recognition, Multilingual NLP, Multimodal ML

Indraprastha Institute of Information Technology Delhi (IIIT Delhi) — **Aug. 2014 – Dec. 2018**
Bachelor of Technology in Computer Science — GPA: 8.78/10.00 — *Delhi, India*
- 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 — **May 2022 – Aug 2022**
Software Engineering Intern — Installments Team — *Seattle, WA*
- Analyzed payment failure data and **improved web page notification** system for **payment failures** to be more descriptive and provide rectification steps to customers using **Java**. Reduced customer tickets regarding payment failures by 72%.

Carnegie Mellon University — **Jan 2022 – Present**
Research Assistant — Advisor: Prof. Yonatan Bisk — *Pittsburgh, PA*
- Building state-of-the-art systems for navigation, localization, mapping and interaction of a **virtual assistant bot** with the Arena environment based on user-assigned real-world tasks in collaboration with **Amazon Alexa AI** as part of the **Simbot Challenge**. Currently **ranked #1 on the Amazon Leaderboard**.

TCS Research and Innovation Labs — **Feb. 2019 – April 2021**
Machine Learning Engineer — Computer Vision Team | Advisors: Dr. Lovekesh Vig & Dr. Gautam Shroff — *Delhi, India*
- 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** for chest x-ray analysis, and skin lesion detection.
- 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%. Worked on **distributed training**, abnormality detection in X-rays using **GANs**, **visual attention**.
- 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 US patent** [1].

Intel Corporation — **Aug. 2017 – Dec. 2017**
Machine Learning Intern | Advisor: Mr. Tigi Thomas — *Bangalore, India*
- 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 — **Aug. 2016 – Dec. 2018**
Machine Learning Intern | Advisor: Prof. Chetan Arora — *Delhi, India*
- 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% across standard FGVC datasets. CNNs **VGG16, AlexNet** etc. were used as pose experts. Curated an Amazon pose-aware apparel dataset. 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 **state-of-the-art NLI performance** 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 like 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] 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]

[3] **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]

[4] **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]

[5] **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]

[6] **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]

[7] 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]

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
Achievements: *Travel Grant*: AICTE-INAE for ICIP 2018, *Dean's List*: 2017-2018, Teaching Fellow at Vivekananda Kendra, Delhi.