KUSHAGRA MAHAJAN

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Education

- **Indraprastha Institute Of Information Technology (IIIT) Delhi, India** — **CGPA: 8.78**
  Bachelor of Technology in Computer Science and Engineering — Aug. 2014 – Dec. 2018
- **Delhi Public School, Rohini, India** — **91.8%**
  Senior Secondary Education (Class XII, CBSE) — May 2014

Work Experience

- **TCS Research and Innovation Labs** — Gurgaon, India
  Researcher [Guide: Dr. Lovekesh Vig] — *Feb. 2019 - Present*
  - **Document Image Alignment and Information Extraction:** Used unambiguous points in characters as keypoints for homography estimation to accurately align document images with a template document. This novel, fast, and memory efficient approach allows precise retrieval of document fields, followed by text recognition on a large scale. Tested on real world datasets of different kinds of forms.
  - **Medical and Cellular Image Analysis:** Worked on abnormality detection in X-ray images on the Stanford MURA dataset. Used anomaly detection GAN and autoencoders, visual attention and body parts ensemble model for classification. Also, worked on the NeurIPS 2019 competition on disentangling biological signals from experimental noise for classifying gene mutations from cell images. Obtained test accuracy of **96.06% (top 5 percentile)** using site-channel composite model, appropriate data preprocessing and ArcFace loss.
  - **Meta-Learning:** Used meta-learning for classification of skin lesions on the ISIC 2018 dataset (with Group Equivariant CNN) and thoracic diseases from the NIH Chest X-ray dataset, obtaining better performance over other few-shot approaches. Extending meta-learning to segmentation of natural scene images, and tumors in different body parts using CT Scan data. Work is in collaboration with the Institute of Liver and Biliary Sciences, Delhi.
- **Computer Vision and Machine Learning Lab, IIIT Delhi** — Delhi, India
  Undergraduate Researcher [Guide: Prof. Chetan Arora (now at IIT Delhi)] — *Aug. 2016 - Oct. 2018*
  - **Fine-grained Visual Classification:** Exploited the pose structure in FGVC problems by creating an ensemble of pose experts and a meta network for aiding pose identification. Proposed approach demonstrated an improvement in classification performance over the state-of-the-art on the Stanford Cars, FGVC-Aircrafts, DeepFashion datasets along with the contributed Footwear dataset.
  - **Texture-assisted Parsing:** Used the texture cues from texture descriptors like Gabor and LBP using early and late fusion strategies for merging the texture and segmentation streams. Approach improved the state-of-the-art segmentation performance on the benchmark fashion parsing datasets, Fashionista and CFPD.
- **Intel Corporation, India** — Bangalore, India
  Undergraduate Technical Intern [Guide: Mr. Tigi Thomas] — *Aug. 2017 - Dec. 2017*
  - **Hand Gesture Detection and Recognition:** IP project on sensor based hand gesture detection and recognition for virtual reality devices and laptops. My task was data preprocessing, followed by building machine learning models for gesture detection and recognition taking into consideration memory constraints and output latency. Tested on Google Maps and music system applications by providing gesture controls.
- **Indian Institute of Technology Delhi (IIT Delhi)** — Delhi, India
  Research Intern, Computer Architecture Lab [Guide: Prof. Smruti R. Sarangi] — *Dec. 2015 - Jul. 2016*
  - **ARM Emulator:** Worked on building an emulator for compiling, running and debugging programs written in the ARM and Thumb assembly languages. The emulator is currently deployed in the Computer Architecture course at IIT Delhi and the University of Adelaide.
  - **DRAM Simulator:** Built a cycle accurate DRAM memory controller model. It leverages a combination of event driven and cycle based simulations, and the performance is at par with the state-of-the-art simulator, DRAMSim2. It is part of the architectural simulator Tejas at IIT Delhi.
- **Teaching Assistant, IIIT Delhi** — Delhi, India
  Course: Machine Learning [Instructor: Prof. Saket Anand] — *Aug. 2018 - Dec. 2018*
  - Teaching Assistant for the Machine Learning course offered in Fall 2018 semester at IIIT Delhi taken by 130 students. I was responsible for preparing and grading assignments, quizzes, and mentoring projects.

Patents and Publications

- **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 (in process for US filing)
- **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).
- **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] **(Presented)**
- **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] **(Presented)**
- 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] **(Presented)**

Academic Projects

- **Unsupervised Disentangling of Factors of Variation in Speech** *May 2017 - July 2018*
  Used cycle-consistency and a discriminator for the disentanglement of speaker style information from speech samples in the Timit dataset. We build on top of the Factorized Hierarchical VAE approach proposed by CSAIL, MIT. Also developed CNN-RNN architectures for emotion classification, achieving competitive performance to the state-of-the-art.
- **Matrix completion based imputation for single-cell RNA-seq data** *Aug. 2018 - Dec. 2018*
  Showed that the graph regularized matrix completion model outperforms the standard nuclear-norm minimization based matrix completion model on most real world single-cell RNA sequencing datasets using standard evaluation metrics such as clustering of cell populations, cell type separability, cell visualization etc.
- **Dynamic Traffic Light System** *Jan. 2017 - May 2017*
  Compared the performances of HOG, DPM and Single Shot Detector for detecting vehicle density at a traffic junction in surveillance videos. Integrated lane isolation, vehicle speed detection, KLT tracking to create a deployable system.
- **Analysis of Customer Churn Patterns to Improve Customer Retention** *Aug. 2018 - Dec. 2018*
  Project aimed at deriving insights from data that help businesses, particularly telecom companies, retain their customer base using IBM's Telco Customer Churn dataset. Analyzed preprocessing, feature selection and outlier detection techniques, used clustering to find patterns in the data and classification approaches for predicting customer churn.

Skills

Programming Languages: C, C++, Java, Python, Matlab, R, SQL, HTML, JavaScript
Tools and Technologies: Caffe, Keras, Tensorflow, PyTorch, Kaldi, OpenCV, Scikit Learn, Linux, NodeJS

Relevant Coursework

Analysis and Design of Algorithms, Discrete Mathematics, Probability and Statistics, Introduction to Calculus (Coursera), Introduction to Ordinary Differential Equations (Coursera), Computer Organisation, Operating Systems, Signals and Systems, Compiler Design, Database System Implementation, Image Analysis, Machine Learning, Computer Vision, Data Mining, Collaborative Filtering, Probabilistic Graphical Models

Awards and Scholarships

- **AICTE-INAE Travel Grant** to present papers at ICIP 2018 *July 2018*
- Part of the **Dean's List 2017** for outstanding academic performance at IIIT Delhi *September 2017*
- **Gold Medalist** for 7 consecutive years of academic excellence at DPS Rohini *May 2014*
- **Principal's cash award winner** for highest marks in Computer Science in class XII at DPS Rohini *May 2014*

Co-curricular Activities

- **Community Involvement**
  - Teaching Fellow at Vivekananda Kendra (May 2018 - July 2018) and Sewa Bharti (May 2015 - July 2015). I helped under-privileged students gain valuable exposure to computer softwares like Ms Excel, Ms Powerpoint and taught them English grammar and elementary Maths.
- **Interests & Hobbies**
  - Cleared Grade 4 exam in Electronic Keyboard Practical and Grade 3 exam in Music Theory organized by Trinity College London in Jan. 2012.