Ankur Singh

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Academic Qualifications

Year	Degree	Institute
Aug 2020 - Ongoing	M.Tech, Electrical Engineering	Indian Institute of Technology, Kanpur
Aug 2016 - July 2020	B.Tech, Electrical Engineering	Indian Institute of Technology, Kanpur
March 2015	AISSCE	Air Force School, Viman Nagar, Pune
March 2013	AISSE	Air Force School, Viman Nagar, Pune

Research Interests

- **Deep Learning**, **Computer vision**, **Incremental Learning**, **Self-Supervised Learning**, **Medical Imaging**

Scholastic Achievements

- **Secured All India Rank 636 in JEE Advanced 2016 (99.682 percentile)**
- **Secured 99.18 percentile in JEE Mains 2016**
- **Holder of Prime Minister Scholarship**

Publications

- **The Curious Case of Convex Networks** , Sarath Sivaprasad, Ankur Singh, Naresh Manwani, Vineet Gandhi. **ECML 2021 [Link]**

- **CT Image Synthesis Using Weakly Supervised Segmentation and Geometric Inter-Label Relations For COVID Image Analysis**, Dwarikanath Mahapatra, Ankur Singh, Behzad Bozorgtabar. *Under Review at* **MedIA [Link]**

- **Pedestrian Intention Prediction with Multi-Input Concatenation**, Ankur Singh, Upendra Suddamalla. **CVPR** Workshops 2021 **[Link]**

- **Video Colorization using CNNs and Keyframes Extraction: An application in saving bandwidth**, Ankur Singh, Anurag Chanani, Harish Karnick. **CVIP '19 Oral [Link]**.

Research Experience

- **Semi-Supervised Super Resolution, M.Tech thesis** (Sep' 20-Ongoing)
  With **Prof. Piyush Rai, Prof. Vipul Arora, IIT Kanpur**
  - The goal is to convert a low-resolution climate/weather forecast into a high-resolution forecast using deep learning
  - The proposed method involves different super-resolution techniques using **GANs** and **Fully Convolutional Networks**

- **Pedestrian Intention Estimation** (Sep' 20-Ongoing)
  Research Intern, Moovita Singapore
  - The aim is to determine pedestrian intentions such as crossing the road in the path of the ego-vehicle
  - Using pose based information, surroundings context information, location data and spatio temporal CNNs for the task

- **Convex Neural Networks** (Aug' 20-Nov '20)
  With **Prof. Vineet Gandhi, IIIT Hyderabad**
  - Investigated a constrained formulation of neural networks where the output is a convex function of the input.
  - Showed that these networks have outstanding generalization ability and robustness to label noise
  - Experiments showed that convex MLP networks outperform vanilla MLP on standard image classification datasets

- **Medical Imaging for Covid Image Analysis** (April '20-July '20)
  With **Dr. Dwarikanath Mahapatra, Inception Institute of Artifical Intelligence**
  - Generated synthetic images to train networks for segmenting COVID-19 infected areas from lung CT images.
  - Introduced a weakly supervised segmentation (WSS) step that segments a CT image into different labeled regions.
  - The generated segmentation maps are used to model the geometric relationship between the different pathological regions.

- **Adversarial Incremental Learning** (May '19-Nov '19)
  With **Prof. Vinay Namboodiri, IIT Kanpur**
  - Formulated an approach using **Adversarial Learning** to tackle class-incremental learning in image classification.
  - The proposed model neither used exemplars nor any generative examples to preserve information about the old tasks.
  - Obtained **state of the art results** in class-incremental learning on CIFAR-100, MNIST and SVHN datasets.

- **Video Colorization using CNNs and Keyframes Extraction (CVIP '19 Oral)** (Aug '18-Nov '18)
  With **Prof. Harish Karnick, IIT Kanpur**
  - Developed an end to end framework that **extracts key frames** from a colored video and **trains a Convolutional Neural Network** from scratch on these colored frames.
  - Saved **two thirds** of bandwidth while transmitting a video using the proposed method.
  - The whole process starting from key frames extraction to training a model and then obtaining the colored output video, happened in **near real-time** using the proposed method.

- **ECG arrhythmia classification using 2D CNN** (May '18-July '18)
  Vios Medical, Bangalore
  - Used **2-Dimensional CNNs** instead of the traditional LSTM models to detect arrhythmia in ECG signals.
  - Achieved an accuracy of **98.31** in classifying 6 different types of arrhythmia using different classification networks
  - **Github Repository** of the project currently has **148 stars** and **82 forks**

Other Projects

- **Medical Imaging for Breast Cancer detection** (Apr '20-May '20)
  - Worked on BACH Grand Challenge for Computer Aided Detection of Breast Cancer from medical images.
  - Used Self Supervised Learning to pre-train networks for tackling less medical data.
  - Achieved an accuracy of 89% on the test set.

- **GANs** (Apr' 20)
  - Did a literature survey on different GANs such as Least Squares GANs, Cycle GANs, Super-Resolution GANs
  - Implemented Least Squares GANs, Cycle GANs and Super-Resolution GANs in Pytorch

- **Self-Supervised Learning** (Aug '19-Nov '19)
  - Did literature survey of various self-supervised learning techniques using different pretext tasks.
  - Experimented with different pretext tasks such as predicting image rotations, edge detection in images etc

- **Hierarchical Face localization and Drowsiness detection** (Dec '18)
  - Developed a near-realtime approach for heirarchical face localization and drowsiness detection.
  - Used temporal features of the video for drowsiness detection.

- **Word Boundary detection** (Aug '18 - Nov '18)
  - Used MFCC Vectors and spectrograms to detect word boundaries in speech.
  - Used Convolution Neural Networks on spectrograms for word boundaries.

- **Tweets Classification** (Dec '17)
  - Classified tweets mentioning personal intake of medicine in twitter using LSTM and Bidirectional LSTM.
  - Used self trained word embedding models to pre process the tweets using Word2Vec.

- **Prosthetic Arm** (May '17 - June '17)
  - Engineered an artificial gripper on the concept of prosthetics using 3D printing and communication via Bluetooth.
  - Employed micro-controllers(Arduino ATmega and Nano) to communicate with an auxilliary glove having flex sensors.

Technical Skills

- **Programming Languages**: Python, C, Matlab
- **Machine Learning Tools**: Pytorch, Keras, Tensorflow, Sklearn, Numpy, OpenCV, Pandas, NLTK, Matplotlib, PIL

Relevant Coursework

- Visual Recognition
- Image Processing
- Probability and Statistics
- Machine Learning
- Fundamentals of Computing
- Introduction to Real Analysis
- Neural Networks
- Linear Algebra
- Complex Variables