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My research interests lie in the general area of machine learning, particularly in deep learning and reinforcement learning as well as their applications in computer vision, game theory and autonomous driving

EDUCATION

- **National University of Computer and Emerging Sciences** — Lahore
  Master of Science in Data Science — *Aug 2018 – Present*

- **National University of Computer and Emerging Sciences** — Islamabad
  Bachelor of Science in Computer Science — *Aug 2013 – June 2017*

EXPERIENCE

Edraak Systems — Lahore
Machine Learning Engineer — *Feb 2020 - Present*

Computer Vision and Graphics Lab — LUMS, Lahore
MS Thesis Student — *Feb 2019 - Present*

- Worked on Cross-view Image Retrieval and currently working on Cyclist Detection

Vision Processing Lab — ITU, Lahore
Summer Intern — *Summer 2018*

- Worked on an end-to-end model for Indoor Self Driving Car

Recognition, Vision and Learning Lab — FAST NUCES, Islamabad
Machine Learning Intern — *Sep 2016 - May 2018*

- Worked on several problems including Mastering Tic Tac Toe using Self play and Reinforcement Learning, Autonomous driving in car simulations, Textual Image deblurring, Neural Steganography, Image Super Resolution and Nerve Segmentation

Recognition, Vision and Learning Lab — FAST NUCES, Islamabad
Summer Intern — *Summer 2016*

- Participated in DiDi Research Algorithm Competition For predicting number of drivers required in a certain area at a certain time

- Used Xgboost, Collaborative Filtering, Ensemble Of Classifiers, Decision Tree, Random Forest along with feature engineering techniques including augmenting features, removing and replacing features with mean value and data normalization

Dr. Majid Khan — FAST NUCES, Islamabad
Research Assistant — *Aug 2015 - Dec 2015*

- Worked on practical implementation of data security and information hiding algorithms

PROJECTS

- **Cross-view Image Retrieval**: Proposed a novel cross-modal retrieval method specifically for multi-view images to find a feature space as well as an embedding space in which samples from street-view images are compared directly to satellite-view images (and vice-versa) along with a new dataset
  - ANMRR : 0.02
  - mAP : 0.96
  - p@5 : 0.97
  - Precision : 0.96
  - Recall : 0.96
  - F1-Score : 0.96

- **Skin Classification**: Built a deep learning model that classifies skin images with samples of 8 common skin pathologies and carcinoma
  - Applied Transfer Learning using GoogleNet and ResNet
  - Generated Images using a Generative Adversarial Network
  - Test Accuracy : 0.935

- **Sentiment Analysis**: Built a model for sentiment analysis of movie reviews
  - Performed Visualization using t-SNE, Yellowbrick and WordCloud Pre processing using NLTK
  - AUC_ROC : 0.75
  - BAC : 0.528
  - Test Accuracy : 0.652

- **Indoor Self Driving Car**: Built a model for driving in a corridor
  - Successfully trained a model to predict steering angle from front view images

- **Alpha Zero on Tic Tac Toe**: Mastering tic tac toe using self play and reinforcement learning
  - 40-0 against seventh generation player on 3x3 Maze in 40 games

- **Autonomous Driving in Car Simulations**: Built a model for steering prediction on euro truck simulator 2
  - Applied DeepLabV3+ for Segmentation to use it as a side task
  - Worked on some other simulators including Carla and TORCS

- **Textual Image Deblurring**: Textual image deblurring using convolutional neural networks
  - Validation PSNR on ihradis : 18.64

- **Image Super Resolution**: Densely connected networks and perceptual losses for image transfer tasks
  - PSNR on Set 5 : 28.25
  - PSNR on Set 14 : 29.48
  - PSNR on Sun-Hays80 : 29.04
  - PSNR on Urban 100 : 29.35

- **Neural Steganography**: End to end trained cnn encoder-decoder networks for image steganography
  - Using CIFAR 10 and MNIST, Encoder-PSNR : 32.9
  - Using CIFAR 10 and MNIST, Decoder-PSNR : 32.0

- **Nerve Segmentation**: Predict nerve structure from ultrasound images of the neck
  - Built models using CNN, Skip connections, Xgboost, Residual Blocks

- Different models tried with modifications include U-Net, Fully Convolutional Networks for Semantic Segmentation
  - Achieved score of 0.69 using dice coefficient

- **Fish Localizer**: Predict bounding box of fishes in images
  - Labeled regions of images containing fishes with help of students
  - Used selective search for region proposal along with SVM and Artificial Neural Networks for classification

- **User Activity Recognition**: Predict user activity based on sensors data
  - 99% Accuracy and log loss of < 0.001 using Random Forest Classifier

Publications

- **Cross-view Image Retrieval - Ground to Aerial Image Retrieval through Deep Learning**
  International Conference on Neural Information Processing, 210-221, 2019

Technical Skills

- **Languages**: Python, C/C++, R, C#, Java, Go, JavaScript, MATLAB/Octave, Lua

- **Frameworks**: Tensorflow, Scipy, Keras, Scikit-learn, OpenCV, Caffe, Torch, Django

- **Others**: Bash, Git, Android, Latex, SSH