Arsal Syed

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Research Interest

My research focuses on building pedestrian trajectory prediction algorithms by leveraging computer vision and deep learning techniques. This is essential for numerous intelligent transportation applications such as situation understanding of connected and autonomous vehicles, intersection safety through traffic monitoring and robot-human interaction. I am interested in bringing machine learning research to industrial automation applications such as prognostics, predictive maintenance and health management.

Education

Sept '17 - Aug '21 **PhD**, Electrical Engineering, University Of Nevada Las Vegas (UNLV)
Coursework: Adaptive Controls , Non-Linear Systems, Digital Controls Theory, Adaptive Signal Processing

Jan '14 - Dec '15 **MS**, Electrical Engineering, New York Institute of Technology (NYIT)
Coursework: Multivariate Controls , Modern Control Theory, Probability Theory

Aug '08 - July '12 **BS**, Engineering Science, Ghulam Ishaq Khan Institute (GIKI), Pakistan

Skills

Deep Learning: RNN/LSTM, GAN, VAE, Transformers, Graph Neural Networks

Machine Learning: Logistic Regression, Random Forest, One-class SVM

Computer Vision: Semantic Segmentation (SegNet, PSP-Net), Object Detection (Yolo, R-CNN)

Programming: Python(Tensorflow, Keras, PyTorch, Scikit-Learn), Matlab, R

AV Datasets: CamVid, Cityscapes, NuScenes, Lyft, Ford, Agroverse, KITTI

AWS and MLOps: Redshift, S3, Kinesis, Lambda, MLFlow, DynamoDB, Flask Web API

Experience

Dec'21 - Present **Postdoctoral Researcher, RealTime Intelligent Systems Lab, UNLV | Las Vegas, NV**
- Currently developing high performance machine learning infrastructure for real-time pedestrian trajectory prediction by gathering and analysing data from surveillance cameras.
- The prototype will incorporate end to end ML/DL capabilities including real-time data ingestion from multiple vision feeds, ML experimentation, automated model development, real-time inference and monitoring (more details)

Sep'17 - Nov'21 **Research Assistant, RealTime Intelligent Systems Lab, UNLV | Las Vegas, NV**
- Develop baseline deep learning models based on RNN, GAN and VAE to forecast pedestrian motion.
- Leverage computer vision techniques such as semantic segmentation and CNN to incorporate visual features into forecasting model reducing prediction error by 12% compared to baseline.
- Modeled pedestrian interaction using **Spatio-Temporal Graph Convolution Neural Networks** and applied attention mechanism using Transformers which further reduced trajectory prediction error
- Developed forecasting models based on ARIMA and LSTM to predict traffic flow. Provided insights to transportation researchers by developing front-end visualizations using R-Shiny

Jan'20 - July'20 **Research Intern, Automotive Products Lab, Hitachi America | Farmingtion Hills, MI**
- Performed stereo camera calibration by extracting intrinsic and extrinsic parameters using OpenCV and Matlab and generated disparity maps for depth estimation.
- Develop Eco-Routing functional prototype by modeling and optimizing energy consumption (FAST-Sim) of Connected and Automated Vehicles (CAV) through Drive Cycle Prediction.
- Implemented deep learning based (LSTM-autoencodes) speed prediction model. Optimized the model using TensorRT to reduce inference time and deployed on NVIDIA-Xavier edge device.

Jun'19 - Aug'19 **Applied Scientist Intern, Payments and Products, Amazon.com | Seattle, WA**
- Responsible for prescriptive and predictive modeling for UK Branded Credit Cards. Performed feature engineering to develop 400 features based on shopping history, prime tenure etc
- Built logistic regression model to predict customer conversion probability with accuracy of 93%. Interpret ROC curves to asses business impact and assign costs to outcomes (FN/TP/FP) for incentive optimization
- Collaborated with PMs to launch variable incentive program by targeting multiple customer segments. This resulted in 14% increase in total acquisitions.

Apr'16 - Sep'17 **Controls Systems Specialist, Automation Engineering, Amazon.com | Avenel, NJ**
- Initiated data driven practices for predictive maintenance and evaluation of sortation equipment downtime.
- Developed anomaly detection model (One-Class SVM) to predict redundant alarms saving 10 hrs downtime and 33% production losses.
- Created dashboards using Tableau to visualize sensor alarms from industrial sortation equipment and shared insights with operation managers for downtime planning.

Jan'15 - Dec'15 **Research Assistant, New York Institute of Technology | NY**
- Received research funding from **University Transportation Research Center** for traffic density estimation.
- Developed data collection methodology through in-vehicle sensors and cellular infrastructure.
- Forecast traffic density using physics based Lighthill-Whitham-Richards (LWR) traffic flow Model

Jun'15 - Aug'15 **Research Intern, Center For Urban Science and Progress (CUSP), NYU | NY**
- Modeling, analysis and evaluation of traffic behaviour using SUMO and MATSim
- Generated plans for multi-agents using openstreet map (OSM) to incorporate in simulation.

Publications

- **A. Syed** and B. Morris, Semantic Scene Upgrades for Trajectory Prediction, Journal of Machine Vision Applications (submitted)

- **A. Syed** and B. Morris, STGT: Forecasting Pedestrian Motion Using Spatio-Temporal Graph Transformer, IEEE Intelligent Vehicles Symposium (IV), 2021, pp. 1553-1558, doi: 10.1109/IV48863.2021.9575498.

- **A. Syed**, Morris B.T. CNN, Segmentation or Semantic Embeddings: Evaluating Scene Context for Trajectory Prediction. In Bebis G. et al. (eds) Advances in Visual Computing. ISVC 2020 Lecture Notes in Computer Science, vol 12510

- **A. Syed** and B. T. Morris, SSeg-LSTM: Semantic Scene Segmentation for Trajectory Prediction. IEEE Intelligent Vehicles Symposium (IV), 2019, pp. 2504-2509, doi: 10.1109/IVS.2019.8813801.

- S. A. Wadoo, **A. Syed**, V. Sood and S. Ali, Prediction of traffic density from wireless cellular data. IEEE 19th International Conference on Intelligent Transportation Systems (ITSC), 2016, pp. 575-580, doi: 10.1109/ITSC.2016.7795611.

Conferences/Talks

Dec' 15 4th Connected and Autonomous Vehicles Symposium at SUNY Polytechnic, Albany NY
Nov' 15 ITS Travel Information System and Mobile Application for Enhanced Transportation Workshop, NY
Dec' 14 Symposium of University Research and Creative Expression (SOURCE) NYIT, NY