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VESAL AHSANI

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SUMMARY

- Currently **Adjunct Faculty** at Amirkabir University of Technology (Tehran Polytechnic).
- Recently started my own startup "**Intelligent Automotive Interior Sensing Technology (IAIST)**" (secured **$150,000** non-repayable grant for my startup development).
- Established "**Sharif Center for Information Systems and Data Science**" (link) 2 years ago.
- More than 10 years of research in diverse fields of AI, computer vision, autonomous vehicles, intelligent transportation systems, NLP, Fintech and big data.

EDUCATION

Iowa State University, *Ames, IA* 2019
Degree: Doctor of Philosophy in Civil Engineering (Concentration: Intelligent Infrastructure Engineering) GPA: 3.8 / 4.0
Minor in Computer Science
Dissertation title: *"Big data driven assessment of probe-sourced data"*

Udacity 2018
Self-Driving Car Engineer Nanodegree (One-year online program)

Rutgers University, *New Brunswick, NJ* 2015
Degree: Master in Urban Transportation Planning - Quitted after 2 semesters GPA: 4.0 / 4.0

Sharif University of Technology & Ferdowsi University of Mashhad, *Iran* 2014
Degree: Bachelor of Science in Civil Engineering GPA: 3.5 / 4.0

EXPERIENCE

Adjunct Faculty Jan 2024 – present
Department of Civil and Environmental Engineering, ***Amirkabir University of Technology (Tehran Polytechnic)****, Tehran, Iran*

- Teaching "**Applied Machine Learning**" course for MS and PhD students
- Instructing on various machine learning models, including all types of regression, SVM, decision trees, random forests, and KNN.
- Teaching several deep learning models, including various CNN architectures, YOLO, and GANs.
- Educating students on coding in Python from scratch, including packages such as NumPy, pandas, scikit-learn, OpenCV, PyTorch, and TensorFlow.
- Guiding students on how to apply ML and DL models to real-world projects, including:
    - Self-driving cars: Developing a decision-making center for autonomous vehicles using deep learning models
    - Analyzing smart card data for bus transportation using deep learning
    - Detecting road surface defects using smartphone images connected to vehicles
    - Comparing deep object detectors on a new vulnerable pedestrian dataset
    - Investigating structural element failures on the platform based on existing stresses
    - Detecting and grading road pavement failures (thermal cracks and potholes)
    - Examining two types of failures, Alligator Cracking and Rutting, at three severity levels: weak, medium, and severe

- Utilizing real data (images, videos, text, CSV files) in practical applications.

Postdoctoral Research Fellow Jan 2022 – Nov. 2023

Electrical Engineering dept, ***Sharif University of Technology****, Tehran, Iran*

- Established Sharif Center for Information Systems and Data Science (link) under supervision of Dr. Babak Khalaj.
- Developed the center's roadmap focusing on research and development in the diverse fields of ML and AI with emphasis on international projects and collaborations.
- Leading a team of 5 PhD students, 4 Master's students, and 6 undergraduate students (totally 15 researchers).
- Recently started my company "Intelligent Automotive Interior Sensing Technology (IAIST)".

Graduate Research Assistant Dec 2016 – June 2019

InTrans, ***Iowa State University****, Ames, IA*

- Developed various ML and DL models in different fields, including intelligent transportation systems, self-driving cars.
- Contributed to a team tasked with making a golf cart autonomous, including mounting LiDAR, radar, cameras, and sensors; finding lane lines; vehicle detection and tracking; sensor fusion, and other related tasks.
- Collaborated with more than 12 PhD and Master's students in the research team on several data science projects.
- Assisted the PI and managers in creating research proposals, writing grant proposals, and preparing technical reports.

Researcher 2014 – 2015

Center for Advanced Infrastructure and Transportation (CAIT), ***Rutgers University****, Piscataway, NJ*

- Worked on detecting recurring and non-recurring traffic congestion using big data analytics.
- Constructed various statistical models for analyzing traffic conditions.

PROJECTS

Intelligent Automotive Interior Sensing Technology (IAIST) *(in progress)*

- *Driver Monitoring:* Implemented computer vision and machine learning to assess driver alertness, issuing real-time alerts for distraction, drowsiness, etc.
- *Predictive Behavior Analysis:* Utilized predictive algorithms to proactively respond to driver and passenger behavior, enhancing road safety.
- *Emotional State Detection:* Detected occupants' physical and emotional states, adjusting in-cabin settings for an improved user experience.
- *Intelligent Alerting System:* Provided instant notifications to drivers and fleet managers, mitigating risks associated with inattention.

New Perspectives for the Metaverse-as-a-Service

- Provided an overview of the privacy and security aspects of the metaverse, including wireless access, learning algorithms, data access, and human-centric interactions from different perspectives.
- Focused on the advantages and challenges of using the edge computing paradigm in MaaS to help metaverse operators to identify an appropriate approach.
- Concentrated on the steps that the MaaS developer should take and utilized blockchain technology to address various difficulties associated with creating and developing the Metaverse platform.

Deep Learning with PyTorch

- Created a course for graduate students and scientists in the EE department.
- Explored diverse areas including PyTorch neural network classification, PyTorch workflows, computer vision, custom datasets, experiment tracking, model deployment, transfer learning, transformers (Vision transformer – ViT), Graph Attention Network (GAT), Generative Adversarial Networks (Vanilla GAN, Conditional GAN, DCGAN), and Reinforcement Learning.
- Most of the course materials are presented in Google colab and accessible on my Github.

Traffic Congestion Detection From Camera Images

- Developed deep learning models; YOLO and DCNN achieved 91.5% and 90.2% accuracy, respectively.
- Implemented machine learning algorithms; SVM, Naïve Bayes, k-NN, decision tree, and random forest. SVM had the highest f1-score of 86.73%

Lyft Perception Challenge

- Developed a deep learning model for semantic segmentation using Keras MobileNet, pretrained VGG-16 weights trained on ImageNet, and trained the model with TensorFlow using the CARLA and Kitti road datasets.

NVIDIA AI City Challenge

- Developed deep learning models to detect and track vehicles in videos using YOLO-v3; 96% accuracy achieved.
- Estimated vehicles' speeds from videos using modified vanishing point algorithms.

Waze Data Evaluation

- Used Sparse Principal Component Analysis (SPCA) to cluster irregular Waze traffic reports.
- Analyzed opportunities and challenges of using Waze data compared to INRIX and Wavetronix data sources.

Real-Time Performance Monitoring And Historical Trend Assessment

- Processed over 1 TB traffic data from 1000+ radar sensors and probes using MapReduce in Java and Apache PIG.
- Built spatiotemporal pattern networks in Python to detect system anomaly.
- Generated interactive traffic data visualization in Tableau.

Assessing The Impact Of Game Days On Travel Patterns And Route Choice

- Proposed Extended-EigenSpot algorithm for traffic hotspot detection on major routes.
- Dynamic Bayesian Networks (DBN) approach is applied to forecast the start-time and location of hotspot clusters.
- Examined INRIX reliability in terms of coverage and penetration.
- Conducted statistical analysis on speed difference of game day compared to normal day.

Real-Time Traffic Incident Detection

- Modified Dynamic Time Warping algorithm (DTW) to identify the shortest (optimal) warping path.
- Real-time traffic incident detection using warping paths.

PUBLICATIONS

- "Metaverse-as-a-Service: A Novel Operator View" *2nd Abu Dhabi 6g Summit, Nov. 2023*.
- "A Novel Metaverse-as-a-Service Architecture from an Operator View" *IEEE International Conference on Metaverse Computing, Networking and Applications (IEEE MetaCom 2023)* (pp 209-216).
- "Spatio-temporal Game Day Traffic Hotspot Detection and Prediction" (*Accepted into Journal of Big Data Analytics in Transportation*).
- "Unlocking Metaverse-as-a-Service The three pillars to watch: Security and Privacy, Edge Computing, and Blockchain" *arXiv preprint arXiv:2301.01221, 2023*.
- "Real-Time Traffic Incident Detection Using Dynamic Time Warping Algorithm" *Acta Scientific Computer Sciences* 5.1 (2023): 30-39.
- "The Spatial Estimation of Expected Accident Frequency of Rural Divided Four-Lane Highways in Order to Exposure Variables and Cmf (Case Study: Main Roads Network of Hamedan Province)" *Available at SSRN 4067001* (2022).
- "Improving Probe-Based Congestion Performance Metrics Accuracy by Using Change Point Detection." *Journal of Big Data Analytics in Transportation* 2.1 (2020): 61-74.
- "Quantitative analysis of probe data characteristics: Coverage, speed bias and congestion detection precision." *Journal of Intelligent Transportation Systems* 23.2 (2019): 103-119.
- "Assessing the Impact of Game Day Schedule and Opponents on Travel Patterns and Route Choice using Big Data Analytics." (2019).
- "Traffic congestion detection from camera images using deep convolution neural networks." *Transportation Research Record* 2672.45 (2018): 222-231.
- "Comparison of machine learning algorithms to determine traffic congestion from camera images." *Transportation Research Board 97th annual meeting, Washington, DC*. 2018.
- "Evaluation of opportunities and challenges of using INRIX data for real-time performance monitoring and historical

trend assessment." (2017).

AWARDS AND HONORS

- Secured **$150,000** grant for my startup "**Intelligent Automotive Interior Sensing Technology (IAIST)**" 2024
- Ranked **14th** among 300+ scientists and engineers around the world in Lyft Perception Challenge 2019
- ITS Minnesota Graduate Student Scholarship 2018
- **3rd** Place Winner of Midwest Big Data Hackathon 2018
- Awarded $34,000 Merit-Based Scholarship, Rutgers University 2014
- Ranked within top **0.1%** among 350,000 participants in Iran national university entrance exam (BS degree) 2009

CONFERENCES

- 6G Summit, Nov. 2023, Abu Dhabi, UAE.
- IEEE International Conference on Metaverse Computing, Networking, and Applications (IEEE MetaCom), July 2023, Kyoto, Japan.
- The Transportation Research Board (TRB) 98th annual meeting, Jan. 2019, Washington DC, USA.
- Conference on Computer Vision and Pattern Recognition (CVPR), June 2018, Salt Lake City, Utah, USA.
- The Transportation Research Board (TRB) 97th annual meeting, Jan. 2018, Washington DC, USA.
- The Transportation Research Board (TRB) 96th annual meeting, Jan. 2017, Washington DC, USA.

TECH SKILLS

Programming:	Python, R
Data Science:	PyTorch, TensorFlow, OpenCV
Business Analytics:	MySQL, NoSQL
Cloud Technologies:	GCP, AWS

REFERENCES

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