MEHRAN ZAMANI

MASc. | AI Engineer | Software Developer | MERN Stack

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SUMMARY OF SKILLS AND QUALIFICATION

- 4 years of experience in developing AI/ML platforms for a variety of applications
- Expert in Python and fluent in machine learning platforms such as PyTorch and TensorFlow
- Expert in systems programming with 8+ years of C++ experience and working knowledge of Rust
- Experienced in data manipulation and preprocessing techniques and strategies
- Experienced in post-processing, filtering, and statistical analysis techniques
- Published in AI with three published papers, two accepted papers, and one under review
- Multi-disciplinary generalist with production level applied AI experience
- Devotee of software development best practices and Agile methodologies

EXPERIENCE

Graduate Research Associate

University of Waterloo/Toyota

Jan. 2021 – Ongoing Waterloo, Ontario

- Implemented epoch-split and data-split continual strategies for the short-term microscopic traffic participants' behaviour prediction strategy enabling the agents to train during the vehicle's downtime as new data becomes available. Converging over time the accuracy of predictions with an overall average accuracy of 1.5% MAPE
- Submitted two manuscripts from the results of the work done at Columbiad Launch Services Inc. and the project with Toyota
- Working on publishing the work done at the scaled autonomous vehicle test platform

Intern AI Engineer

Columbiad Launch Services Inc.

Sept. 2020 – Dec. 2020 Kitchener, Ontario

- Created an orbital dynamics Python module with functions for space object dynamics, orbital element computations and space data stream processing as the toolbox for this project to be used by future researchers
- Designed and developed a space domain awareness infrastructure, a universal model for resident space object tracking and motion prediction using a recurrent neural network
- Statistical analysis on the results show a significant improvement in the accuracy of forecasts compared to the industry standard SGP-4 framework with ≈2% MAPE for 10-day horizon compared to ≈50%
- Improved the efficiency of training by incorporating distributed data-split continual-learning strategy
- Used Amazon Elastic Cloud Computing, Google Cloud Compute Engine and Compute Canada GPU node resources to expedite the training
- Worked directly with the client and consulted Columbiad Launch Services Inc. for the decision-making in hardware and software implementation choices

ACHEIVEMENTS

Champion of Footballer Robot League
Achieved 1st place in a simulation footballer robot tournament for competing controller designs

President of Robotics Club
Was the president of Robotics Club under Student Scientific Association of University of Isfahan for three consecutive terms.

Best Paper Award
Recieved the best paper award in the 7th International Conference of Controls, Dynamic Systems, and Robotics (CDSR'20)

SKILLS

Languages and Tools

Python	●●●●●
C++	●●●●●
Matlab	●●●●●
JavaScript	●●●●○
Rust	●●●○○
Linux	●●●●●
Git	●●●●●
Docker	●●●●○
Apache Spark	●●●●○
Apache Hive	●●●●○
SQL	●●●●○
MongoDB	●●●●○
GraphQL	●●●○○
Apache Hadoop	●●●○○
Amazon Web Services	●●●○○
Google Cloud Platform	●●●○○

PROJECTS

Short-Term Microscopic Traffic Participants Behaviour Prediction for Automated Vehicles

University of Waterloo/Toyota

Sept. 2018 – Sept. 2020

- Proposed and established a novel hybrid deep-learning PGM strategy for microscopic, short-term, multi-agent, and context-aware traffic participant behaviour prediction
- Deployed the method for different traffic scenarios including highway merging, urban, intersection, and roundabout driving, and achieved accurate forecast results with great performance and real-world implementation considerations
- Inspired and impressed Toyota, the strategy is being investigated for implementation in next-gen Toyota vehicles

Scaled Autonomous Vehicle Test Platform

University of Waterloo/SHEVS Lab

Jan. 2019 – Sept. 2020

- Recruited, mentored, and supervised two final year design project teams and one undergraduate research assistant
- Designed and incorporated a scaled-down city layout in a 900 sqft. space, with a control network containing 14 nodes (6 computers and 8 Vicon® global positioning system cameras)
- Designed and built two fully-instrumented scaled-down robot cars with Encoders, LiDARs, and Cameras, controlled by NVIDIA® Jetson™TX2 running Ubuntu® and Arduino® actuator controller
- Incorporated human-in-the-loop system and control scheme
- Developed and deployed an ML-based roundabout controller

PUBLICATIONS

1. M. Zamani Abnili, and Nasser L. Azad, "Universal Forecasting Model for Context-Aware Perception in Autonomous Highway Merging," *IEEE transactions on Intelligent Vehicles*. (Under review)
2. M. Zamani Abnili, Nasser L. Azad, H. B. Oqab, and G. B. Dietrich "Space Domain Awareness Using Deep Continual Learning Sequence Predictors," *19th IAA Symposium on Space Debris*. (Accepted/to be published)
3. M. Zamani Abnili, and Nasser L. Azad, "On-line Situational Awareness for Autonomous Driving at Roundabouts using Artificial Intelligence," *Journal of Machine Intelligence and Data Science (JMIDS)*, 2021, pp. 17–24, doi: TBA
4. M. Zamani Abnili, and Nasser L. Azad, "Roundabout Situational Awareness for Automated Vehicles with Hybrid Machine Learning Approach," In Proc. *7th International Conference of Control, Dynamic Systems, and Robotics (CDSR'20)*, 2020, pp. CDSR 155-1 – 155-8, doi: 10.11159/cdsr20.155. (Best paper award)
5. M. Zamani Abnili, and Nasser L. Azad, "A New Data-Driven Approach For On-line Traffic Participant Behaviour Prediction at Intersections for Automated Driving," *Progress in Canadian Mechanical Engineering*. V.3, Jun. 2020, doi: 10.32393/csme.2020.110
6. M. Zamani Abnili, and Nasser L. Azad, "Short Term Predictions of Preceding Vehicle Speeds for Connected and Automated Vehicles," In Proc. *6th International Conference of Control, Dynamic Systems, and Robotics (CDSR'19)*, 2019, pp. CDSR 132-1 – CDSR 132-8, doi: 10.11159/cdsr19.132.

Libraries

PyTorch | TensorFlow | PySpark | Scikit-Learn | Pandas | Numpy | Scipy | NLTK | OpenCV | Selenium

Node | TypeScript | Express | React

ML Experience

- Deep Neural Network
- Recurrent Neural Network
- Long Short-Term Memory
- Gated Recurrent Unit
- Dynamic Bayesian Network
- Learning Probabilistic Graphical Model
- Reinforcement Learning | Q-Learning
- Genetic Algorithm
- Fuzzy Logic Systems

Misc.

- Filtering | Smoothing
- Data Analysis | Statistical Methods
- Data Cleaning | Parsing | Processing
- Graph Algorithms | Network Systems
- Distributed Computation Techniques
- Embedded Systems

EDUCATION

MASc. Mechanical and Mechatronics Engineering

University of Waterloo

Jan. 2018 – Dec. 2020

- **Project:** Short-Term Microscopic Traffic Participants Behaviour Prediction for Automated Vehicles
- **Advisor:** Nasser L. Azad
- **Sponsors:** Toyota | NSERC | OCE

B.Sc. Mechanical Engineering

University of Isfahan

Sept. 2013 – May. 2017

- **Project:** Thermodynamic modelling of internal combustion engines
- **Advisor:** H. Ahmadikia
- **Special Achievements:** Early Graduation in 7 terms | Contribution to the book "Internal Combustion Engines" by H. Ahmadikia, University of Isfahan Press, 2018

REFERENCES

Upon request