DANIAL ABDOLLAHI NEJAD

AI Researcher at Applied Robotics and AI Solutions (ARAS)

CONTACT INFORMATION

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EDUCATION

M.Sc. in Electrical Engineering,   2022 - 2025
K.N. Toosi University of Technology, Tehran, Iran,
Thesis title: Unified Relational Deep Learning for Customer Segmentation and Purchase Prediction Using Graph Neural Networks
Advisor: Prof. Hamid D. Taghirad,
GPA: 3.65/4.

B.Sc. in Electrical Engineering,   2017 - 2022
Shiraz University, Shiraz, Iran,
Thesis title: Simulation and Control of Self-Balancing Robot using Reinforcement Learning and Comparison with Classical Methods.

RESEARCH INTERESTS

- **Graph Neural Networks (GNN):** Theories and applications for modeling complex and structured data
- **Explainable AI (XAI):** Enhancing transparency and trust in AI models by providing clear explanations of model decisions
- **Machine Learning in Robotic Systems:** Applying machine learning methods to different robotic tasks
- **Time Series:** Modeling, forecasting, and extracting insights from sequential data, with applications in sensor data

RESEARCH EXPERIENCE

Research Assistant at ARAS, AI Lab (A&D Lab)   2022-Present

- **Enhancing Personalization with Graph Neural Networks on Structured Data**
  - **Customer Segmentation**
    * Learn customer embeddings on temporal relational graphs using a modified BYOL-based self-supervised GNN in PyTorch Geometric and TorchFrame.
    * Apply unsupervised clustering to form stable and interpretable customer segments.
  - **Product Recommendation**
    * Learn user–item embeddings on relational graphs using contrastive training with graph augmentations and a hybrid loss combining InfoNCE and BPR.
    * Fine-tune embeddings for accurate, scalable, and personalized top-K product recommendations.
  - **Explainability with Retrieval-Augmented Generation (RAG)**
    * Trace model decisions from graph outputs to raw database features for transparent interpretation.
    * Use gradient-based methods (Integrated Gradients, Saliency) to identify key nodes, edges, and temporal factors.

* Apply a RAG layer to retrieve relevant subgraphs and generate concise, evidence-based explanations with an LLM.

- **Explainable Customer Segmentation using Deep Embedding for Clustering** [Github]

  – Develop a platform for user behavior analysis using deep learning and clustering based on purchase history and personal traits, focusing on model explainability for strategic insights.

- **Sales Forecasting Using Time Series Data**

  – Utilize time series data to develop predictive models for sales forecasting, employing methods such as Lightgbm and LSTM.

- **Predicting Customer's Future Purchases and Recommendations for Retail Industries and E-Commerce**

  – Collect and preprocess diverse datasets, apply machine learning algorithms like XGBoost and LightGBM for accurate predictions, and develop user-friendly software for commercialization.

Research at ARAS, Parallel and Cable-Driven Robots Lab (PACR Lab)   2022-Present

- **Trajectory Tracking of a Planar Cable-Driven Parallel Robot (CDPR) Using Deep Reinforcement Learning** [Github]

  – Design and simulate a planar CDPR in MuJoCo, using the DDPG algorithm for optimizing end-effector trajectory tracking performance.

- **Simulation and Control of Self-Balancing Robot Using Reinforcement Learning**

  – Simulate a self-balancing robot in MATLAB Simscape, implementing control using Deep Q-Network (DQN) reinforcement learning and comparing its performance with fuzzy and classic control methods.

SELECTED PUBLICATIONS

- **D. A. Nejad**, and H. D. Taghirad, "RAG-based Interpretable Personalized Recommendations Using Graph Neural Networks on Structured Data," *Unpublished Manuscript.*

- **D. A. Nejad**, A. Mehrabi, A. Rezaei, A. Jahani, S. A. Khalilpour, H. Kh. Seyedi, and H. D. Taghirad, "Bridging Complexity and Interpretability: A Two-Phase Clustering Framework," *2024 IEEE RSI International Conference on Robotics and Mechatronics (ICRoM 2024)*, [PDF].

- **D. A. Nejad**, A. Sharifi, M. R. Dindarloo, A. S. Mirjalili, S. A. Khalilpour, and H. D. Taghirad, "Control of Cable Driven Parallel Robots Through Deep Reinforcement Learning," *2024 IEEE RSI International Conference on Robotics and Mechatronics (ICRoM 2024)* [**Best Paper Award**], [PDF].

- A. Mehrabi, **D. A. Nejad**, A. Jahani, A. Rezaei, S. A. Khalilpour, H. Kh. Seyedi, and H. D. Taghirad, "Variational Autoencoders: Tackling Imbalanced Data through Generative Modeling," *2024 IEEE RSI International Conference on Robotics and Mechatronics (ICRoM 2024).*

- A. Jahani, A. Rezaei, A. Mehrabi, **D. A. Nejad**, S. A. Khalilpour, H. Kh. Seyedi, and H. D. Taghirad, "Self-Updating LightGBM Clustering: A Hybrid Approach for Managing Data Intermittency, Noise, and Missing Value," *2024 IEEE RSI International Conference on Robotics and Mechatronics (ICRoM 2024).*

- A. Rezaei, A. Jahani, **D. A. Nejad**, A. Mehrabi, S. A. Khalilpour, H. Kh. Seyedi, and H. D. Taghirad, "Predicting Customer Behavior in Autonomous Retail Application: A Classification-Based Approach," *2024 IEEE RSI International Conference on Robotics and Mechatronics (ICRoM 2024).*

TEACHING EXPERIENCES

- **Modern Control** - Instructor: Prof. Hamid D. Taghirad [Scholar] [Github]

- **Artificial Intelligence, Machine Learning (Graduate Course)** - Instructor: Dr. Mahdi Aliyari-Shoorehdeli[Scholar] [Github]

SKILL AND PROFICIENCY

- **Programming Languages**: Python, Matlab, C/C++

- **Deep learning framework**: PyTorch, PyG (PyTorch Geometric)

- **Embedded Systems**: ROS, Arduino IDE

- **Software**: Simulink, MuJoCo, LabVIEW, COMSOL

- **Languages**: Persian, English (TOEFL iBT: 101/120 - R: 28, L: 26, S: 23, W: 24).

COURSES

- Machine Learning [Github]
- Neural Networks and Advanced Neural Controllers
- Machine Learning with Graph (online Stanford [CS224])
- Deep Reinforcement Learning (online UC Berkeley [CS285])
- Deep Learning Specialization (on Coursera [Certificate])
- Big Data Analytics and Systems
- Linear/Nonlinear Control Systems
- System Dynamics

REFERENCES

- **Prof. Hamid D. Taghirad**
  Professor, Director of the Applied Robotics and AI Solutions (ARAS), Faculty of Electrical Engineering, K.N. Toosi University of Technology, Tehran, Iran.
  Email: taghirad@kntu.ac.ir

- **Dr. Mahdi Aliyari-Shoorehdeli**
  Associate Professor of Control and Mechatronics Engineering, K. N. Toosi University of Technology.
  Email: aliyari@kntu.ac.ir