Neda Amirirad

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SUMMARY

- PhD researcher in Computational Biology / Machine Learning, specializing in large-scale analysis of immune-related gene expression data and network-based modeling of autoimmune diseases (RA and SLE).
- Strong experience in statistical modeling, machine learning, and high-dimensional data analysis, including gene co-expression networks, community detection, representation learning, and pathway enrichment.
- Skilled in developing reproducible computational pipelines for large biological datasets using Python (NumPy, Pandas, scikit-learn, NetworkX, statsmodels, matplotlib), R, and advanced graph-analytic methods.
- Proven ability to conduct independent research, contribute to publications, and collaborate in interdisciplinary teams across biology, healthcare, and computing.
- Excellent technical communication skills with experience presenting at academic conferences (e.g., Complex Networks 2025, INFORMS Annual Meeting 2025) and mentoring in graduate-level courses.

EDUCATION

Ph.D., Industrial Engineering *Aug 2024 – Present*
State University of New York at Binghamton, Binghamton, NY

Ph.D. Coursework, Computer Science *Aug 2023 – May 2024*
University of South Florida, Tampa, FL

M.S., Systems Engineering *Sep 2011 – Feb 2014*
Islamic Azad University, Tehran, Iran

B.S., Computer Engineering *Sep 2004 – Jun 2008*
Islamic Azad University, Tehran, Iran

RELEVANT COURSEWORK

Advanced Topics in Health Systems; Advanced Engineering Analytics; Modeling and Simulation; Machine Learning; Dynamic Programming; Operations Research; Integer Linear Optimization; Mathematical Programming; Decision Making Theory; Nonlinear Programming; Data Structures; Principles of Database Design; General Economics I; Advanced Microeconomics I; Optimization of Nonlinear Models.

PROFESSIONAL EXPERIENCE

Research Assistant, *Aug 2025 – Present*
State University of New York at Binghamton, Binghamton, NY

- Conducting computational immunology research using large-scale RNA-seq datasets from autoimmune diseases (Rheumatoid Arthritis and Systemic Lupus Erythematosus).
- Building gene co-expression networks (≈20k genes) and applying advanced network science methods (Louvain/Leiden community detection, consensus clustering, percolation-based thresholding) to identify immune-related modules.
- Performing pathway enrichment analysis, cross-disease module comparison, and integrating novelty scoring (EuropePMC + GWAS) to highlight under-explored but biologically relevant genes.
- Developing reproducible computational pipelines for graph construction, TOM-based smoothing, hub-gene identification, and cross-condition comparison.
- Preparing manuscripts and presentations for conferences in computational biology, network science, and healthcare analytics.

Teaching Assistant, "Computational Tools" course *Aug 2024 – May 2025*
State University of New York at Binghamton, Binghamton, NY

- Holding office hours and tutoring sessions.

Teaching Assistant, "Grad Seminar in Complex System Science" seminar *Aug 2023 – May 2024*
State University of New York at Binghamton, Binghamton,

- Developing exams and assessment material for the exams, homework, and quizzes
- Holding office hours and tutoring sessions, grading student submissions, and providing feedback.

Teaching Assistant, "Augmented Reality" course *Aug 2020 – Dec2023*
University of South Florida, Tampa, FL

- Developing exams and assessment material for the exams, homework, and quizzes
- Holding office hours and tutoring sessions, grading student submissions, and providing feedback.

Teaching Assistant, "Operations System" course *Dec 2024 – May 2024*
University of South Florida, Tampa, FL

- Developing exams and assessment material for the exams, homework, and quizzes
- Holding office hours and tutoring sessions, grading student submissions, and providing feedback.

Teaching Assistant, "Human-Computer Interaction" course *Dec 2024 – May 2024*
University of South Florida, Tampa, FL

- Developing exams and assessment material for the exams, homework, and quizzes
- Holding office hours and tutoring sessions, grading student submissions, and providing feedback.

Teaching Assistant, "Decision-Making Theory" course *Feb 2009 – Jun 20211*
Islamic Azad University, Tehran, Iran

- Developing exams and assessment material for the exams, homework, and quizzes
- Holding office hours and tutoring sessions, grading student submissions, and providing feedback.

SIGNIFICANT ACADEMIC PROJECTS

Network-Based Analysis of Autoimmune Diseases (RA and SLE) Using Large-Scale RNA-seq Data

- Built a weighted gene co-expression network from RA synovial RNA-seq (~19k genes, filtered to ~2.7k disease-relevant genes; n=87 samples).
- Identified gene communities using Louvain/Leiden and prioritized hub genes (strength-based) at global and within-community levels; summarized key immune-related modules.
- Interpreted modules via pathway enrichment and evidence mining (literature + GWAS) to highlight under-studied, biologically plausible RA candidates.
- Oral presentation at: The International Conference on Complex Networks and Their Applications (Complex Networks 2025).

Systemic Lupus Erythematosus (SLE) Network Modeling (Manuscript in preparation)

- Constructed SLE gene co-expression networks from large-scale RNA-seq (~20k genes) and identified robust immune-related modules using community detection.
- Prioritized hub genes in major communities using strength-based centrality generated a shortlist of candidate drivers for downstream validation.
- Performed pathway enrichment to characterize dominant immune processes represented by key modules.

Profiling Depression Risk Groups Among Students Using PCA and Cluster Analysis

- Cleaned and preprocessed psychological survey data with mapping, imputation, and IQR-based outlier removal.
- Reduced dimensionality using PCA (6 components, ~88% variance explained).
- Applied K-Means clustering to segment students into high-risk, low-risk, and hidden-risk risk groups.
- Validated clustering results using MANOVA (Wilks' Lambda = 0.41, $p < 0.0001$) and feature-level ANOVA.
- Interpreted and visualized cluster profiles based on stress, sleep, diet, and satisfaction metrics.

Deep-Learning Based Bone Fracture Detection in X-ray Images Using Transfer Learning

- Deployed an artificial neural network prediction algorithm.
- Optimized using the Adam optimizer and the BCELoss loss function.
- The model's performance is evaluated on the test sets from each fold of cross-validation.
- Utilized the pre-trained Xception model with custom layers for feature extraction and classification.
- Optimized using the Adam optimizer and the categorical cross-entropy loss function.
- Employed early stopping and learning rate reduction techniques to enhance model generalization.

- Achieved a test accuracy of 91% and evaluated performance using accuracy and loss metrics.

Implement a Lime function to explain the AI model's decisions using a model interpretability method

- Explain a prediction made on a specific data instance.
- Implemented LIME (Local Interpretable Model-agnostic Explanations) to provide transparent explanations for the predictions of a Random Forest classifier on the WineQT dataset.
- Analyzed the impact of individual features on the model's decisions, improving the understanding of feature importance in determining wine quality.
- Developed interactive visualizations to effectively communicate the results of LIME analyses, enhancing the interpretability and trustworthiness of the model's predictions.

Presenting an Organizational Planning Selection Model for ERP Systems Based on Intuitionistic Fuzzy Sets

- Created a model based on multi-criteria decision-making techniques and intuitionistic fuzzy logic to select an Enterprise Resource Planning (ERP) system.
- Developed a model to evaluate and select the most suitable ERP system for organizations using multi-criteria decision-making techniques and intuitionistic fuzzy logic.
- Applied Intuitionistic Fuzzy Sets to handle uncertainty and vagueness in decision-making processes, enhancing the robustness and reliability of the ERP system selection.
- Conducted a comprehensive case study, applying the proposed model to evaluate popular ERP systems. The results demonstrated the model's effectiveness in guiding organizations to make informed and strategic ERP system choices.

Design and Development of an After-Sales Service Website for a Manufacturing Company

- Developed a secure user registration and authentication system to allow customers to create accounts and log in to access personalized after-sales services.
- Implemented features for users to select the type of service they require, including options for various maintenance and repair services, ensuring a user-friendly interface for easy navigation and service booking.
- Integrated functionality for users to specify their city and province, enabling the website to connect customers with the nearest service centers, optimizing service delivery based on geographical location.

Implement a Deep Learning Model for Heart Disease Prediction

- Reading and understanding the dataset, extracting features and labels, splitting the dataset into training and testing sets, and normalizing the data.
- Building a neural network using TensorFlow and Keras, including layers such as Dense and Dropout, and analyzing parameters like activation functions, loss functions, and optimization methods.
- Training the model, evaluating its performance on the test set, and analyzing results for accuracy and reliability.

PUBLICATIONS

- Amirirad, N., & Sayama, H. (2025), Network Community Detection and Novelty Scoring Reveal Underexplored Hub Genes in Rheumatoid Arthritis. https://arxiv.org/abs/2509.00897
- Kavoosi Davoodi, S. M., Amiri Rad, N., & Hosseinzadeh Kashan, A. (2015). Presenting an organizational planning selection model for ERP systems based on intuitionistic fuzzy sets. *Journal of Applied Environmental and Biological Sciences*, 5(9S), 808-820.
- Golabian, M., Kavoosi Davoodi, S. M., Amiri Rad, N., Raeisi, A., & Haji Molana, S. M. (2015). Development the use of renewable energies in Iran: A system thinking approach. *Journal of Applied Environmental and Biological Sciences*, 5(11S), 370-375.

COMPUTER SKILLS

Programming Languages:	Python, VBA, C++, C#, Java SE, T-SQL, HTML/CSS, MATLAB, R
Tools and Libraries:	Pandas, Numpy, PyTorch, TensorFlow, Matplotlib, Jupyter Notebook
Modeling and Simulation:	Simio
General Applications:	MS Office, Adobe Photoshop, Adobe Illustrator, Adobe Premiere
Engineering Applications:	Expert Choice, SQL Server, Microsoft Project
Statistical Analysis & Data Mining:	SPSS, Minitab

CORE STRENGTHS

• Machine learning, statistical modeling, deep learning (PyTorch)
• Optimization: linear programming, nonlinear optimization, dynamic programming

• Mathematics: linear algebra, probability, statistics
• Complex systems modeling, robustness analysis