

# Maryam Haghani

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🌐 Maryam-Haghani

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Ph.D. student in Computer Science specializing in Computational Biology, with experience in developing bioinformatics algorithms and tools. I eager to collaborate with interdisciplinary teams to solve real-world problems while continuously learning and growing.

## EDUCATION

**Ph.D. in Computer Science** - GPA: 4/4 2022 – 2027 (Expected)  
Virginia Polytechnic Institute and State University, Blacksburg, Virginia

**Master of Computer Science** - GPA: 18.08 /20 2012 - 2015  
Shahid Beheshti University (SBU), Tehran  
**Thesis:** Solving differential equations from European and American option pricing models in the stock market using mesh-free method, leveraging parallelism with CUDA

**Bachelor of Computer Science** - GPA: 16.91/20 2008 - 2012  
Shahid Beheshti University (SBU), Tehran

## INTEREST AREAS

- Computational Biology and Bioinformatics
- Algorithms (Design and Analysis - Optimization)
- Applied Deep Learning and NLP, LLM
- Data Science for Bioinformatics

## RESEARCH PROJECTS

**Analysis of Arabidopsis Nuclear Envelope Proteins using scRNA-Seq Data** 2025  
Performed scRNA-seq analysis of Arabidopsis nuclear envelope proteins from root cells using R.

- Identified cell type-specific genes and analyzed co-expression patterns.
- Generated gene clusters and constructed a co-expression network using hdWGCNA.
- Visualized co-expression networks to highlight functional links between genes.

**Integration of GRN inference algorithms using single cell multi-omics data to BEELINE** 2024  
(Google Summer of Code (GSoC))  
Mentored an intern under the support of the National Resource for Network Biology (NRNB)

- Integrate three new gene regulatory network (GRN) inference algorithms into BEELINE, expanding its library and testing on diverse datasets to enhance platform utility for GRN research.

**HostVirusPair – Enhancing Host-Viral Protein Complex Prediction** (Virginia Tech) 2024  
Haghani, M., Bhattacharya, D., and Murali, T. M. – Under submission

- Developed a novel MSA pairing algorithm using sequence-based deep learning models to predict new interaction pairs and incorporate interchain coevolutionary signals.
- Integrated the new paired MSA in AlphaFold-Multimer, achieving higher DockQ scores and enhanced accuracy in host-virus complex structure predictions.

**NEFFy – A Toolbox for NEFF Calculation and MSA Conversion** (Virginia Tech) 2023  
Haghani, M., Bhattacharya, D., and Murali, T. M. – Bioinformatics (2025)

- Developed NEFFy, a tool for calculating the Number of Effective Sequences (NEFF) and converting multiple sequence alignments (MSAs) across various formats and alphabets (protein, DNA, RNA).
- Added column-wise NEFF calculation, multimeric MSA handling, and MSA format conversion.
- Built in C++ for efficiency, with a Python library for easy integration into bioinformatics workflows.

## COURSE PROJECTS

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### Protein-Protein Interaction Prediction (Virginia Tech)

2024

- Predicted protein interactions from sequences (binary classification).
- Used AlphaFoldDB structures and generated binding site embeddings with an Equivariant Graph Neural Network (EGNN), and incorporated ESM2 embeddings for long-range sequence dependencies.
- Processed embeddings through CNN and LSTM for interaction prediction by a fully connected network.

### LLM-based Text-to-SQL Models for Financial Analysis (Virginia Tech – Group Project)

2024

- Created a financial dataset from U.S. Treasury data and assessed Text-to-SQL models including Code-LLaMA-13B, SQL-Code-LLaMA-7B, and SQLCoder-7B using SQL Hardness Criteria and SQAM metrics based on query complexity.

### Comparative Analysis of Proteomic Data Using Mass Spectrometry and Computational Tools (Virginia Tech - Under the guidance of Dr. Richard Helm)

2023

- Conducted a comparative analysis of two rat groups using two mass spectrometry instruments, employing FragPipe and MS-Fragger for protein identification and quantification.
- Used statistical methods to identify significant proteins and evaluate consistency across instruments.

### Traffic Sign Recognition with Computer Vision models (Virginia Tech – Group Project)

2023

- Developed traffic sign recognition models using CNN, YOLOv5, and Vision Transformer (ViT).
- Applied transfer learning and hyperparameter tuning to optimize performance.

## WORK EXPERIENCE

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### Software Engineer | Rayan Bourse Company – Tehran

2017 – 2020

- Developed scalable web applications for stock market, collaborating across teams to build solutions using C# Web API, JavaScript, React, and SQL Server.
- Managed all phases of application development, from gathering requirements to deployment, working closely with product owners to ensure functionality, performance, and alignment with user needs.

### Software Engineer | Saze Company – Tehran

2016 – 2017

- Implemented optimized web-based workflow applications, using C#, Web Forms, MVC, JavaScript, jQuery, and Angular.js to improve internal operational efficiency.

### R&D Team Member | Fakour Company (Telecom) – Tehran

2015 – 2016

- Collaborated internationally to enhance Clarity, an application for monitoring telecom infrastructure.
- Developed mediation drivers in Java SE to connect hardware with Clarity, focusing on efficiency and reliability to ensure smooth communication between the hardware and software in the telecom industry.

## SKILLS

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| • <b>Programming Languages:</b>                  | Python, R, C++, C#, Java                       |
| • <b>Web Development:</b>                        | HTML, JavaScript, jQuery, React.js, Angular.js |
| • <b>Data Science/Machine Learning:</b>          | PyTorch, Scikit-learn, NumPy, SciPy, Pandas    |
| • <b>Databases:</b>                              | SQL Server, PostgreSQL, MySQL                  |
| • <b>Version Control &amp; CI:</b>               | Git, SVN, Team Foundation, Jenkins             |
| • <b>Project Management &amp; Methodologies:</b> | Agile, Kanban, Scrum, ScrumBan                 |
| • <b>High-Performance Computing:</b>             | CUDA, OpenMP, OpenCL                           |