

# Sepideh Fatemi

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## Research Interests

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Knowledge-Guided Machine Learning, Large Language Models, Symbolic Regression, Time Series Modeling

## Education

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### Virginia Tech

PhD in Computer Science, GPA: 4.0/4.0

Blacksburg, VA, USA

Jan 2024-present

### University of Tehran

B.Sc. in Engineering Science - Computer Specialization, GPA: 3.66/4

Tehran, Iran

2017-2022

## Research Experience

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### Graduate Research Assistant, Science Guided Machine Learning Lab

Under supervision of Professor Anuj Karpatne

Virginia Tech

Jan 2024-present

- ModularSR: Vision-Language guided symbolic regression modular symbolic regression framework to enhance interpretability and scalability when modeling complex physical systems.
- LakeFM: Foundation Model for aquatic science to, (a) learn effective representations of process variables (b) 2D prediction along temporal and depth axes and (c) continual learning and (d) handling variable cross-frequency learning
- MissTSM: Model-agnostic approaches for time-series modeling under sparse data conditions
- ClaPred: Predicting chlorophyll-a concentrations using **LSTM**, **Transformer**, and **Transfer Learning** methods.
- MCL: Modular Compositional Learning for time series modeling, integrating Machine Learning modules with process-based components.

### Research Assistant at Convergent Technologies Research Center

Under supervision of Dr. Mohammad Reza Kazemi

University of Tehran

Jan 2022-Aug 2022

- Developed an end-to-end digital phenotyping platform for activity classification using sensory and motor data from mobile devices, comparing individuals with psychiatric disorders to a control group.
- Built a full-stack web service (back-end and front-end) to visualize individuals' activity patterns from GPS data, presented to their healthcare providers at the Atieh Clinic.

### Internship at Convergent Technologies Research Center

Under supervision of Dr. Abdol-hossein Vahabie

University of Tehran

summer 2021

- Conducted behavioral and neural analysis of human cognitive systems, focusing on memory, judgment, and attention bias to design user studies for story-recall tasks.
- Implemented speech-to-text, Word2Vec, and sentiment analysis tools for NLP tasks involving Persian language text.

## Publications

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- **Sepideh Fatemi**, Abhilash Neog, Amartya Dutta, M. Sawhney, et al. "Scientific Equation Discovery using Modular Symbolic Regression via Vision-Language Guidance". *CVPR 2025, CV4Science Workshop*
- Abhilash Neog, Medha Sawhney, KS Mehrab, **Sepideh Fatemi**, et al. "Toward Scientific Foundation Models for Aquatic Ecosystems". *ICML 2025 Workshop*
- Amartya Dutta, M. Sawhney, K.S. Mehrab, Abhilash Neog, Mridul Khurana, **Sepideh Fatemi**, et al. "Open World Scene Graph Generation using Vision Language Models". *CVPR 2025 Workshop, ICML 2025 Workshop*
- Abhilash Neog, Arka Daw, **Sepideh Fatemi**, Anuj Karpatne. "Masking the Gaps: An Imputation-Free Approach to Time Series Modeling with Missing Data". *NeurIPS 2024 Workshop*
- Bennett J McAfee, Aanish Pradhan, Abhilash Neog, **Sepideh Fatemi**, et al. "LakeBeD-US: a benchmark dataset for lake water quality time series and vertical profiles". *Earth System Science Data, 2025*
- **Sepideh Fatemi**, Ehsan Maani Miandoab, Nazanin Imandoost, "Study of Nonlinear Dynamics and Chaos in Virotherapy and Radio Virotherapy". The First Conference on Complex Systems with Focus on Network Science, 2022

## Teaching Experience

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**Teaching Assistant – Grad courses:** Machine Learning, Artificial Intelligence

Virginia Tech

**Teaching Assistant – Undergrad courses:** Artificial Intelligence, Advanced Programming, Basic Computer Programming, Database Laboratory

University of Tehran

## Selected Projects

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### AI Art Detection: Distinguishing Human-Created from AI-Generated Artworks

Fall 2024

Built a machine learning model using ViT, ResNet-50, and FFT to classify AI vs. human-made art.

### Analyzing the Impact of Client Dropouts on Vertical Federated Learning Models

Fall 2024

Investigated the effect of client dropout patterns on the convergence and accuracy of Vertical Federated Learning (VFL) models. Implemented neural networks with split learning techniques to analyze feature importance and dropout resilience. Evaluated optimizer impact (Adam, RMSprop, AdaGrad, SGD) and experimented with feature sampling methods.

### Emergence of Social Hierarchies in Multi-Agent Reinforcement Learning

Summer 2023

Developed a multi-agent reinforcement learning environment using OpenAI's Gym and PettingZoo APIs to simulate resource-constrained scenarios. Utilized Deep Q-Networks (DQN) to train agents, observing the natural development of dominance structures and reduced conflict over time.

## Professional Activities

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### Lighting talk at CVPR2025, CV4Science Workshop

Nashville, TN

Talk on Scientific Equation Discovery using Modular Symbolic Regression via Vision-Language Guidance, showcasing a novel framework for modular equation discovery for complex systems.

### Participated in Amazon - Virginia Tech Initiative for Efficient and Robust ML Event

September 2024

Engaged in a series of lectures and poster sessions covering state-of-the-art (SOTA) advancements in Machine Learning, with a focus on Large Language Models (LLMs) across various domains. Interacted with researchers and industry experts to discuss novel ML methodologies and their real-world applications.

### Poster Presentation in 6th Iranian Symposium on Brain Mapping Updates

8 July 2022

Presented my bachelor's thesis project on a smartphone-based digital phenotyping application designed for passive data collection and behavioral analysis using the Beiwe platform.

### Member of the Engineering Science Scientific Association, University of Tehran

2018-2019

Educational and Scientific activities, Certification activities, Competitions and Conferences arrangements

## Skills

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### Programming Languages

Python, Java, C++/C, JavaScript

### Machine Learning & Data Science

PyTorch, Scikit-Learn, TensorFlow

### Engineering Tools

Matlab, Simulink, Arduino, AutoDesk AutoCad

### Web

Spring, Flask, HTML5, CSS, Bootstrap

### Database

Postgres, MySQL, MongoDB, Neo4j, ElasticSearch, Kafka