Kazem Meidani

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SUMMARY

I am a senior **PhD candidate** at **Carnegie Mellon University (CMU)**, and a graduate research assistant in Mechanical and Artificial Intelligence Lab (MAIL). During my PhD, I also worked with **Electronic Arts** as an AI Scientist Research Intern in EA AI Lab. My research primarily focuses on AI for mathematical and scientific understanding. Most of my works fall into the following categories:

- Language Models (LMs): LLMs as Search Agents, Multi-modal Pre-training, Generative LMs for Math, LLMs for Code Generation and Scientific Discovery
- AI4Science: Transformers and Graph Neural Network Models (GNNs) for Learning Physical Systems, Machine Learning and Optimization for Scientific Discovery

EXPERIENCE

Graduate Research Assistant *Aug 2019 - Present*
Carnegie Mellon University *Pittsburgh, PA*
Research Assistant in Mechanical and Artificial Intelligence Lab (MAIL)

Selected Research Projects:
· Developed a **Multi-modal Foundation model for math** via Symbolic-Numeric Integrated Pre-training (SNIP)
· Introduced a **Transformer-based Planning** for symbolic expression generation using pre-trained **language models**
· Developed a framework using **Large Language Models (LLMs)** for Scientific Discovery via **Code generation**
· Developed an **attention-based framework** (OFormer) for data-driven Neural Operator learning
· Developed **Graph Neural Network (GNN)** models for Molecular Dynamics and unstructured flow field data
· Introduced Machine Learning framework for identification of Partial Differential Equations (PDEs)
· Proposed an Integer Programming framework for identification of dynamical systems from videos
· Proposed **Reinforcement Learning (RL)** framework for online optimization algorithm selection

AI Scientist Intern *May 2022 - Aug 2022*
Electronic Arts (EA) *Redwood City, CA*
Internship in EA AI Lab, Research: ML and Deep Learning Frameworks in Games

· Developed a Differentiable Physically-Based Model for inverse lighting optimization (200x faster computation)
· Introduced Deep Inverse Lighting model for lighting design in games

EDUCATION

Carnegie Mellon University *Pittsburgh, PA*
Ph.D. in Engineering (Artificial Intelligence) *2019 - August 2024 (Expected)*
M.Sc. in Engineering (Artificial Intelligence) GPA: 3.93/4.0
· Ph.D. Thesis Title (tentative): Deep Learning for Symbolic Mathematics and Scientific Discovery

Sharif University of Technology *Tehran, Iran*
B.Sc. in Engineering (Mechanical and Industrial Engineering) *2014 - 2019*

TECHNICAL SKILLS

Programming	Python, C/C++, MATLAB
ML & Deep Learning	PyTorch, Tensorflow, JAX
Language Models	Hugging Face, LangChain, LLamaIndex
Optimization	SciPy, GUROBI, CVXPY

SELECTED PUBLICATIONS

· *SNIP: Bridging Mathematical Symbolic and Numeric Realms with Unified Pre-training* **ICLR 2024 Spotlight**
K. Meidani*, P. Shojaee*, C.K. Reddy, AB. Farimani. *Equal-contribution *NeurIPS 2023 AI4Science*

· *Transformer-based Planning for Symbolic Regression*
K. Meidani*, P. Shojaee*, AB. Farimani, C.K. Reddy. *Equal-contribution **NeurIPS 2023**

· *LLM-SR: Scientific Equation Discovery via Programming with Large Language Models*
K. Meidani*, P. Shojaee*, AB. Farimani, C.K. Reddy. *Equal-contribution Under Review

· *Transformer for Partial Differential Equations' Operator Learning*
Z. Li, **K. Meidani**, AB. Farimani. (2023) Transactions on Machine Learning Research (**TMLR**)

· *IP2: Identification of Parametric Dynamical Systems using Integer Programming*
K. Meidani, AB. Farimani. (2023) Expert Systems with Applications (ESwA)

· *Data-driven identification of 2D Partial Differential Equations using extracted physical features*
K. Meidani, AB. Farimani. (2023) Comp. Methods in App. Mech. and Eng. (CMAME)

· *Graph Neural Networks Accelerated Molecular Dynamics*
Z. Li, **K. Meidani**, P. Yadav, AB. Farimani. (2022) Journal of Chemical Physics (**JCP**)

· *Graph convolutional networks applied to unstructured flow field data*
F. Ogoke, **K. Meidani**, A. Hashemi, AB. Farimani. (2021) Machine Learning: Science and Technology (**MLST**)

· *Inverse Lighting with Differentiable Physically-Based Model*
K. Meidani, I. Borovikov, AB. Farimani, H. Chaput. (2023) **LION 17**

· *Online Metaheuristic Algorithm Selection*
K. Meidani, S. Mirjalili, AB. Farimani. (2022) Expert Systems with Applications (ESwA)

· *VecMetaPy: A vectorized framework for metaheuristic optimization in Python*
AP. Hemmasian, **K. Meidani**, S. Mirjalili, AB. Farimani. (2022) Advances in Engineering Software

· *MAB-OS: Multi-Armed Bandits Metaheuristic Optimizer Selection*
K. Meidani, S. Mirjalili, AB. Farimani. (2022) Applied Soft Computing

RELATED GRADUATE COURSES

- Machine Learning
- Deep Learning
- Convex Optimization
- Probability and Statistics
- Deep Reinforcement Learning and Control
- Numerical Methods

HONORS AND AWARDS

- Ranked 1st in SRBench Competition 2023 (track 1) for Symbolic Regression.
- Ranked 1st in Industrial Engineering class of 2019 at Sharif University of Technology
- Ranked 2nd in Mechanical Engineering class of 2019 at Sharif University of Technology
- Ranked 7th in national exam for university entrance (2014)