

# Mohammad Elhamod

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in mohannadelhamod

## Education

- Virginia Tech, Blacksburg, VA** August 2023  
*Ph.D. candidate in Computer Science*  
GPA: 3.78
- McGill University, Montreal, QC** April 2012  
*M.Eng in Computer Engineering*  
GPA: 3.83
- Jordan University of Science and Technology, Irbid, Jordan** June 2007  
*B.Sc in Computer Engineering*  
GPA: 84.4%. Rated Excellent

## Research Interests

Interested in Science-Guided Machine Learning and ML interpretability and visualization tools. Involved in interdisciplinary projects that span a variety of scientific domains, including physics and biology.

## Research Experience

- Durability, Damage Tolerance and Reliability Branch, NASA** June 2022 — August 2022  
*Research Intern*
- Testing, developing and applying deep learning to demonstrate the use of physics-informed generative adversarial networks to learn and quantify the variability in aerospace materials, ultimately generating an infinite number of virtual tests for certification purposes.
- Science-Guided Machine Learning Lab, Virginia Tech** August 2019 — Present  
*Graduate Research Assistant*
- Supervised by Prof. Anuj Karpatne.
  - CoPhy-PGNN: Learning Physics-guided Neural Networks with Competing Loss Functions for Solving Eigenvalue Problems:**
    - Investigating a deep learning approach to the computationally expensive eigen-decomposition numerical solvers.
    - Showing applications in quantum physics and electromagnetic propagation.
    - Achieving high accuracy with low computational complexity.
    - Using loss landscape visualization to explain the method's advantages.
  - Guiding Neural Networks Using Taxonomies and Phylogenies for Species Modelling:**
    - Tackling the problem of species modelling in the paucity of labelled training data.
    - Infusing taxonomic and phylogenetic information into model training.
    - Improving model interpretability by learning visual features that resemble biological traits.
    - Using visualization tools to help biologists answer questions about species and their defining anatomical traits.
- Visual Surveillance Group, McGill University** January 2010 — April 2012  
*Graduate Research Assistant*
- Supervised by Prof. Martin D. Levine.
  - Thesis: Real-Time Automated Annotation of Surveillance Scenes:**
    - Developed a real-time video surveillance system that detects semantically defined activities of interest.
    - Improved the performance of low-level processing and object tracking.
    - Devised a framework for detecting events that are of interest to public spaces surveillance.
  - Unconstrained real-time face recognition using face morphing and SVM classifiers.**

## Peer-Reviewed Journal and Conference Publications

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- Abantika Ghosh, **Mohannad Elhamod**, Jie Bu, Wei-Cheng Lee, Anuj Karpatne, and Viktor A. Podolskiy. Physics-informed machine learning of optical modes in composites. In *Conference on Lasers and Electro-Optics*, page FTu1B.1. Optica Publishing Group, 2022
- **Mohannad Elhamod**, Jie Bu, Christopher Singh, Matthew Redell, Abantika Ghosh, Viktor Podolskiy, Wei-Cheng Lee, and Anuj Karpatne. Cophy-pgmn: Learning physics-guided neural networks with competing loss functions for solving eigenvalue problems. *ACM Trans. Intell. Syst. Technol.*, 2022
- **Mohannad Elhamod**, Kelly M. Diamond, A. Murat Maga, Yasin Bakis, Henry L. Bart Jr., Paula Mabee, Wasila Dahdul, Jeremy Leipzig, Jane Greenberg, Brian Avants, and Anuj Karpatne. Hierarchy-guided neural networks for species classification. *Methods in Ecology and Evolution*, 2021.
- Jeremy Leipzig, Yasin Bakis, Xiaojun Wang, **Mohannad Elhamod**, Kelly Diamond, Wasila Dahdul, Anuj Karpatne, Murat Maga, Paula Mabee, Henry L. Bart, and Jane Greenberg. Biodiversity image quality metadata augments convolutional neural network classification of fish species. In Emmanouel Garoufallou and María-Antonia Ovalle-Perandones, editors, *Metadata and Semantic Research*, pages 3–12, Cham, 2021. Springer International Publishing. [Best Research Paper Award.]
- **Mohannad Elhamod** and Martin D. Levine. Automated real-time detection of potentially suspicious behavior in public transport areas. *IEEE Transactions on Intelligent Transportation Systems*, 14(2):688–699, 2013
- **Mohannad Elhamod** and Martin D. Levine. Real-time semantics-based detection of suspicious activities in public spaces. In *2012 Ninth Conference on Computer and Robot Vision*, pages 268–275, 2012

## Workshop Papers, Presentations, and Posters

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- **Mohannad Elhamod**, Kelly M. Diamond, A. Murat Maga, Yasin Bakis, Henry L. Bart, Paula Mabee, Wasila Dahdul, Jeremy Leipzig, Jane Greenberg, Brian Avants, and Anuj Karpatne. Hierarchy-guided neural networks for species classification. In *2nd Symposium on Science-Guided AI (SGAI-AAAI-21)*, November 2021
- **Mohannad Elhamod**, Jie Bu, Christopher Singh, Matthew Redell, Abantika Ghosh, Viktor Podolskiy, Wei-Cheng Lee, and Anuj Karpatne. Learning Physics-guided Neural Networks with Competing Physics Loss: A Summary of Results in Solving Eigenvalue Problems. In *AAAI 2021 Spring Symposium on Combining Artificial Intelligence and Machine Learning with Physical Sciences*. AAAI-MLPS 2021, AAAI, March 2021
- **M Elhamod**, MA Maruf, PK Mandke, and A Karpatne. Biology-guided neural network for species classification. In *Integrative and Comparative Biology*, volume 61, pages E228–E229. Oxford Univ Press Inc Journals Dept, 2001 Evans Rd, Cary, NC 27513 USA, 2021. [Nominated for the Best Student Paper: Wake Award.]
- MA Maruf, **M Elhamod**, PK Mandke, and A Karpatne. Biology-guided neural network for fish trait discovery. In *Integrative and Comparative Biology*, volume 61, pages E577–E578. Oxford Univ Press Inc Journals Dept, 2001 Evans Rd, Cary, NC 27513 USA, 2021
- **Mohannad Elhamod**, Jie Bu, Christopher Singh, Matthew Redell, Wei-Cheng Lee, and Anuj Karpatne. Poster: Physics-inspired neural networks meet condensed matter theory. In *3rd Physics Informed Machine Learning*, January 2020

## Honors and Awards

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### Pratt Fellowship - Virginia Tech

July 2021 and July 2022

- Awarded to a limited number of exceptional applicants admitted to the Computer Science and Applications graduate program.

### Wake Award - Society for Integrative and Comparative Biology (SICB)

October 2020

- Nominated for the Best Student Paper.

### Special Stock Award - Microsoft

September 2018

- Awarded to exceptional employees for their contributions in areas of great impact.

### Provost's and Principal's Graduate Fellowship - McGill University

February 2010

- Awarded to recruit high-caliber students.

## Work Experience

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### Microsoft – Azure Monitoring

April 2016 – July 2019

Software Engineer II

- A member of *Application Insights/Azure Monitoring* team.
- Worked on *Metrics Explorer*, a feature that allows millions of customers to visualize and analyze their data.
- Lead *Azure Monitoring*'s product accessibility compliance efforts to provide a seamless experience for people with disabilities.

### Microsoft – Microsoft Edge

March 2013 – April 2016

Software Engineer I

- Worked on core features on the *Windows Phone* platform, such as InPrivate experience and tabs center.
- Lead the product's accessibility compliance efforts to provide a seamless experience for people with disabilities.

## Graduate Teaching Experience

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I have lectured, created assignments and material, held office hours, and graded the following classes:

- **Data-Centric Computing Capstone** (Instructor): A class of 20 students at the CS department at Virginia Tech.
- **Data Analytics** (Teaching Assistant): A class of more than 70 students at the CS department at Virginia Tech (2 semesters).
- **Computer and Biological Vision** (Teaching Assistant): A course on image processing that connects biological and computer vision. A class of more than 40 students at the ECE department at McGill University.
- **Artificial Intelligence** (Teaching Assistant): A class of more than 40 students at the ECE department at McGill University.

## Professional Service

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### CS Grad Council board member

2020 – 2021, 2022 – 2023

Virginia Tech

- Elected for two terms as Treasurer and Vice President, respectively.
- Lead efforts for promoting student rights and resolving student-advisor conflicts.
- Hosted a workshop on building healthy student-advisor relationships.

### Fellow

2022-2023

Virginia Tech Graduate Academy for Teaching Excellence (GrATE)

- Delivering a workshop titles "*Takeaways from being a class instructor*".
- Planning a graduate student podcast on teaching and education.

### Reviewer and Program Committee member

2022

KGML-AAAI

### Reviewer and Program Committee member

2021

SGAI-AAAI

### Reviewer

2021

IEEE-TETCI

### External Reviewer

2021

KDD

### Co-organizer

2021

Great Lakes Bioinformatics Conference

### Interdisciplinary Research Honor Society member

2021

Virginia Tech

### CS delegate to Graduate and Professional Student Senate

2019 – 2020

Virginia Tech

### Hosted a talk titled "*The Graduate Student and Self-Worth*".

2020

Virginia Tech

## Extracurricular Activities, Skills, and Projects

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**Visited European universities. Developed a global understanding of different education systems.** 2022  
*Virginia Tech's Global Perspectives Program*

**Delivered a talk on “Dynamic Split Points in a Decision Tree”.** 2020  
*Seattle's Chapter of “Papers We Love”*

**SQUEAKY, the Robot** 2017  
*Microsoft Hackathon*  
Used *Microsoft Azure Cognitive Services* to train a robot to recognize people's faces and address them by name.

### **Martial Artist**

A 3rd kyu in both Aikido and Karate, and a white belt in Jujutsu

### **Blogger**

Writing an educational blog for Arab audience.

### **Photographer**

A photography enthusiast with a wide range of interests. Won the 2nd place in the graduate school's art & photography contest.

### **Musician**

An ex-member of Itraab Arabic music ensemble

### **Amateur Stand-up Comedian**

## Languages

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### Programming:

- C++
- Python
- JavaScript
- Matlab

### Natural:

- Arabic (native)
- English (fluent)
- French (basic)
- Spanish (basic)