Zachary Hamida, Ph.D.

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Professional Experience

2021-present — Postdoctoral Research Associate
Polytechnique Montreal | Transportation Ministry of the Quebec Province

- Development of a reinforcement learning benchmark environment for emulating non-destructive evaluations on the bridge network in Quebec province.
- Derived optimal decision-making methods tailored for maintenance planning.
- Developed a standalone software for navigating and predicting the deterioration of infrastructure.
- Led a team of entry-level researchers to identify problems in existing models and implement solutions using machine learning (ML) algorithms.
- Monitor and maintain the performance of machine learning models.

2017-2020 — Doctoral Research Assistant
Polytechnique Montreal | Transportation Ministry of the Quebec Province

- Designed and developed predictive models for modelling the deterioration based on non-destructive evaluation data (visual inspections).
- Conducted data analysis to identify patterns in non-destructive evaluation data from bridges.
- Worked with MTQ to understand their decision-making requirements and translate them into data-driven solutions.
- Contributed to the development of machine learning frameworks and libraries.
- Provided technical guidance and mentoring to entry-level researchers.

2016-2017 — Data Scientist
Find a Nurse | Startup

- Designed a framework to prioritize search results based on the clients needs.
- Participated in local and regional hackathons.

2014-2017 — Graduate Research Assistant
American University of Beirut | Schlumberger

- Developed a framework for improving revenue by optimizing wells placement in oil fields.
- Automated the process of parsing and retrieving data from simulation files.

Technical Skills

- Programming Languages: Python, MATLAB (App Designer, GPU compute), R
- Machine Learning Tools: PyTorch, Scikit-Learn, Ray, Streamlit
- Development Tools: AWS, Docker, MLflow, TensorBoard, Github Actions
- Applications: Time-Series Models, Deep Reinforcement Learning, Image Segmentation, Recommender Systems
- Engineering Software: ArcGIS, Revit, Navisworks, Primavera
- Adaptability and Flexibility in Fast-Paced Environments

Software Development

Open-Source — **InfraPlanner:** (Python) Benchmark reinforcement learning environment for maintenance planning,
- Emulate the deterioration process of transportation infrastructure.
- Test and evaluate the effectiveness of maintenance policies.

OpenIPDM: (MATLAB + App designer) Infrastructure probabilistic deterioration modelling,
- Model the deterioration and effect of interventions based on visual inspections.
- Generate synthetic data and calibrate the deterioration model parameters.

Education

2017-2020	Ph.D. in Civil Engineering, **Polytechnique Montreal**, Montreal | Prof. James-A Goulet (Adviser) Thesis: "Stochastic Modelling of Infrastructures Deterioration and Interventions based on Network-Scale Visual Inspections" | Polytechnique Page
2014-2016	M.Sc. in Computational Science, **American University of Beirut**, Beirut | Prof. George Saad (Adviser) & Prof. Fouad Azizi(Co-Adviser) Thesis: "Hybrid Optimization Techniques for Oil Field Development"
2008-2013	B.Eng. in Civil Engineering **University of Aleppo**, Aleppo | Prof. Ammar Kadaan (Adviser) Final Year Project: "Structural Analysis & 4D Simulation for Multi-Storey Building"

Certificates & Awards

Sep. 2023	AWS Certified Machine Learning - Specialty. Amazon Web Services (AWS)
Jun. 2023	Machine Learning Engineering Certificate. Toronto Institute of Data Science and Technology.
Apr. 2021	Higher Education Teaching Certificate. Harvardx Center.
Dec. 2016	AUB Startup Bootcamp by AltCity. 1st Place Award (Find A Nurse Startup Member).
Sep. 2014	Graduate Research Assistantship (GRA). American University of Beirut, Beirut, Lebanon.
Sep. 2014	Partial Scholarship in Visual Communication. Istituto Europeo di Design (IED), Florence, Italy.

Mentoring Experience

Teaching	**Teaching Assistant with Lecture Duties:** - CIV6540: Probabilistic Machine learning for Civil Engineers (Winter, 2021 | 2023) - CIV8530: Structural and System Reliability (Fall, 2022)
Supervision	**Research Project Mentoring:** - Ali Fakhri, M.Eng. at Polytechnique Montreal (2021-present). - Blanche Laurent, M.Eng. at Polytechnique Montreal (2020-2022, Degree earned).

Academic & Social Service

Reviewer & Committee	- Journal of Geoenergy Science and Engineering - Developments in the Built Environment - International Symposium on Intelligent Technology for Future Transportation (ITFT) - International Probabilistic Workshop (IPW)
Moderator & Organizer	- Research Day of Structural Engineering Group at Polytechnique Montreal. - 9th Annual Postdoctoral Research/Career Day in Quebec Province.
Selection Committee	- NSERC scholarship. - Arbour Foundation scholarship.

Journal Publications

1. Fakhri, S.A.K., **Hamida, Z.** & Goulet, J-A. (In Preparation, 2023). "Using Bayesian Neural Networks for Integrating Structural Attributes in the Deterioration Analyses".
2. **Hamida, Z.** & Goulet, J-A. (Submitted, 2023). "Quantifying the Cost of Delaying Maintenance Actions on Transportation Infrastructure Using Reinforcement Learning".
3. Laurent, B., Deka, B., **Hamida, Z.** & Goulet, J-A. (2023). "Analytical Inference for the Inspectors Uncertainty based on Network-Scale Visual Inspections". Journal of Computing in Civil Engineering. DOI
4. **Hamida, Z.** & Goulet, J-A. (2023). "Hierarchical Reinforcement Learning for Transportation Infrastructure Maintenance Planning". Reliability Engineering and System Safety. DOI
5. **Hamida, Z.**, Laurent, B. & Goulet, J-A. (2022). "OpenIPDM: A Probabilistic Framework for Estimating the Deterioration and Effect of Interventions on Bridges". SoftwareX. DOI.
6. **Hamida, Z.** & Goulet, J-A. (2022). "A Stochastic Model for Estimating the Network-Scale Deterioration and Effect of Interventions on Bridges". Struct. Control & Health Monitoring. DOI.
7. **Hamida, Z.** & Goulet, J-A. (2021). "Quantifying the Effects of Interventions Based on Visual Inspections of

Bridges Network". Structure and Infrastructure Engineering. DOI.

8. **Hamida, Z.** & Goulet, J-A. (2021). "Network-Scale Deterioration Modelling of Bridges Based on Visual Inspections and Structural Attributes". Structural Safety. DOI.
9. **Hamida, Z.** & Goulet, J-A. (2020). "Modeling Infrastructure Degradation from Visual Inspections Using Network-Scale State-Space Models". Struct. Control & Health Monitoring. DOI.
10. **Hamida, Z.**, Azizi, F. & Saad, G. (2017). "An Efficient Geometry-based Optimization Approach for Well Placement in Oil Fields". Journal of Petroleum Science and Engineering. DOI.

Conferences, Reports & Posters

1. **Hamida, Z.** & Goulet, J-A. (2023). "Maintenance Planning for Bridges using Hierarchical Reinforcement Learning". 14th International Conference on Applications of Statistics and Probability in Civil Engineering. Dublin, Ireland.
2. Fakhri, S.A.K., **Hamida, Z.** & Goulet, J-A. (2023). "Bayesian neural networks for large-scale infrastructure deterioration models". 14th International Conference on Applications of Statistics and Probability in Civil Engineering. Dublin, Ireland.
3. **Hamida, Z.** & Goulet, J-A. (2023). "OpenIPDM: Une librairie ouverte pour modéliser la dégradation d'un parc d'infrastructures". 29e Colloque sur la progression de la recherche québécoise concernant les ouvrages d'art. Québec, Canada.
4. **Hamida, Z.** & Goulet, J-A. (2022). "Modelling the Deterioration of Infrastructures Using Network-Scale Visual Inspections". 11th International Conference on Structural Health Monitoring of Intelligent Infrastructure. Montreal, Canada.
5. Laurent, B., **Hamida, Z.** & Goulet, J-A. (2022). "Estimating the Bias Associated with Inspectors in the Context of Visual Inspections on Infrastructures". 11th International Conference on Structural Health Monitoring of Intelligent Infrastructure. Montreal, Canada.
6. **Hamida, Z.** & Goulet, J-A. (2021). "Prédire la dégradation et comprendre l'effet des interventions : une méthode d'apprentissage machine adaptée aux rapports d'inspection issus d'une large population de structures". Technical Report for the Ministry of Transport in Quebec (MTQ).
7. **Hamida, Z.** & Goulet, J-A. (2019). "State-Space Models for Network-Scale Analysis of Bridge Inspection Data". 13th International Conference on Applications of Statistics and Probability in Civil Engineering. Seoul, South Korea.
8. **Hamida, Z.** & Goulet, J-A. (2019). "Modeling Infrastructure Degradation from Visual Inspections Using Network-Scale State-Space Models". Modeling and Numerical Methods for Uncertainty Quantification (MNMUQ 2019), Porquerolles Island, France.

Activities

- Cycling, Stand up PaddleBoard, Running, Basketball & Guitar.

References

- Available upon request.