

Seminars

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This page presents work in progress research seminars that are held weekly. These seminars carry on Machine Learning and Bayesian based methods applied to civil engineering. All seminars are open to the public.

Previous seminars : [2016-2017](#) | [2017-2018](#) | [2018-2019](#) | [2019-2020](#)

Dec 16 2021
09:00 | Zoom

Presenter: Bhargob Deka | Ph.D student, Polytechnique Montreal

Title: Using deep ensemble for a 1D toy example.

Abstract: In this seminar, we will see how to use deep ensemble for uncertainty quantification through a simple toy example.

Dec 09 2021
09:00 | Zoom

Presenter: James-A. Goulet | Professor, Polytechnique Montreal

Title: Tutorial: How to make a regime switching analysis with BDLM.

Abstract: One key feature of BDLM is its capacity to handle non-stationary conditions through regime switching. Creating configuration files for a BDLM analysis with the switching Kalman filter involves multiple steps in order to ensure that the model parameters as well as its initial hidden states are correctly initialized. This seminar will show how to proceed step-by-step, from modelling the data associated with explanatory variables, model the dependency between structural responses and explanatory variables, and finally create a regime switching model.

Nov 26 2021
09:00 | Zoom

Presenter: Jishnu Mukhoti | Ph.D student University of Oxford

Title: Simple ways to compute uncertainty in Deep Neural Networks.

Abstract: The tremendous success of deep neural networks has led to a surge in their application in different real-life problems. In fact, some of these problems, like self-driving vehicles and automated medical diagnosis, can have a profound impact on human life. In such situations, along with being accurate, it is imperative for a deep neural network to be able to quantify its uncertainty reliably (i.e., it should know what it does not know). Most well-known uncertainty quantification methods in deep learning either fail to scale up to large datasets and network architectures or suffer from additional computational and temporal overhead, often rendering them infeasible for adoption in practical large-scale problems. In this talk, I will give a brief overview of uncertainty quantification methods in deep learning, discuss the above-mentioned methods and their respective failure modes and finally introduce relatively simpler and more effective ways of quantifying uncertainty in neural networks.

Nov 18 2021
09:00 | Zoom

Presenter: Bhargob Deka, Van-Dai Vuong, James-A. Goulet Polytechnique Montreal

Title: ICOLD Benchmark - Dam Behaviour Prediction.

Abstract: In this presentation, we introduce the ICOLD Benchmark, our methods to make predictions as well as preliminary results.

Nov 11 2021
09:00 | Zoom

Presenter: Zach Hamida | Postdoc, Polytechnique Montreal

Title: Maintenance Planning for Structures Using A Policy Gradient Approach.

Abstract: In this talk, a policy gradient approach is presented with an application in the context of infrastructures maintenance.

Nov 04 2021
09:00 | Zoom

Presenter: James-A. Goulet | Professor, Polytechnique Montreal

Title: Solving Partial Differential Equations with TAGI.

Abstract: This presentation will present how we can seek to solve partial differential equations (PDE) using neural networks. First, we will see how we can relate the parameters of a neural network to the partial derivatives and boundary conditions defining a PDE, and then how the network can be learnt using either tractable approximate Gaussian inference (TAGI) or the standard gradient backpropagation.

Oct 28 2021
09:00 | Zoom

Presenter: Bhargob Deka | Ph.D student, Polytechnique Montreal

Title: Topics in Bayesian Neural Networks part two: Bayes-by-BackProp.

Abstract: In this presentation, I will introduce another one of the state-of-the-art Bayesian Neural networks called Bayes-by-BackProp by Chris Bundell and show its application on a toy problem as well as the regression benchmarks.

- Oct 14 2021**
09:00 | Zoom
- Presenter:** Zach Hamida | Postdoc, Polytechnique Montreal
Title: Network-Scale Maintenance Planning for Infrastructures Using Reinforcement Learning (Formulation, Part 2)
Abstract: This talk is about formulating the problem of planning maintenance activities on a network-scale
- Oct 07 2021**
09:00 | Zoom
- Presenter:** Van-Dai Vuong | Ph.D student, Polytechnique Montreal
Title: Matrix Profile for Anomaly Detection.
Abstract: This seminar presents the Matrix Profile method and its application for anomaly detection in time series.
- Sep 30 2021**
09:00 | Zoom
- Presenter:** Blanche Laurent | MSc. student, Polytechnique Montreal
Title: Online inspection uncertainty characterization for network-scale infrastructure monitoring.
Abstract: This seminar presents the framework used to estimate inspector parameters in the context of modelling infrastructure deterioration thank to an SSM model using Network-Scale Visual Inspections.
- Sep 23 2021**
09:00 | Zoom
- Presenter:** Bhargob Deka | Ph.D student, Polytechnique Montreal
Title: Topics in Bayesian Neural Networks part one: MC-Dropout.
Abstract: In this presentation, I will introduce one of the state-of-the-art Bayesian Neural networks called the MC-dropout by Yarin Gal and show its application on a toy problem as well as the regression benchmarks.
- Sep 16 2021**
09:00 | Zoom
- Presenter:** Shervin Khazael | Ph.D student, Polytechnique Montreal
Title: Damage detection using Reinforcement Learning and Bayesian Dynamic Linear Model.
Abstract: In this seminar we discuss two objectives related to the long-term monitoring of infrastructures: (i) detecting damages (anomalies) from the sensory data, and (ii) quantify the detectability with respect to the damage characteristics. The detection and quantification processes benefit from the ability of Bayesian Dynamic Linear Model (BDLM) to decompose the collected data, as well as the long-term decision-making capacity of Reinforcement Learning.
- Aug 06 2021**
10:00 | Zoom
- Presenter:** Zach Hamida | Postdoc, Polytechnique Montreal
Title: Network-Scale Maintenance Planning for Infrastructures using Reinforcement Learning (Formulation).
Abstract: This talk is about formulating the problem of planning maintenance activities on a network-scale.
- Jul 16 2021**
10:00 | Zoom
- Presenter:** Luong-Ha Nguyen | Postdoc, Polytechnique Montreal
Title: Analytically Tractable Inference in Deep Neural Networks.
Abstract: This seminar presents the application of Tractable Approximate Gaussian Inference (TAGI) on supervised and unsupervised learning tasks. This application showcases how these tasks, which currently rely on gradient-based optimization, can be done with analytically tractable inference.
- Jul 09 2021**
10:00 | Zoom
- Presenter:** Van-Dai Vuong | PhD. student, Polytechnique Montreal
Title: Early-stopping to prevent overfitting.
Abstract: This seminar presents the early-stopping technique to prevent overfitting in neural networks when using multiple epochs.
- June 11 2021**
10:00 | Zoom
- Presenter:** Blanche Laurent | MSc. student, Polytechnique Montreal
Title: Measurement Noise inference for a Network-scale State Space Model.
Abstract: This seminar presents the methodology used to determine inspector parameters in the context of modelling infrastructure deterioration from Network-Scale Visual Inspections.
- June 04 2021**
10:00 | Zoom
- Presenter:** James-A. Goulet | Professor, Polytechnique Montreal
Title: A roadmap to the tenure-track professor application process.
Abstract: This seminar will present the general information related to the tenure-track application process. We will go through the general timeline, the required application documents, and the interview process. I will present what are the key points to keep in mind in order to prepare yourself for the academic life.

- May 21 2021**
10:00 | Webinar
- Presenter:** James-A. Goulet | Professor, Polytechnique Montreal
Title: The decision-making theory behind reinforcement learning.
Abstract: This seminar presents the fundamental theory behind reinforcement learning problems. For that purpose, we will walk through the concepts of decision-making in uncertain contexts and sequential decisions, and we will see how these concepts can be used to leverage the potential of neural networks.
Record: <https://youtu.be/t2PF0SwBOP8>
- May 14 2021**
10:00 | Webinar
- Presenter:** Van Dai Vuong | Ph.D student, Polytechnique Montreal
Title: Exponential smoothing and normalization-on-the-fly .
Abstract: This presentation introduces the Exponential Smoothing and Normalization-on-the-fly methods.
- May 07 2021**
10:00 | Webinar
- Presenter:** Bhargob Deka | Ph.D student, Polytechnique Montreal
Title: Consistency Estimation in State-Space Model.
Abstract: In this presentation, I will present some key theoretical consistency estimation notions that are used to deem any state estimation technique as consistent.
- Apr 30 2021**
10:00 | Webinar
- Presenter:** Zach Hamida | Postdoc, Polytechnique Montreal
Title: Planning Maintenance Activities on a Network of Bridges - An Overview.
Abstract: In this seminar, an overview for the intervention database is provided along with the associated potential costs. In addition to covering the characteristics of the data, intervention planning formulations are discussed.
- Apr 23 2021**
10:00 | Webinar
- Presenter:** Bhargob Deka | Ph.D student, Polytechnique Montreal
Title: Deterministic Variational Inference versus TAGI-NPI for modeling Heteroscedastic Noise Variance.
Abstract: In this presentation, I will introduce another BNN method called Deterministic Variational Inference and compare the results with TAGI-NPI on the UCI datasets.
- Apr 09 2021**
10:00 | Webinar
- Presenter:** Bhargob Deka | Ph.D student, Polytechnique Montreal
Title: Architectures in TAGI for Heteroscedastic Noise Parameter Inference.
Abstract: In this presentation, I would present different 1 D toy problems for Heteroscedastic Noise Inference and also present different architectures for the regression benchmarks.
- Mar 26 2021**
10:00 | Webinar
- Presenter:** Luong-Ha Nguyen | Postdoc, Polytechnique Montreal
Title: Reinforcement Learning in Continuous Action Spaces.
Abstract: Continuous action spaces are a key aspect for reinforcement learning (RL) problems. This seminar will present a framework that employs the Tractable Approximate Gaussian Inference (TAGI) for handling RL problems with continuous actions.
- Mar 17 2021**
10:00 | Webinar
- Presenter:** Zach Hamida | Postdoc, Polytechnique Montreal
Title: Rapport final : Prédire la dégradation et comprendre l'effet des interventions.
Abstract: This presentation provides a summary for the deliverables in the research project "Prédire la dégradation et comprendre l'effet des interventions".
- Mar 12 2021**
10:00 | Webinar
- Presenter:** Shervin Khazael | Ph.D student, Polytechnique Montreal
Title: Anomaly Detection Using State-Space Models and Reinforcement Learning.
Abstract: The early detection of anomalies associated with changes in the behavior of structures is important for ensuring their serviceability and safety. Identifying anomalies from monitoring data is prone to false and missed alarms due to the uncertain nature of the infrastructure responsesâ€™ dependency on external factors such as temperature and loading. Existing anomaly detection strategies typically rely on univariate threshold values and disregard the planning horizon in the context of decision making. In this seminar, we will review the recently proposed anomaly detection framework that combines the interpretability of existing Bayesian dynamic linear models, a particular form of state-space models, with the long-term planning ability of reinforcement learning.
- Mar 05 2021**
10:00 | Webinar
- Presenter:** Van-Dai Vuong | Ph.D student, Polytechnique Montreal
Title: Tractable Approximate Gaussian Inference for Long Short Term Memory (LSTM).
Abstract: This seminar presents the theory of LSTM and the implementation of TAGI to LSTM.
- Feb 19 2021**
10:00 | Webinar
- Presenter:** Shervin Khazael | Ph.D student, Polytechnique Montreal
Title: Bayesian Dynamic Linear Model (BDLM) for Time Series Data Analysis.
Abstract: In this seminar we review the BDLM from the modern machine learning perspective. The

postulations are revisited to establish a unified framework during the modeling. Two different time series are selected, and modeled using openBDLM, an open-source package to implement BDLM. For the comparison, the time series are examined with the Facebook PROPHET package. Finally, the current research directions are discussed for future development of the BDLM.

Feb 05 2021
10:00 | Webinar

Presenter: James A. Goulet | Professor, Polytechnique Montreal

Title: The path toward explaining why TAGI works so well.

Abstract: This seminar will discuss the key assumptions and approximations that are embedded in TAGI. More specifically, we will explore through examples how the covariance between either hidden units or weights parameters influences the feedforward and inference procedures.

Jan 29 2021
10:00 | Webinar

Presenter: Zach Hamida | Postdoc, Polytechnique Montreal

Title: Software Demo: Network-Scale Deterioration Analyses.

Abstract: This presentation offers a demo for a user interface designed to manage & analyze visual inspection data from a network of bridges.

Jan 22 2021
10:00 | Webinar

Presenter: Bhargob Deka | Ph.D Candidate, Polytechnique Montreal

Title: Cholesky-spaced Noise Parameter Inference.

Abstract: In this presentation, I want to show a solution for the non-positive definiteness that results in the higher dimensional Noise Parameter Inference.

Dec 17 2020
10:00 | Webinar

Presenter: Shervin Khazael | Ph.D Candidate, Polytechnique Montreal

Title: Understanding the "Environment" in the context of Reinforcement Learning.

Abstract: This seminar presents the main component of the "Environment" in the context of reinforcement learning. We discuss the environment properties and the OpenAI gym unified framework in order to build the environment. Infrastructure maintenance problem is revisited to show the efficiency of the unified framework.

Nov 26 2020
10:00 | Webinar

Presenter: Luong-Ha Nguyen | Postdoc, Polytechnique Montreal

Title: Tractable Approximate Gaussian Inference for Reinforcement Learning.

Abstract: The goal of reinforcement learning is to learn how to take actions in order to maximize reward. In this talk, we will see the application of tractable approximate Gaussian inference (TAGI) to reinforcement learning. The proposed method will allow (1) modelling uncertainties and (2) balancing exploitation/exploration tradeoff in reinforcement learning problems.

Nov 12 2020
10:00 | Webinar

Presenter: Shervin Khazael | Ph.D Candidate, Polytechnique Montreal

Title: Anomaly Simulation in Bayesian Dynamic Linear Models.

Abstract: In this seminar we introduce the framework to generate anomaly mimicking the real structural damages. Furthermore we quantify the performance of the anomaly simulation generator with respect to a scoring system relies on the confusion matrix.

Nov 05 2020
10:00 | Webinar

Presenter: James A. Goulet | Associate professor, Polytechnique Montreal

Title: Modelling the kinematics of Covid infections using state-space models.

Abstract: This seminar introduces how to model the Covid-19 infections using state-space models.

Oct 22 2020
10:00 | Webinar

Presenter: Zach Hamida | Ph.D. Candidate, Polytechnique Montreal

Title: Stochastic Modelling of Infrastructures Deterioration and Interventions based on Network-Scale Visual Inspections.

Abstract: This research project aims at developing data-driven methods that are well suited for the network-scale analyses of inspection and intervention data of transportation infrastructure. The main objectives of this work are: 1) Modelling infrastructures deterioration from network-scale visual inspections while accounting for the subjective nature of these inspections, 2) Quantifying the local and the network-scale effects of interventions based on visual inspections, 3) Validating and verifying the proposed methods using real and synthetic datasets.

Oct 15 2020
10:00 | Webinar

Presenter: Van-Dai Vuong | Ph.D. Student, Polytechnique Montreal

Title: Multiple time series modelling for Structural Health Monitoring.

Abstract: In this seminar I present my research proposal regarding multiple time series modelling for Structural Health Monitoring.

Oct 08 2020

Presenter: Shervin Khazael | Ph.D. Candidate, Polytechnique Montreal

10:00 | Webinar

Title: Jacques Cartier Bridge Preliminary Data Analysis (update).

Abstract: In this seminar we present an update for Jacques Cartier Bridge data analysis. As more data are available, we use the trained BDLM to forecast the behaviour of the structure.

Oct 01 2020

10:00 | Webinar

Presenter: Bhargob Deka | Ph.D. Candidate, Polytechnique Montreal

Title: Noise Inference in State-Space Models: Modifications.

Abstract: In this presentation I will show some of the modifications that has been made to the earlier version of NI.

Sep 24 2020

10:00 | Webinar

Presenter: Luong-Ha Nguyen | Postdoc, Polytechnique Montreal

Title: Tractable Approximate Gaussian Inference for Generative Adversarial Networks.

Abstract: This seminar presents the application of tractable approximate Gaussian inference (TAGI) to generative modelling i.e. unsupervised learning task. The goal of generative modelling is to learn the underlying structure of the data.

Sep 17 2020

10:00 | Webinar

Presenter: Shervin Khazael | Ph.D. Candidate, Polytechnique Montreal

Title: Jacques Cartier Bridge Preliminary Data Analysis.

Abstract: In this seminar we present an empirical model of Jacques Cartier bridge measurements based on Bayesian Dynamic Linear Modelling. The measurements consist in elongation, inclination, and temperature across different spans. The observations are decomposed into reversible and irreversible responses. We discuss the challenges of future interpretation when more observations are available.

Sep 10 2020

10:00 | Webinar

Presenter: Luong-Ha Nguyen | Postdoc, Polytechnique Montreal

Title: Tractable Approximate Gaussian Inference for Residual Networks.

Abstract: This seminar presents the implementation of TAGI to residual networks. The goal is to ease the training of deeper networks.

Sep 03 2020

10:00 | Webinar

Presenter: Zach Hamida | Ph.D. Candidate, Polytechnique Montreal

Title: Deterioration Analysis of Bridges Using Network-Scale State-Space Models.

Abstract: In this talk, we present a method for estimating the deterioration state of bridges using SSM/SSM-KR deterioration model. The proposed method relies on a Gaussian mixture reduction approach. Further modelling challenges and solutions are also discussed in the presentation.