Curriculum Vitae Nathan Gold

Personal

Address	Toronto, Canada
E-mail	nathan.gold5@gmail.com
Webpage	https://www.nathangold.org
Citizenships	Canada, United States of America

Research Interests

Credit scoring, machine learning in financial applications, multivariate time series analysis, Markov Decision Processes and optimal control, foreign exchange markets, market microstructure, survival analysis, economic forecasting, change-point detection, alternative data credit analysis, developing markets.

Education

Ph.D., York University 2020
Applied Mathematics
Dissertation: *Opto-physiological modelling of light interaction in skin tissue*
Nominated for Most Outstanding Dissertation
Advisor: Prof. Huaxiong Huang
Dissertation Committee: Chair: Prof. Peter Gibson, Prof. Thomas Salisbury, Prof. Steven Xiaogang Wang, Prof. Michael Haslam; Internal Examiner: Prof. Sheila Embleton; External Examiner: Prof. Chun Liu (Illinois Institute of Technology)
NSERC Postgraduate Doctoral Scholar

Honours B.A., York University 2015
Applied Mathematics, Department of Mathematics and Statistics
First Class with Distinction
Member of Dean's Honour Roll
Member of Chair's Honour Roll, Department of Mathematics and Statistics

Academic Experience

Frasch Lab, Université de Montréal, Montréal, Canada 05/2014 – Present
University of Washington, Seattle, United States
Statistical Researcher, Department of Obstetrics-Gynecology,
Faculty of Medicine, CHU Sainte-Justine Research Center
Department of Obstetrics & Gynecology, School of Medicine
Supervisor: Dr. Martin G. Frasch

Centre for Quantitative Analysis and Modelling 09/2018 – 08/2020
The Fields Insitute, Toronto, Canada
Researcher, Health Analytics and Multidisciplinary Modelling Lab

University of Tokyo, Tokyo, Japan 06/2017 - 08/2017
Visiting Researcher, Fluids Engineering Laboratory,
Department of Mechanical Engineering
Supervisor: Prof. Shu Takagi

Université Pierre et Marie Curie, Sorbonne, Paris, France 05/2016 - 08/2016
Inria, Paris, France
Mitacs Globalink Researcher, Laboratoire Jacques Louis-Lions (UPMC)
REO Group (Inria)
Supervisor: Dr. Marc Thiriet

York University, Toronto, Canada 05/2013 – 09/ 2016
Summer Research Student, Department of Mathematics and Statistics
Supervisors: Prof. Huaxiong Huang and Prof. Steven Wang

York University, Toronto, Canada 05/2012 – 09/2012
Research Assistant, Computational Fluid Dynamics
Department of Mathematics and Statistics
Supervisor: Prof. Michael Haslam

Professional Experience

Shara, Washington DC, USA; Nairobi, Kenya 10/2021 - Present
Head of Data Science
Supervisor: Grant Brooke, CEO

- Lead team consisting of one engineer and analyst
- Built Data Warehouse capabilities in GCP BigQuery joining all company data sources with a modern data stack and infrastructure-as-code
- Responsible for all analytics dashboarding development with business stakeholders and product development
- Experiment design and analysis for financial product creation and in-field research with merchants
- Developed and implemented first risk-based scoring procedure for loan applications and behavioural scoring for lending

Harvest Venture Partners, Calgary, Canada 12/2021 - Present
Machine Learning Fund Advisor

- Investment vetting for machine learning and data-driven companies
- Strategic advising for investments
- Technology overview and vetting for potential investments

Nuula, *formerly BFS Capital*, Toronto, Canada 08/2020 - 09/2021
Machine Learning Researcher, Data Science
Supervisor: Gene Sobolev, VP of Data Science

- Developed risk decision engine for dynamic credit limit adjustment for small business line of credit product combining multiple data sources
- Cashflow forecasting models from real-time bank account records predicting 60 days of future balances
- Credit risk assessment model for loan application scoring, resulting in forecasted savings of $15.5 MM per annum
- Deployed machine learning models onto AWS cloud infrastructure
- Technology assessment and review for purchase and implementation

TMX Group, Toronto, Canada 10/2015 - 05/2016
NSERC Engage Research Fellow, eXplore TMX Innovation Lab
Supervisor: David Orzell, Chief Commercial Officer CDS

- Developed predictive analytic software in Python, MATLAB, C, and Apache Spark using machine learning, statistical, and applied mathematics techniques
- Analyzed over 25TB of financial data from the TSX Exchange, Over-the-Counter exchange, and derivative markets for causal relations between Volatility and liquidity
- Prepared weekly presentations and monthly reports for senior management detailing analytic results

Machine Learning Consulting 09/2015 - Current

- Consulted for and advised various data science teams and startups in the design and implementation of machine learning algorithms
- Bayesian inference techniques for decision making optimization in various fields including digital marketing, data stream processing, and healthcare analytics
- Selected Companies: Myia Health, JTG Daugherty Racing, Genesis X, Concord
- Advised for and reviewed proposed technology acquisitions and implementations

---

Research Funding

- University of Canterbury Visiting Scholar (2019), $4500 (NZ), *Modelling and Analysis of Travelling Wave Phenomena in Cellular Media*
  PI with Rua Murray (PI)

- Mitacs Globalink Research Award - INRIA - for research in France (2016), $5000 CAD with 1600€, *Mathematical Modelling of Fetal Cardiovascular, Neurovascular, and Metabolic Response to Umbilical Cord Occlusions*
  PI with Huaxiong Huang (PI) and Marc Thiriet (PI)

Honours and Awards

NSERC Postdoctoral Fellowship - *Declined*, 2021-2023
Natural Science and Engineering Research Council of Canada

- Monetary value of $90,000 ($45,000 per annum)

NSERC Postgraduate Doctoral Scholarship, 2017-2020
Natural Science and Engineering Research Council of Canada
- Monetary value of $63,000 ($21,000 per annum)

Ontario Graduate Scholarship - *Declined*, 2017
Government of Ontario and York University
- Monetary value of $15,000

Irvine R. Pounder Award, 2015
York University, Toronto, Canada
- Highest grade point average in Department of Mathematics and Statistics

Abe Karrass / Donald Solitar Mathematics Award, 2015
York University, Toronto, Canada
- Most outstanding student with an interest in mathematics education
- Monetary value of $2000

Academic Professional Activities

Reviewer
- PLOS Digital Health
- Computers in Biology and Medicine
- Journal of Computational Science
- Frontiers in Pediatrics

Professional Society Membership
- Society for Reproductive Investigation
- Society of Industrial and Applied Mathematics
- Canadian Mathematical Society
- American Mathematical Society

Service Contributions
- Organizer, *Left to the Reader* - York University Graduate Student Mathematics Seminar
- Undergraduate and Graduate Student Representative, Department of Mathematics and Statistics Tenure and Promotion Committee, York University
- Student Representative, Department of Mathematics and Statistics Departmental Council, York University

---

Publications

[1] S.G Roux, N.B. Garnier, P. Abry, **N. Gold**, M.G. Frasch (2021) "Distance to healthy cardiovascular dynamics from fetal heart rate scale-dependent feature sin pregnant sheep model of human labor predicts cardiovascular decompensation", Accepted for publication in Frontiers in Pediatrics.

[2] **N. Gold**, C. Herry, X. Wang, M.G. Frasch (2021) "*Fetal cardiovascular decompensation during labour predicted from the individual heart rate: a prospective study in fetal sheep near term and the impact of low sampling rate*", Frontiers in Pediatrics, Neonatology, doi: 10.3389/fped.2021.593889.

[3] **N. Gold**, M.G. Frasch (2021) "*Fetal cerebral perfusion is better than fetal acidaemia for the prediction of brain injury and might be assessable by sophisticated fetal heart rate metrics*", British

Journal of Obstetrics and Gynecology, doi: 10.1111/1471-0528.16674.

[4] R. Yu, S.J. Wu, A. Huang, **N. Gold**, H. Huang, G. Fu, K. Lee (2019) "*Using polygraph to detect passengers carrying illegal items*", Frontiers in Psychology, Emotion Science, **10** doi: 10.3389/fpsyg.2019.00322.

[5] X. Zhao, **N. Gold**, Y. Fang, S. Xu, Y, Zhang, J. Liu, A. Gupta, H. Huang (2018) "*Verterbal artery fusiform aneurysm geometry in predicting rupture risk*", Royal Society Open Science 2018 **5 180780**. doi: 10.1098/rsos.180780.

[6] B. Eisenberg, **N. Gold**, Z. Song, H. Huang (2018) "*What Current Flows Through a Resistor?*", arXiv:1805.04814, submitted to Physical Review Letters.

[7] S. Jaimungal. T. Salisbury, H. Huang, M. Grasselli, Y. Chen, **N. Gold**, Y, Li, Y. Zhu, A, Day, V, Mouquin, Y. Zhou, M. Zhao, Y. Yan, W. Hu, B. Teng, X. Li, Z. Fei (2018) "*FX Volatility Prediction and Insights from Tick Data and Market Events*", Technical report for OANDA Corp.

[8] X. Ye, **N. Gold**, H. Huang, X. Wang (2018) "*Bayesian Change-Point Detection and Forecasting for Returns of the U.S. Dollar Index and Equity Markets*", submitted to Quantitative Finance.

[9] **N. Gold**, M.G. Frasch, C. Herry, B.S. Richardson, X. Wang (2018) "*A Doubly Stochastic Change Point Detection Algorithm for Noisy Biological Signals*", Frontiers in Physiology, **8:1112.** doi: 10.3389/fphys.2017.01112

[10] **N. Gold**, Q. Wang, M. Cao, H. Huang (2017) "*Liquidity and volatility commonality in the Canadian Stock Market*", Mathematics-In-Industy Case Studies, **8:7.**

[11] X. Ye, **N. Gold**, H. Huang (2016) "*A Study of RMB Exchange Rate Volatility Change Points Based on Bayesian Online Change Point Detection*", Proceedings of the International Conference on Management Science and Engineering 2016.

[12] M.J. Panaggio, P.-W. Fok, G.S. Bhatt, S. Burhoe, M. Capps, C.J. Endholm, F. El Moustaid, T. Emerson, S.-L. Estock, **N. Gold**, R. Halabi, M. Houser, P.R. Kramer, H.-W. Lee, Q. Li, W. Li, D. Lu, Y. Qian, L.F. Rossi, D. Shutt, V.C. Yang, Y. Zhou (2016) "*Prediction and optimal scheduling of advertisements in linear television*", Technical report for Clypd, Inc.

[13] **N. Gold**, Q. Wang, M.G. Frasch, H. Huang. M. Thiriet, S.X. Wang (2016) "*A mathematical model of fetal cardiovascular and metabolic responses to umbilical cord occlusions*", Reproductive Sciences, **23** (1).

[14] Q. Wang, **N. Gold**, M.G. Frasch, H. Huang, M. Thiriet, S.X. Wang (2015) "*Mathematical Model of Cardiovascular and Metabolic Responses to Umbilical Cord Occlusions in Fetal Sheep*", Bulletin of Mathematical Biology, **77** (12), 2264 - 2293.

[15] M.G. Frasch, L.D. Durosier, **N.Gold**, M. Cao, B. Matushewski, L. Keenliside, Y. Louzoun, M. Ross, B. Richardson (2015) "*Adaptive shut-down of EEG activity predicts critical acidemia in near-term ovine fetus*", Physiological Reports, **3** (e12435).

[16] **N. Gold**, X. Wang, C. Herry, M.G. Frasch (2015) "*Prediction of Fetal Cardiovascular Decompensation During Labour From Heart Rate Variability: Validation in Fetal Sheep Model of Human Labour*", Reproductive Sciences, **22** (1).

[17] **N. Gold**, N. Aminnejad, H. Huang, R. Li, X. Zhou (2020) "*A clinical scoring metric for liver disease mortality evaluation*", submitted to Therapeutics and Clinical Risk Management.

Presentations

- "*The Stories Our Bodies Tell - Mathematics in Medicine*", **TEDx** Talk, TedxUoftSalon: Intersections, Toronto, October 3, 2019.
- "*How to Make a Really Good Smoothie*", Left to the Reader, York University Graduate Student Seminar Series, York University, Toronto, May 8th, 2019.
- "*How to Make a Really Good Smoothie - Modelling*", InFoMM Graduate Modelling Camp, Mathematical Institute, University of Oxford, Oxford, April 4, 2019.
- "*Machine learning for the analysis of liquidity commonality and volatility changes in financial markets*", Forum "Math-for-Industry" 2018 (FMfI2018), Fudan University, Shanghai, November 20, 2018.
- "*Physiology Based Lie Detection*", Left to the Reader, York University Graduate Student Seminar Series, York University, Toronto, October 1st, 2018.
- "*Change-Point Detection and Forecasting of the U.S. Dollar Index and Equity Markets*", Workshop on Mathematical Finance, China Academy of Research for Finance (CAFR), Shanghai Advanced Institute of Finance, Shanghai Jiao Tong University, Shanghai, May 14th, 2018.
- "*FX Volatility Prediction and Insights from Tick Data and Market Events - OANDA Group*", 2018 Fields-China Joint Industrial Problem Solving Workshop in Finance, Shanghai University of Finance and Economics, Shanghai, May 12th, 2018.
- "*Change-point detection for noisy non-stationary biological signals*", Left to the Reader, York University Graduate Student Seminar Series, York University, Toronto, September 28th, 2017.
- "*Change-point detection for noisy non-stationary biological signals*", Workshop on Waves in Neural Media, Focus Program on Multi-scale Modelling of Wave Structures in Tissues, Fields Institute, Toronto, September 8th, 2017.
- "*Broker and Trader Analysis - The TMX Group*", Fields-China Joint Industrial Problem Solving Workshop in Finance, Fields Institute, Toronto, May 12th, 2017.
- "*Mathematical Modelling of Fetal Cardiovascular and Metabolic Response to Acidemia During Labour*", Mathematical Modelling in Medicine/Biology Workshop, Yau Mathematical Sciences Center, Sanya, December 14th, 2016.
- "*Mathematical Modelling of Fetal Cardiovascular and Metabolic Response to Acidemia During Labour*", Inverse Problems and Image Analysis Seminar, Fields Institute, Toronto, November 11th, 2016.
- "*Mainstreet Research: Improving online polling results*", Fields Industrial Problem Solving Workship, Fields Institute, Toronto, August 19th, 2016.
- "*A mathematical model of fetal cardiovascular and metabolic responses to umbilical cord occlusions*", Society for Reproductive Investigation 63rd Annual Scientific Meeting, Montréal, March 17th, 2016.
- "*Risky Business: Localized Factor Model for Credit Risk Analysis*", Graduate Student Mathematical Modelling Camp, Rensselaer Polytechnical Institute, June 19th, 2015.
- "*TMX Group: Identification of Causal Factors Between Liquidity and Volatility*", The 2015 Big Data Industrial Problem Solving Workshop, Fields Institute, Toronto, May 29th, 2015.

- "*Prediction of fetal cardiovascular decompensation during labour from heart rate variability*", Society for Reproductive Investigation 62nd Annual Scientific Meeting, San Francisco, March 27th, 2015.
- "*Prediction of Fetal Cardiovascular Decompensation During Labour From Heart Rate Variability: Validation in Fetal Sheep Model of Human Labour*" , Canadian National Perinatal Research Meeting 2015, Montebello, February 24th, 2015.
- "*Estimating long-term risk using short-term data*", Fields-Mprime Industrial Problem Solving Workshop, Fields Institute, Toronto, August 15th, 2014.
- "*Physiological fetal distress pattern due to umbilical cord occlusion: data driven modelling*", Problem Solving Workshop on Neurovascular Coupling and Developing Brain, Fields Institute, Toronto, July 25th, 2014.

Teaching Experience

Course Director and Lecturer - MATH 2271 "Differential Equations for Scientists and Engineers" Fall 2019–2020, Department of Mathematics and Statistics, York University

Developed and delivered original lectures three times a week to 100 second year engineering students for core course requirement and professional engineering licensing requirement; conceived of midterm tests and final exam, as well as homework problems for students to complete; held weekly office hours for student questions; maintained course website for student access; simulated inquiry based problem solving techniques applying course material to real-world engineering examples and problems.

Tutorial Leader - MATH 1200 "Problems, Conjectures and Proofs" Fall–Winter 2017–2018 and 2018–2019, Department of Mathematics and Statistics, York University

Developed and delivered weekly seminar style tutorials for 20–30 first year mathematics students; developed students problem solving and critical thinking skills on novel mathematical puzzles and problems; encouraged active student participation with weekly presentations and black-board problem solving sessions; graded students' assignments and tests; maintained course website for student access.

ESL Course Instructor

- MATH 1013 "Applied Calculus I" Fall 2016–2017, Department of Mathematics and Statistics, York University
- MATH 1014 "Applied Calclus II" Winter 2016–2017, Department of Mathematics and Statistics, York University

Developed and delivered weekly seminar style review tutorials for 20–30 first year ESL students; encouraged active student participation and skill development with weekly presentations and black-board problem solving sessions; held weekly student meetings to review lectures and prepare for exams.

Graduate Teaching Assistant

- MATH 2271 "Differential Equations for Scientists and Engineers" Winter 2018–2019, Department of Mathematics and Statistics, York University
- MATH 3241 "Numerical Methods I" Fall 2018–2019, Department of Mathematics and Statistics, York University
- MATH 3242 "Numerical Methods II" Winter 2018–2019, Department of Mathematics and Statistics, York University
- MATH 3090 "Computational Mathematics" Fall 2018–2019, Department of Mathematics and Statistics, York University

- MathStat Lab Tutor Fall–Winter 2015–2016, 2017–2018, Department of Mathematics and Statistics, York University
- MATH 2241 "Symbolic Computing" Fall 2018–2019, Department of Mathematics and Statistics, York University
- MATH 1019 "Discrete Mathematics for Computer Science", Department of Mathematics and Statistics, York University
- MATH 1013 "Applied Calculus I" Fall 2015–2016, Department of Mathematics and Statistics, York University
- MATH 1014 "Applied Calclus II" Winter 2015–2016 , Department of Mathematics and Statistics, York University
- MATH 1505 "Calculus for Life Sciences" Fall–Winter 2015–2016, Department of Mathematics and Statistics, York University

Responsible for grading students' assignments, midterm exams and final exams; invigilation duty; tutor in drop-in MathStat Lab centre for first and second year mathematics and statistics courses.