

Lalla Mouatadid

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Staff Research Scientist

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Summary & Expertise

Research Scientist and Mathematician who thrives at the frontier of **Computer Science, Mathematics, and AI**. Known for rapidly mastering new fields and delivering cutting-edge research across diverse domains, from graph mining to LLM reliability. Brings deep mathematical rigor to every project and excels at translating complex concepts into clear insights for technical and non-technical audiences. Recognized for publications, patents, and impactful collaborations at leading academic and industry conferences (*List on page 2 & 3*). Fluent in **French and English**.

- + Rapid domain adaptation & cutting-edge research delivery
- + Cross-disciplinary innovation in Computer Science and AI
- + Research leadership, university-industry collaborations
- + Mathematical modeling & algorithm design
- + Technical & non-technical communication excellence
- + **Technical:** Python, Bash, PyTorch

Professional Experience

Staff Research Scientist, Intuit AI Research. Toronto, ON, Canada 2020-2024

Graph Mining:

- Led the data and graph mining capability of Intuit's TurboTax Knowledge graph, developing an end-to-end pipeline to detect and consolidate repetitive tax calculation subgraphs.
- Reduced the size of Intuit's Tax Knowledge graph, cutting overhead for tax analysts to streamline the yearly IRS and CRA tax updates.
- Expanded the framework into a reusable sandbox, enabling other teams to detect problematic subgraphs (potential fraud subgraphs on Intuit's fraud network).

LLM Reliability:

- Co-developed a perturbation-based uncertainty quantification method for LLMs, reducing the expected calibration error (ECE) by 50% on average.

Hybrid AI/Learning with Constraints:

- Built a pipeline combining ML, symbolic AI, and optimization to generate actionable recommendations for Intuit's small businesses.
- Developed a *scalable* framework incorporating symbolic domain knowledge as constraints for learning.

Document Understanding:

- Led Intuit's university collaboration with Virginia Tech (securing ~200K funding over 2 years) on document understanding, focusing on relation extraction on invoices using edge-aware graph attention networks.
- Co-developed an unsupervised document image enhancement solution using Cycle-Consistent diffusion models, improving the quality of documents and invoices uploaded to Intuit's QuickBooks.

Graph Architect/Engineer, Xperiel. San Francisco Bay Area 2018-2020

Led a team to build apps using ROX: Xperiel's Graph-based platform, reaching over 1 million users and visitors.

Visiting Researcher Summers 2017, 2015

Université Paris Diderot, IRIF, Paris, France.

Brandenburgische Technische Universität, Cottbus, Germany.

Adjunct Professor, University of Toronto, Computer Science Department 2014, 2016

CS373: Algorithm Design, Analysis & Complexity. 100+ students.

Software Engineer, NISA. Nanaimo, BC, Canada 2009-2012

Built customized software solutions for clients. Sole developer for NISA's biggest projects (at the time): [CanadianNanny.ca](https://www.canadiannanny.ca)

Education

PhD in Theoretical Computer Science, University of Toronto 2014-2018

Thesis: *Efficient Algorithms on Co-comparability Graphs via Vertex Orderings*.

Supervisors: Derek Corneil & Allan Borodin

MSc in Theoretical Computer Science, University of Toronto 2012-2014

BSc in Computer Science, Minor in Math, Vancouver Island University 2006-2010

Graduated with *distinction / magna cum laude*

Selected Awards & Fellowships

NSERC Postdoctoral Fellowship (Declined)	2019-2021
Alfred B. Lehman Graduate Scholarship	2017-2018
NSERC Post Graduate Scholarship – Doctoral	2015-2018
Graduate Student Fellowship, Computer Science, University of Toronto	2012-2017

Publications¹

- (α, β) -Modules on Graphs.**
Michel Habib, Lalla Mouatadid, Éric Sopena, & Mengchuan Zou.
Journal: SIAM Journal on Discrete Mathematics. 2024. Vol. 38, issue 1, pp 566-589.
- SPUQ: Perturbation-Based Uncertainty Quantification for Large Language Models.**
Xiang Gao, Jiaxin Zhang, Lalla Mouatadid, & Kamalika Das.
Conference: 18th Conference of the European Chapter of the Association for Computational Linguistics (EACL'24).
- RE²: Region-Aware Relation Extraction from Visually Rich Documents**
Pritika Ramu, Sijia Wang, Lalla Mouatadid, Joy Rimchala, & Lifu Huang.
Conference: 24th Conference of the North American Chapter of the Association for Computational Linguistics (NAACL'24).
- DECDM: Document Enhancement using Cycle-Consistent Diffusion Models**
Jiaxin Zhang, Joy Rimchala, Lalla Mouatadid, Kamalika Das, & Kumar Sricharan.
Conference: IEEE/CVF Winter Conference on Applications for Computer Vision (WACV'24).
- A New Graph Parameter to Measure Linearity.**
Pierre Charbit, Michel Habib, Lalla Mouatadid, & Reza Naserasr.
Journal: Journal of Graph Theory. 2023. Vol. 103, issue 3, pp 462-485.
Conference: 11th International Conference on Combinatorial Optimization (COCOA'17).
- Mining Frequent Patterns on Knowledge Graphs.**
Lalla Mouatadid.
Conference: 15th ACM International Conference on Web Search and Data Mining (WSDM'22).
- Actionable Recommendations with Hybrid AI.**
Sudhir Agarwal, Lalla Mouatadid, Anu Sreepathy.
Conference: AAI Symposium on Machine Learning and Knowledge Engineering (AAAI MAKE'22).
- A Scalable Technique for Weak-Supervised Learning with Domain Constraints.**
Sudhir Agarwal, Anu Sreepathy, & Lalla Mouatadid.
Workshop: NeurIPS Workshop: Has it Trained Yet? (Neurips'22 Workshop).
- A General Algorithmic Scheme for Combinatorial Decompositions with Application to Modular Decompositions of Hypergraphs.**
Michel Habib, Fabien de Montgolfier, Lalla Mouatadid, Mengchuan Zou.
Journal: Theoretical Computer Science. 2022. Vol. 923, pp 56-73.
Conference: 30th International Workshop on Combinatorial Algorithms (IWOCOA'19).
Invited to the Special Issue.
- Maximum Induced Matching Algorithms via Vertex Ordering Characterizations.**
Michel Habib & Lalla Mouatadid.
Journal: Algorithmica. 2020. Vol. 82, issue 2, pp 260-278.
Poster: 49th ACM Symposium on the Theory of Computing - (STOC'17 Theory Fest).
Conference: 28th International Symposium on Algorithms and Computation (ISAAC'17).
Invited to the Special Issue.
- Approximating Modular Decomposition is Hard.**
Michel Habib, Lalla Mouatadid, Mengchuan Zou.
Conference: 6th International Conference on Algorithms and Discrete Applied Mathematics (CALDAM'20).
- Graph Searches and Geometric Convexities in Graphs.**
Feodor Dragan, Michel Habib, & Lalla Mouatadid. Technical report, Manuscript, 2018.
Conference: 10th International Colloquium on Graph Theory and Combinatorics (ICGT'18).

13. **A Fast, Simple Algorithm for Computing the Bump Number of a Poset.**
Derek Corneil, Lalla Mouatadid, & Gara Pruesse.
Technical report, Manuscript, 2018.
14. **Linear Time Maximum Weighted Independent Set on Co-comparability Graphs.**
Ekkehard Köhler & Lalla Mouatadid.
Journal: Information Processing Letters. 2016. Vol. 116, issue 6, pp 391-395.
Poster: The ACM Celebrations of Women in Computing (ACMW'13).
Best Poster Award.
15. **Path Graphs, Clique Trees, and Flowers.**
Lalla Mouatadid & Robert Robere.
Technical report, Manuscript, 2015.
16. **Linear Time LexDFS on Co-comparability Graphs.**
Ekkehard Köhler & Lalla Mouatadid.
Conference: 14th Scandinavian Workshop on Algorithm Theory (SWAT'14).

¹As is customary in Math & Theoretical Computer Science, authors are listed alphabetically by surname.

Patents

Issued:

1. **Storage Structure for Pattern Mining.**
Lalla Mouatadid & Jay Jie-Bing Yu.
US Patent: [11,531,527](#).
2. **Model Based Document Image Enhancement.**
Jiaxin Zhang, Tharathorn Rimchala, Lalla Mouatadid, Kamalika Das, & Sricharan Kumar.
US Patents: [11,769,239](#) and [12,045,967](#).
3. **Scalable Weak-Supervised Learning with Domain Constraints.**
Sudhir Agarwal, Anu Sreepathy, & Lalla Mouatadid.
US Patent: [11,783,609](#).
4. **Optimizing Questions to Retain Engagement.**
Kevin Furbish, Glenn Scott, & Lalla Mouatadid.
US Patent: [12,093,640](#).

Pending:

5. **Controlling Uncertain Output by Large Language Models.**
Xiang Gao, Jiaxin Zhang, Lalla Mouatadid, & Kamalika Das.
US Patent App: 18/220,814.
6. **Verifiable Cacheable Calculations.**
Glenn Scott, Michael Gabriel, Roger Meike, & Lalla Mouatadid.
US Patent App: 17/246,401.
7. **Hybrid Artificial Intelligence Generated Actionable Recommendations.**
Sudhir Agarwal, Lalla Mouatadid, Anu Sreepathy, & Kevin Furbish.
US Patent App: 17/698,676.
8. **Modeling and Managing Affinity Networks.**
Glenn Scott, Roger Meike, & Lalla Mouatadid.
US Patent App: 17/958,275.

Selected Invited Talks

- 2021 [Graph + AI Summit](#)
Talk: *Mining Frequent Patterns on Knowledge Graphs* (remote).
[ICALP](#). Workshop on Graph Width Parameters: from Structure to Algorithms.
Talk: *Measuring Linear Structure on Graphs* (remote).
- 2019 [Stanford University](#). Theory Seminar
Talk: *Graph Searches on Structured Families of Graphs*.

- GROW**. Graph Classes, Optimization, and Width Parameters, Vienna, Austria.
A Talk: *General Algorithmic Scheme for Modular Decompositions of Hypergraphs*.
- 2018 **North Carolina State University**. Theory Seminar.
Talk: *Graph Searches on Structured Families of Graphs*.
- Dagstuhl**. Seminar on High Performance Graph Algorithms.
Talk: *A Toolbox to Extract Structure from Graphs*.
- SIAM Discrete Mathematics**. Denver, CO., US. Track: Modification Problems to Discrete Structures.
Talk: *Maximum Induced Matching Algorithms via Vertex Orderings*.
- 2017 **Princeton University**. Discrete Mathematics Seminar.
Talk: *Graph Searches on Structured Families of Graphs*.
- Shanghai Jiao Tong University**. Shanghai, China.
Talk: *Graph Searches on Structured Families of Graphs*.
- 2016 Invited to the **Heidelberg Laureate Forum**. Heidelberg, Germany.
Poster: *Graph Searches on Structured Families of Graphs*.
- GRASTA**. Graph Search - Theory and Algorithms. Lorentz Center, Leiden, The Netherlands.
Talk: *Graph Searches on Structured Families of Graphs*.
- 2015 **University Paris Diderot**. Theory Seminar. Paris, France.
Talk: *Path Graphs, Clique Trees, and Flowers*.
- Brandenburgische Technische Universität**, Math Seminar. Cottbus, Germany.
Talk: *Path Graphs, Clique Trees, and Flowers*.

Teaching Experience

- 2014, 2016 **Course Instructor**, University of Toronto
Algorithm Design, Analysis, & Complexity. Links to 1st & 2nd offerings.
- 2013-2018 **Teaching Assistant**, University of Toronto
Computability & Logic (Graduate course). Algorithm Design, Analysis, & Theory (Graduate course).
Advanced Algorithm Design. Algorithm Design Analysis, & Complexity. Data Structures and Analysis
Introduction to Theory of Computation. Mathematical Expression & Reasoning for Computer Science

Professional Services

- 2013-Present **Journal Reviewer:**
Journal of Graph Theory (JGT). SIAM Discrete Mathematics (SIDMA). Discrete Applied Mathematics (DAM).
Journal of Combinatorics (JOC). Discrete Mathematics & Theoretical Computer Science (DMTCS). RAIRO
- Operation Research. Information Processing Letters (IPL)
- 2017 **Program Committee Member:**
GROW: Workshop on graph classes, optimization, and width parameters.