

# Parsa Kamalipour

Montréal, QC – Canada

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## Education

### Concordia University ↗

Master of CS (Thesis-based) in Computer Science, advised by Prof. Hovhannes Harutyunyan ↗

Montreal, QC, Canada

Sep 2024–Present

- **GPA:** 3.58/4.0

- **Research Topics:** Community Detection, Social Networks Analysis, Algorithms Design, Graph Theory

### Vali-e-Asr University of Rafsanjan ↗

B.Sc. in Computer Engineering, advised by Dr. Fahimeh Dabaghi-Zarandi ↗

Rafsanjan, Iran

Sep 2018–Jun 2023

- **GPA:** 16.26/20.0 \*Graduated with Honors

## Publications

- *Spider Community Detection: Seeded Geodesic Expansion with Modularity-Guided Refinement and Greedy Merge Matching* ↗
  - H. Harutyunyan, **Parsa Kamalipour** — *Computers (in revision)*, 2026
- *From Dense Graphs to Meaningful Communities: Assessing Community Quality Using Geodesic Distance Modularity on Metric Backbone-Sparsified Networks* ↗
  - **Parsa Kamalipour**, H. Harutyunyan — *SNAMS 2025 (accepted)*
- *LLM-Based Code Translation for Cross-Language Refactoring Mining* ↗
  - I. Hemati Moghadam, M. M. Afkhami, V. Zaytsev, M. H. Ashoori, H. Bazmandegan, and **Parsa Kamalipour** — *Empirical Software Engineering (in revision)*
- *Extending refactoring detection to Kotlin: A dataset and comparative study* ↗
  - I. Hemati Moghadam, M. M. Afkhami, **Parsa Kamalipour**, V. Zaytsev — *SANER 2024*, doi.↗
- *Community detection in complex network based on an improved random algorithm using local and global network information* ↗
  - F. Dabaghi-Zarandi, **Parsa Kamalipour** — *Journal of Network and Computer Applications*, 2022. doi.↗

## Experiences

### Research Experience

#### Algorithms & Complexity Lab, Concordia University

Montreal, QC, Canada

Graduate Research Assistant, Supervisor: Prof. Hovhannes Harutyunyan

Aug 2024 – Present

- Designed the **Spider graph** community detection algorithm combining **geodesic expansion**, **modularity-guided refinement**, and **greedy merge matching**.
- Benchmarked Spider on 14 real-world networks (up to **8,035 nodes / 183,663 edges**) against **Leiden**, **Louvain**, and **Infomap**, achieving **8–15%** improvement in **NMI**, **modularity**, and **F1-score**.
- Applied **metric backbone**, yielding on average **65% edge reduction**, and introduced **Weighted Average Geodesic Distance Modularity (wGDM)** to normalize and balance the original GDM for evaluating local community quality on sparsified graphs.
- Built a reproducible experimental pipeline with fixed random seeds, baseline implementations, and automated evaluation scripts.

#### Formal Methods and Tools (FMT) Group, University of Twente

Enschede, The Netherlands

Research Collaborator (Remote), Supervisor: Dr. Iman Hemati Moghadam

Aug 2023 – Mar 2024

- Implemented the **KotlinCode2Text** parser and integrated it into the **RefDetect** framework for automated refactoring detection.
- Built two refactoring datasets used for empirical evaluation in the *SANER 2024* study.
- Improved analysis reliability and runtime through targeted debugging and algorithmic refinements.
- Explored **LLM-based prompt engineering** for cross-language code translation in refactoring mining.

#### Department of Computer Engineering, Vali-e-Asr University of Rafsanjan

Rafsanjan, Iran

Undergraduate Research Assistant, Supervisor: Dr. Fahimeh Dabaghi-Zarandi

Aug 2021 – Mar 2024

- Developed the **CRLG** community detection framework based on an randomized algorithm using local and global network information.
- Implemented weighted probabilistic seeding and similarity-driven community assignment with heuristic community merging.
- Evaluated on real networks and GN/LFR benchmarks, achieving up to **+10%** improvement over **LCDR**, **MOACO**, **Node2vec-SC**, **NE-N2V**, **CDASS**, and **TS** using **NMI**, **modularity**, and **density**.

### Teaching Experience

#### Gina Cody School of Engineering and Computer Science, Concordia University

Montreal, QC, Canada

Graduate Teaching Assistant

Sep 2024 – Present

- Delivered **tutorials and laboratory demonstrations, graded assignments and exams**, and provided student support through **Programmer On Duty (POD)** sessions, office hours, and detailed feedback on coursework and projects. Courses:
  - COMP 233: Probability and Statistics for CS (S25,F25)
  - COMP 248: Object-Oriented Programming I (F25,W26)
  - COMP 335: Introduction to Theoretical CS (F24,S25)
  - COMP 339: Combinatorics (F24,F25)
  - COMP 348: Principles of Programming Languages (W25,S25)
  - COMP 465: Design and Analysis of Algorithms (W25)
  - COMP 472: Artificial Intelligence (F25)
  - SOEN 363: Data Systems for Software Eng (W25,F25,W26)
  - COEN 311: Computer Organization and Software (F25,W26)
  - COEN 317: Microprocessor-Based Systems (W26)

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### Department of Computer Engineering, Vali-e-Asr University of Rafsanjan

Undergraduate Teaching Assistant

Rafsanjan, Iran

Mar 2021 – Jan 2024

- Served as **Head TA and Tutorial Leader** for multiple foundational CS courses, mentoring students, coordinating grading, and collaborating with faculty to design assignments and support student projects in various courses.
- Courses: Data Structures, Algorithms Design, Discrete Mathematics, Operating Systems, Information Retrieval, Software Engineering, Database Systems, Artificial Intelligence, Data Mining.

## Research Interests

- Design & Analysis of Algorithms
- Graph Theory & its applications
- Machine Learning & Graph Mining
- Social Networks Analysis & Complex Networks

## Honors and Awards

- 2025: Awarded Concordia Conference and Exposition Allowance – Concordia University
- 2024: DRW Graduate Scholarship in Computer Science – Concordia University & DRW Company
- 2024: Concordia Merit Scholarship (Entrance Scholarship Award) – Concordia University, School of Graduate Studies
- 2024: Financial Research Support (FRS) – Concordia Faculty of Engineering and Computer Science
- 2023: Distinguished Student Award – Awarded among all students of Vali-e-Asr University
- 2023: Top Researcher Award – Earned this prestige award among all undergraduate students in Kerman Province

## Selected Projects

### Evaluation of Scalable Training Strategies for Graph Neural Networks ↗

Concordia University, Montréal

Optimizing Graph Neural Networks for Scalable Community Detection

2024

- Designed and implemented scalable GNN-based community detection pipelines using **GCN** and **GraphSAGE** architectures with full-batch training, neighbor sampling, and graph partitioning strategies.
- Conducted extensive experiments on **SBM (1K, 10K)**, **CORA**, and **Reddit** datasets, demonstrating that neighbor sampling and graph partitioning enable training on large graphs where full-batch methods fail due to memory constraints.
- Achieved up to **90% accuracy** on SBM (10K nodes) with graph partitioning while reducing memory footprint, and enabled scalable training on Reddit where full-batch methods resulted in out-of-memory failures.
- Analyzed trade-offs between accuracy, training time, and memory usage, providing practical guidelines for scalable GNN deployment in real-world large-scale social networks.

### Experimental Study of Network Flow Optimization Algorithms ↗

Concordia University, Montréal

Minimum-Cost Flow Algorithms on Randomized Source–Sink Networks

2024

- Implemented the **Successive Shortest Path** algorithm from scratch, including residual graph construction, Bellman–Ford based minimum-cost path extraction, and flow augmentation logic.
- Designed and executed large-scale experimental evaluation on **randomized Euclidean directed graphs** across 28 configurations with varying density ( $r$ ), capacity bounds, and cost regimes.
- Compared **SSP**, **Capacity Scaling**, **Scaling-SSP**, and **Primal–Dual** algorithms using metrics including total cost, flow value, number of augmenting paths, mean path length, and proportional path length.
- Demonstrated that the **Primal–Dual algorithm consistently achieves optimal minimum cost**, while SSP achieves competitive performance in sparse regimes and degrades in dense graphs.

			ari	conductance	$f1_{score}$	modularity	nmi
dataset	algorithm						
amazon	CNM	0.273000	0.0000000.280000	0.9240000.822000			
	Infomap	0.273000	0.0000000.280000	0.9240000.822000			
	LabelProp	0.288000	0.1680000.294000	0.8370000.774000			
	Leiden	0.276000	0.0000000.283000	0.9240000.824000			
	Louvain	0.276000	0.0000000.283000	0.9240000.824000			
	Spider	0.276000	0.0000000.283000	0.9240000.824000			
citeseer	CNM	0.203000	0.0830000.272000	0.8350000.347000			
	Infomap	0.172000	0.0100000.402000	0.4600000.193000			
	LabelProp	0.051000	0.3470000.069000	0.6910000.351000			
	Leiden	0.144000	0.0770000.199000	0.8550000.331000			
	Louvain	0.154000	0.0780000.214000	0.8520000.326000			
	Spider	0.197000	0.0610000.273000	0.8450000.340000			
cora	CNM	0.315000	0.1300000.392000	0.7900000.471000			
	Infomap	0.295000	0.0990000.394000	0.7840000.467000			
	LabelProp	0.144000	0.4210000.177000	0.6530000.428000			
	Leiden	0.306000	0.1200000.370000	0.8120000.480000			
	Louvain	0.258000	0.1210000.324000	0.8050000.463000			
	Spider	0.331000	0.0900000.424000	0.7860000.479000			
dblp	CNM	0.800000	0.0010000.801000	0.9870000.972000			
	Infomap	0.406000	0.0000000.411000	0.9760000.925000			
	LabelProp	0.835000	0.1640000.836000	0.9550000.961000			
	Leiden	0.830000	0.0020000.831000	0.9880000.975000			
	Louvain	0.800000	0.0010000.801000	0.9870000.971000			
	Spider	0.731000	0.0010000.733000	0.9870000.961000			
high <sub>school</sub>	CNM	0.394000	0.1250000.494000	0.5410000.659000			
	Infomap	1.000000	0.3160001.000000	0.5760001.000000			
	LabelProp	0.429000	0.1820000.522000	0.5470000.729000			
	Leiden	0.675000	0.2440000.721000	0.5810000.876000			
	Louvain	0.810000	0.2710000.834000	0.5820000.930000			
	Spider	0.914000	0.2960000.924000	0.5790000.969000			
karate	CNM	0.568000	0.2810000.746000	0.3810000.565000			
	Infomap	0.591000	0.2010000.764000	0.4020000.568000			
	LabelProp	0.383000	0.2810000.656000	0.3250000.364000			
	Leiden	0.465000	0.2880000.646000	0.4200000.588000			
	Louvain	0.509000	0.2880000.687000	0.4150000.600000			
	Spider	0.772000	0.1280000.882000	0.3720000.677000			
polblogs	CNM	0.785000	0.3980000.889000	0.4270000.654000			
	Infomap	0.685000	0.6450000.825000	0.4250000.526000			
	LabelProp	0.792000	0.3350000.894000	0.4260000.683000			
	Leiden	0.765000	0.4220000.877000	0.4270000.632000			
	Louvain	0.767000	0.3740000.878000	0.4270000.640000			
	Spider	0.819000	0.0730000.910000	0.4260000.729000			
primary <sub>school</sub>	CNM	0.161000	0.4040000.288000	0.2280000.431000			
	Infomap	0.000000	0.0000000.165000	0.0000000.000000			
	LabelProp	0.000000	0.0000000.165000	0.0000000.000000			
	Leiden	0.573000	0.5590000.626000	0.2840000.800000			
	Louvain	0.513000	0.5110000.575000	0.2840000.750000			
	Spider	0.761000	0.6050000.787000	0.2740000.883000			

## Skills

Programming	Python, C, C++, C#, Java, MATLAB, Ruby, Unity Engine, Bash, Assembly (x86, ARM), VHDL
ML & Data	NumPy, Pandas, SciPy, Scikit-learn, PyTorch, Matplotlib, Seaborn, NetworkX, iGraph
Graph Mining	Community Detection, Link Prediction, Node Classification, Network Embeddings, Graph
& Network Science	Algorithms, Social Network Analysis, SNAP & LFR Benchmarks, Large-Scale Network Evaluation
Tools & Databases	Linux, L <sup>A</sup> T <sub>E</sub> X, Jupyter, Markdown, Obsidian, Git, Docker, PostgreSQL, MySQL, MongoDB, Neo4j

## **Languages**

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**Persian:** Native

**English:** Proficient (C1)

**French:** Pre-intermediate (A2)