

Paul Liu

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Education

PhD in Computer Science

STANFORD UNIVERSITY

Thesis: *In progress.*

Stanford, California

2017–Present

Masters in Computer Science

UNIVERSITY OF BRITISH COLUMBIA

Thesis: Characterizing minimum-length coordinated motions for two discs

Vancouver, British Columbia

2015–2017

Bachelors in Mathematics and Physics

UNIVERSITY OF BRITISH COLUMBIA

Thesis: Searching for the vector-like quark TA – study of multivariate analysis techniques

Vancouver, British Columbia

2010–2015

Work Experience

Computer Science Department, Stanford

RESEARCH ASSISTANTSHIP

Ongoing research in distributed computing models and large-scale graph algorithms as part of my Ph.D. work.

Stanford, USA

Fall 2017 - Present

Microsoft

APPLIED DATA SCIENTIST INTERN

Worked on improving advertising relevance for search queries to the Bing search engine. Improved text classification accuracy by 15% (relative increase) through CNN-based models (to be implemented in production). Also showed promising gains in few-shot learning accuracy through Graph Convolutional Network models.

Sunnyvale, USA

July 2019 – September 2019

Adobe

CREATIVE LABS INTERN

Worked on the simulation of water bubble sounds for graphics applications. Previous works takes weeks of compute time to generate realistic acoustical simulations of liquid sounds and leverages complicated but accurate CFD codes. In this project, we aim to create new algorithms that creates acoustically plausible water sounds while bringing computational speed closer to realtime.

Seattle, USA

June 2018 – Sept 2018

Vital Mechanics

RESEARCH ENGINEER

Produced mathematical models of the human body for digital simulations. As one of the first two engineers, my work varied widely, from setting up testing and CI infrastructure to building complex physical models and optimizing solvers for specialized large and sparse linear systems. This work was spun off into a Government of Canada funded startup (Vital Mechanics Research).

Vancouver, Canada

Jan 2014 – Aug 2017

Computer Science Department, UBC

RESEARCH ASSISTANT

Worked on several problems in 2-body coordinated motion. Given two robots on an obstacle-free plane and two destination points, what is the shortest path each robot should take so that the two robots are not within unit distance of each other? We have classified optimal motions for a large variety of cases and have fully solved the problem when the robots are simple geometric shapes.

Vancouver, Canada

Jan. 2016 – Feb. 2018

Facebook

SOFTWARE ENGINEERING INTERN

Worked on statistical algorithms for detecting anomalies in time-series data. This algorithm was released to all Facebook engineers through a widely used computational backend for logging data. The algorithm was also taken up by internet.org, where it was used to detect abnormal patterns in traffic data.

Menlo Park, USA

May 2015 – Aug 2015

Google

SOFTWARE ENGINEERING INTERN

Created a stochastic model for proposed ads by potential advertisers. Purpose of the model was to predict an ad's performance before the ad is released to the public. Additionally created pipelines to automatically validate accuracy of model.

Los Angeles, USA

May 2013 – Sept 2013

Scientific Computing Lab, UBC

NSERC RESEARCH ASSISTANTSHIP

Created a high-performance C++ software package for performing incomplete factorizations of symmetric indefinite matrices. The complete source code, as well as extensive documentation, can be found at <https://github.com/inutard/matrix-factor>.

Vancouver, Canada

May 2012 – May 2015

Publications

1. Biniarz, A., **Liu, P.**, Maheshwari, A., and Smid, M. H. M. Approximation algorithms for the unit disk cover problem in 2D and 3D. *Computational Geometry: Theory and Applications* (2017), 60:8–18.
2. Greif, C., He, S., and **Liu, P.** SYM-ILDL: incomplete LDL^T factorization of symmetric indefinite and skew-symmetric matrices. *ACM Transactions on Mathematical Software* (2016), 44(1):1:1–1:21.
3. Harvey, N. J. A., Liaw, C., and **Liu, P.** Greedy and local ratio algorithms in the MapReduce model. *Proceedings of the 30th Symposium on Parallelism in Algorithms and Architectures, (SPAA)* 2018, pages 43–52.
4. Liaw, C., **Liu, P.**, and Reiss, R. Approximation schemes for covering and packing in the streaming model. *Proceedings of the 30th Canadian Conference on Computational Geometry, (CCCG)* 2018, pages 172–179.
5. **Liu, P.**, Benson, A. and Charikar, M. A sampling framework for counting temporal motifs. *Proceedings of the 12th ACM International Conference on Web Search and Data Mining (WSDM)* 2019, pages 294–302.
6. **Liu, P.** and Lu, D. (2014). A fast 25/6-approximation for the minimum unit disk cover problem. *CoRR*, abs/1406.3838. 1–5.
7. **Liu, P.** and Vondrak, J. Lower bounds for submodular optimization in the adaptive model. *Manuscript under preparation*.
8. **Liu, P.** and Vondrak, J. Submodular optimization in the MapReduce model. *Proceedings of the 2nd Symposium on Simplicity in Algorithms (SOSA@SODA)* 2019, pages 18:1–18:10.
9. Kumar, R., **Liu, P.**, Benson, A. and Charikar, M. Retrieving top weighted triangles. *In submission*.
10. Kirkpatrick, D. G. and **Liu, P.** Characterizing minimum-length coordinated motions for two discs. *Proceedings of the 28th Canadian Conference on Computational Geometry, (CCCG)* 2016, pages 252–259.
11. Greif, C., Karbet, S., **Liu P.**, Xue, F. A factorized sparse approximate inverse preconditioner for symmetric indefinite linear systems. *Manuscript under preparation*.

Service

- Reviewer for *Electronic Transactions on Numerical Analysis (ETNA)*.
- Reviewer for *Symposium on Computational Geometry (SoCG)*.
- Reviewer for *European Symposium on Algorithms (ESA)*.

Awards

- 2017 **Stanford School of Engineering Fellowship**
- 2017 **Mackenzie King Open Scholarship**
- 2016 **David W. Strangway Fellowship**
- 2015–2016 **Walter C. Koerner Fellowship**
- 2015 **Computer Science Merit Scholar**
- 2015–2017 **NSERC CGS-M Grant**
- 2015 **GSS Open Scholar Award**
- 2015 **Physics and Astronomy Undergraduate Scholarship**
- 2014–2015 **Reginald Palliser-Wilson Scholarship**
- 2014 **John Collison Memorial Scholarship**
- 2014 **Dharma Master Chuk Mor Memorial Scholarship**
- 2013 **Dorothy Gladys Studer Memorial Scholarship**
- 2013 **Volkoff Scholarship**
- 2013 **Rick Sample Memorial Scholarship**
- 2012 **W.H. MacInnes Scholarship**
- 2012 **NSERC USRA Research Award**
- 2011–2013 **Trek Excellence Scholarship**
- 2010 **President’s Entrance Scholarship**
- 2010 **BC Provincial Examination Scholarship**

Teaching experience

CS 348C Computer Graphics: Animation and Simulation

Stanford

TEACHING ASSISTANT

2019

Designed assignments and held office hours. One cool aspect of this course was that all assignments were animated videos. Created weekly video composites of class assignments synced to music.

CS490, Problem Solving Seminar

University of British Columbia

INSTRUCTOR

2014

Taught a full-credit course to expose students to computing contest problems. Designed curriculum and materials that are still currently in use.

Science One

UBC

TEACHING ASSISTANT

2012

Science One is an inter-disciplinary course at UBC encompassing all first-year science courses (equivalent of at least six full-credit courses).
Designed assignments and taught review sessions for the Math portion of the program.

Honours

2016–2019 **Coach**, ACM-ICPC Contest World Finals

2012–2014 **Canada Site Winner**, ACM ICPC Pacific Northwest Regionals

2013 **Finalist**, ACM ICPC World Finals

2013 **Bronze Medal**, U. Chicago Invitational Contest

2012 **Bronze Medal**, International University Physics Competition

2011 **7th nationally**, Google AI Contest

Extracurricular Activity

UBC Programming Team

Vancouver, Canada

COACH (2014–PRESENT), CONTESTANT (2011–2017)

2014–Present

- Competed on contests across North America.
- Created structured practices for team members.
- Wrote original contest problems for local contests.
- Created a training for local high school contestants.

UBC Math Circle

Vancouver, Canada

ORGANIZER

2012–2015

- Created structured practices for high school students competing in math contests.
- Arranged for special faculty lectures every week.

UBC & Stanford Badminton Team

TEAM MEMBER

2016–Present

- Represented UBC and Stanford in badminton games against different schools.
- Provincially and nationally ranked in individual competition.