

## Education

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### PhD in Computer Science

STANFORD UNIVERSITY

Stanford, California

2017–Present

**Thesis:** *In progress.*

### Masters in Computer Science

UNIVERSITY OF BRITISH COLUMBIA

Vancouver, British Columbia

2015–2017

**Thesis:** Characterizing minimum-length coordinated motions for two discs

### Bachelors in Mathematics and Physics

UNIVERSITY OF BRITISH COLUMBIA

Vancouver, British Columbia

2010–2015

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

## Work Experience

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### Computer Science Department, Stanford

RESEARCH ASSISTANTSHIP

Stanford, USA

Fall 2017 – Present

Continued research in distributed computing models and fast simulation of liquid sounds.

### Adobe

CREATIVE LABS INTERN

Seattle, USA

June 2018 – Sept 2018

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.

### Vital Mechanics

RESEARCH ENGINEER

Vancouver, Canada

Jan 2014 – Aug 2017

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).

### Computer Science Department, UBC

RESEARCH ASSISTANT

Vancouver, Canada

Jan. 2016 – Feb. 2018

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.

### Facebook

SOFTWARE ENGINEERING INTERN

Menlo Park, USA

May 2015 – Aug 2015

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.

### Google

SOFTWARE ENGINEERING INTERN

Los Angeles, USA

May 2013 – Sept 2013

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.

### Scientific Computing Lab, UBC

NSERC RESEARCH ASSISTANTSHIP

Vancouver, Canada

May 2012 – May 2015

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>.

## Publications

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- Biniarz, A., **Liu, P.**, Maheshwari, A., and Smid, M. H. M. (2017). Approximation algorithms for the unit disk cover problem in 2D and 3D. *Computational Geometry: Theory and Applications*, 60:8–18.
- Greif, C., He, S., and **Liu, P.** (2017). SYM-ILDL: incomplete LDL<sup>T</sup> factorization of symmetric indefinite and skew-symmetric matrices. *ACM Transactions on Mathematical Software*, 44(1):1–1:21.

- Harvey, N. J. A., Liaw, C., and **Liu, P.** (2018). 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.
- Kirkpatrick, D. G. and **Liu, P.** (2016). Characterizing minimum-length coordinated motions for two discs. Proceedings of the 28th Canadian Conference on Computational Geometry, CCCG 2016, pages 252–259.
- Liaw, C., **Liu, P.**, and Reiss, R. (2018). Approximation schemes for covering and packing in the streaming model. Proceedings of the 30th Canadian Conference on Computational Geometry, CCCG 2018, pages 172–179.
- **Liu, P.** and Vondrak, J. (2018). Submodular optimization in the MapReduce model. CoRR, abs/1810.01489. 1–10. To appear in Symposium on Simplicity in Algorithms (SOSA) 2019.
- **Liu, P.** and Lu, D. (2014). A fast 25/6-approximation for the minimum unit disk cover problem. CoRR, abs/1406.3838. 1–5. (Undergraduate work)
- **Liu, P.**, Benson, A. and Charikar, M. (2018). A sampling framework for counting temporal motifs. CoRR, abs/1810.00980. 1–10. To appear in ACM International Conference on Web Search and Data Mining (WSDM) 2019.
- Greif, C., Karbet, S., **Liu P.**, Xue, F. A factorized sparse approximate inverse preconditioner for symmetric indefinite linear systems. Manuscript in preparation.

## Service

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

## Courses Taught

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### Computer Science 490, Problem Solving Seminar

*University of British Columbia*

INSTRUCTOR

2014

Taught a full 3-credit course to expose UBC students to computing contest problems. Designed curriculum and materials that are still in use 3 years later.

## Honours

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2016–2018 **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

## Awards

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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**

## Extracurricular Activity

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### 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.