Yuchong Pan

Contact Information

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Research Interests

Algorithms, combinatorics, optimization, theoretical computer science — especially combinatorial optimization, submodular optimization, network flow theory, network design, graph algorithms, data structures, graph theory, complexity theory.

Education

University of British Columbia

B.Sc., Computer Science and Mathematics, Combined Honours, expected 2021
- Minor in Arts, Philosophy

Employment

Microsoft Corporation

Software Engineer Intern, 2020
Software Engineer Intern, 2019
Software Engineer Intern, 2018

University of British Columbia

Undergraduate Teaching Assistant, 2020
Undergraduate Academic Assistant, 2019–2020
Undergraduate Teaching Assistant, 2019
Student Assistant, 2019
Undergraduate Teaching Assistant, 2018

Jisuanke

Teaching Researcher, 2018–2019
Lecturer, 2018–2019

Sogou, Inc.

Software Engineer Intern, 2017

InitialView

Software Engineer Intern, 2016–2017

Research Experience

University of British Columbia

Optimization problems on network flows with side constraints (thesis), 2020–2021
- Advisor: F. Bruce Shepherd
- Studied several optimization problems on network flows with side constraints (i.e., unsplittable, confluent, and d-furcated flows), including the *minimum congestion*, *maximum routable demands*, and *minimum number of rounds* problems.
- Studied several classical algorithms on these optimization problems, including
  - the 2-approximation algorithm for the *minimum congestion* problem on single-sink unsplittable flows by Dinitz et al. (1999),
  - the $O(1 + \log k)$-approximation algorithm for the *minimum congestion* problem on confluent flows by Chen et al. (2004),

- the 3-approximation algorithm for the *maximum demands* problem on confluent flows by Chen et al. (2004), and
- the $(1 + \frac{1}{d-1})$-approximation algorithm for the *minimum congestion* problem on d-furcated flows with $d \geq 2$ by Donovan et al. (2007).

◦ Studied several open questions relevant to these optimization problems, including Michel Goemans' 2-congestion conjecture for the cost version of the *minimum congestion* problem on single-sink unsplittable flows, $O(1)$-congestion for bifurcated flows, and $O(1)$ confluent rounds to route all demands.

◦ Documents: [Proposal]

Gradual typing of recursive types, 2019–2020

◦ Advisor: Ronald Garcia

◦ Applied the *Abstract Gradual Typing (AGT)* approach, based upon abstract interpretation, to iso-recursive and equi-recursive types to obtain static and dynamic semantics for *gradual typing* in terms of pre-existing static types, which enables programming languages to seamlessly combine dynamic and static checking. In particular, the dynamic semantics of the gradual language are induced from an internal runtime language whose terms represent corresponding source gradual typing derivations.

◦ Proved that the gradual language with recursive types induced by the AGT approach satisfies the refined criteria for gradual typing of Siek et al. (2015), including type safety, static guarantee and dynamic guarantee.

◦ Wrote a tutorial that demonstrates the AGT approach on a toy language BA (Boolean and Arithmetic Language), which produces TBA, GBA and MBA (Typed/Gradual/Mixed Boolean and Arithmetic Language, respectively).

Teaching Experience

University of British Columbia

Teaching Assistant

CPSC 311	Definition of Programming Languages, Fall 2020
CPSC 421/501	Introduction to Theory of Computing (graduate), Fall 2019
CPSC 121	Models of Computation, Fall 2018

Academic Assistant

CPSC 411 Introduction to Compiler Construction, Fall 2019–Spring 2020
Involved in the redesign of the course, supervised by William J. Bowman.

Jisuanke

Lecturer

Competitive Programming, Level 6 Spring 2019
Topics: network flows and bipartite graphs, data structures (splay tree, treap, link-cut tree), string algorithms (the Aho-Corasick algorithm, suffix array), bitmask DP, probability, computational geometry, query decomposition techniques

Competitive Programming, Level 5 Fall 2018
Topics: graph connectivity, segment tree and binary indexed tree, string algorithms (the Knuth–Morris–Pratt algorithm, trie), hashing, elementary game theory, dynamic programming (tree DP, space-time optimization techniques), elementary number theory, divide-and-conquer techniques

Competitive Programming, Level 3 Summer 2018
Topics: C++, dynamic programming (longest increasing subsequence, maximum subarray, longest common subsequence, edit distance, knapsack problems), search techniques (BFS, DFS, pruning, state representation)

Teaching Researcher

Competitive Programming, Level 6 Spring 2019

Topics: network flows and bipartite graphs, data structures (splay tree, treap, link-cut tree), string algorithms (the Aho-Corasick algorithm, suffix array), bitmask DP, probability, computational geometry, query decomposition techniques

Volunteer Experience

Shaoxing No.1 High School

Summer Coach (Competitive Programming), 2016

Student Lecturer (Competitive Programming), 2013–2015

Manuscripts

- Unsplittable Flow Problem on Paths and Trees: Closing the LP Relaxation Integrality Gap (with A. Jozefiak). UBC CPSC 531F Survey, 2019. [Link]

Talks and Presentations

- The Single-Source Unsplittable Flow Problem. UBC Computer Science. University of British Columbia. Online. 2020. [Scribe] [Note]
- Perturbation-Stable Maximum Cuts. Algorithms Reading Group, UBC Computer Science. University of British Columbia. Online. 2020. [Slides]
- Unsplittable Flow Problem on Paths and Trees: Closing the LP Relaxation Integrality Gap (with A. Jozefiak). UBC CPSC 531F Survey. University of British Columbia. Vancouver, BC. 2019. [Slides]
- Introduction to Communication Complexity. Quantum Club Seminar. University of California, Santa Barbara. Santa Barbara, CA. 2019.
- Gradual Typing for Octave Language (with A. Li, K. Wang, and P. Wang). UBC CPSC 311 Project. University of British Columbia. Vancouver, BC. 2018. [Report]
- Some Math Notes (in Chinese). Competitive Programming Summer School. Shaoxing No. 1 High School. Shaoxing, China. 2016. [Slides]
- Graph Algorithms (in Chinese). Competitive Programming Summer School. Shaoxing No. 1 High School. Shaoxing, China. 2016. [Slides]
- Miller-Rabin Primality Test and Pollard's ρ Integer Factorization Algorithm (in Chinese). Competitive Programming Seminar. Shaoxing No. 1 High School. Shaoxing, China. 2015. [Slides]

Honors and Awards

- Faculty of Science International Student Scholarship (CAD $7,500), University of British Columbia, 2020.
- J Fred Muir Memorial Scholarship in Science (CAD $200), University of British Columbia, 2020.
- Trek Excellence Scholarship (CAD $4,000), University of British Columbia, 2020.
- Science Scholar, University of British Columbia, 2020.
- Dean's Honour List, University of British Columbia, 2020.
- Faculty of Science International Student Scholarship (CAD $5,000), University of British Columbia, 2019.
- Dean of Science Scholarship (CAD $350), University of British Columbia, 2019.
- Trek Excellence Scholarship (CAD $4,000), University of British Columbia, 2019.
- Stanley M Grant Scholarship in Mathematics (CAD $1,500), University of British Columbia, 2019.
- Programming Language Implementation Summer School Fellowship (€400), 2019.
- Science Scholar, University of British Columbia, 2019.
- Dean's Honour List, University of British Columbia, 2019.
- Faculty of Science International Student Scholarship (CAD $10,000), University of British Columbia, 2018.
- Dean of Science Scholarship (CAD $425), University of British Columbia, 2018.
- Trek Excellence Scholarship (CAD $4,000), University of British Columbia, 2018.

- Marie Kendall Memorial Scholarship in Science (CAD $925), University of British Columbia, 2018.
- Joel Harold Marcoe Memorial Scholarship (CAD $150), University of British Columbia, 2018.
- Science Scholar, University of British Columbia, 2018.
- Dean's Honour List, University of British Columbia, 2018.
- 27th Place (out of 118 teams), North American Invitational Programming Contest, Open Division (USA + Canada), 2018.
- 11th Place (out of 67 teams), ACM International Collegiate Programming Contest, Pacific Northwest Regional (Division 1), 2017.
- 1st Place, Microsoft College Code Competition, 2017.
- Outstanding International Student Award (CAD $6,000), University of British Columbia, 2017.
- Silver Medal, China Team Selection Competition for International Olympiad in Informatics, China Computer Federation, 2015.
- Bronze Medal, Asia Pacific Informatics Olympiad, China Computer Federation, 2015.
- First Prize, National Olympiad in Informatics in Provinces (Advanced Division), China Computer Federation, 2014.
- First Prize, National Olympiad in Informatics in Provinces (Advanced Division), China Computer Federation, 2013.

Professional Service

Journal Review

SIAM Journal on Discrete Mathematics (SIDMA)

Selected Coursework

Mathematics

Probability (graduate)
Stochastic Processes (graduate)
Submodular Optimization (graduate)
Combinatorial Optimization (graduate)
Measure Theory and Integration (graduate)
Introduction to Theory of Computing (graduate)
Tools for Modern Algorithm Analysis (graduate)
Beyond Worst-Case Analysis (seminar)
Real Variables I & II
Numerical Linear Algebra
Introduction to Group Theory
Introduction to Rings and Modules

Computer Science and Engineering

Introduction to Software Engineering
Definition of Programming Languages
Introduction to Compiler Construction
Computer Hardware and Operating Systems
Intermediate Algorithm Design and Analysis
Machine Learning (Coursera, Stanford University)
Programming Languages (Coursera, University of Washington CSE 341)

Philosophy

Metaphysics
Philosophy of Law
Philosophy of Religion
Philosophy After 1800 (Russell & Wittgenstein)

Academic Training

- Second Programming Language Implementation Summer School. Bertinoro, Italy. 2019.

Relevant Skills

Languages: English, Mandarin

Programming: LaTeX, Racket, Standard ML, JavaScript, C/C++, Java, C#, Python, Ruby, MATLAB, Go, MySQL

Last Updated

December 20, 2020