Tao Hou

Ph.D., The Ohio State University
Address: 2015 Neil Ave, Columbus, OH 43210
Email: taohou01@gmail.com
Homepage: taohou01.github.io

Education

The Ohio State University, Ohio, USA *Aug 2016–Present*
Ph.D., Computer Science and Engineering
Advisor: Tamal K. Dey
Research interest: Computational topology, topological data analysis, computational geometry
GPA: 3.97/4.0

Tsinghua University, China *Aug 2010–Jul 2013*
M.E., Software Engineering
Advisor: Li Chen
Research interest: Mesh simplification, iso-surface extraction
GPA: 83.18/100

Beijing Institute of Technology, China *Sep 2006–Jul 2010*
B.E., Software Engineering
GPA: 86.85/100

Work Experience

EUC, **VMware** (China) *Jul 2015–Jul 2016*
Member of Technical Staff

- Development and maintenance of the PCoIP protocol, which is the underlying data communication library for VMware's remote desktop product *Horizon View* (C/C++)
  Relevant skills: Network protocol, transfer security, etc.

Complex Search, **Baidu, Inc.** (China) *Jul 2014–Jun 2015*
Senior Software Engineer

- Modifying the framework of General Search Service, which is the underlying search service for Baidu's complex search results: Implementing a new base class for easier integration of modules serving specific search results; changing the module loading mechanism to accommodate the module developers' needs (C/C++)
- Programming of the masking and de-duplicating functions for Baidu search's right-column recommendation results (PHP)
- Migration of *Webapp* data into Baidu's complex search platform *Aladdin* (PHP)

Publications

Names ending with * means that authors are ordered alphabetically.

Tamal K. Dey*, Tao Hou*, and Sayan Mandal*. *Computing Minimal Persistent Cycles: Polynomial and Hard Cases.* ACM-SIAM Symposium on Discrete Algorithms (SODA) 2020.

Tamal K. Dey*, Tao Hou*, and Sayan Mandal*. *Persistent 1-Cycles: Definition, Computation, and Its Application.* Workshop on Computational Topology in Image Context (CTIC) 2019.

Tao Hou, Li Chen. *On-the-fly simplification of large iso-surfaces with per-cube vertex modifiability detection.* Journal of Visualization 19.4 (2016): 715-726.

Research Projects (On-going)

Geometrical descriptors for zigzag persistence

· We are trying to develop the theory and algorithms for finding geometrical descriptors for zigzag persistence. We managed to nail down the definition and observed some interesting phenomena. We also see the hope of polynomial time algorithms for (some) intervals with additional assumptions on the input complexes and filtrations.

Image processing for microstructure discovery from material science data

· This project is collaborated with people in Material Science from *Rutgers University* and the main focus is to discover the microstructures from the data with some topological insights. Our algorithm has managed to determine the thresholds of certain polymer images by the balance of topological features which produces better results than some commercial softwares. The current focus is on segmenting the foreground from the background on some noisy battery anode scans. This is a pretty challenging task and we have tried to use minimal cuts to delete some noisy spikes on the data. More heuristics from image processing or machine learning may be helpful.

Machine learning meets TDA

· The aim is to study machine learning theory and application from the point of view of computational topology. We went through several papers in this field with some related to computational topology and some not. We may try to delve further on utilizing topological descriptors to facilitate the classification of graphs.

Research Projects (Finished)

Persistent cycles for general dimension

· We inspected the NP-hardness of computing minimal representative cycles for persistent homology in general dimension and designed polynomial time algorithms for *weak pseudomanifolds* (see our SODA 2020 paper for details). My contribution includes the development of the theory, the proof of the claims, the design of the algorithms, and the major writing of the paper. I also implemented the algorithm for infinite intervals for which I wrote a cell complex data structure for both simplicial and cubical complexes. The codes can be found on Github.

Persistent 1-cycles

· We developed the definition of representative cycles for persistent homology, inspected the NP-hardness of computing the minimal ones in dimension one, and designed polynomial time algorithms computing cycles that work well in practice (see our CTIC 2019 paper for details). My contribution includes the development of the theory, the proof of the claims, the design of the algorithms, and the major writing of the paper.

Major Courses for PHD

CSE 5543: Geometrical Modeling (A)
CSE 5522: Advanced Artificial Intelligence (A)

CSE 5523: Machine Learning (A)
CSE 6341: Foundation of Programming Language (A)
CSE 6331: Algorithms (A)
CSE 6431: Advanced Operating Systems (A)
CSE 6321: Computability and Complexity (A)
MATH 5801: General Topology & Knots Theory (A)
MATH 6801/6802: Algebraic Topology I & II (A)
MATH 6701: Differentiable Manifold (A^-)

Teaching Assistant

CSE 6332: Advanced Algorithms, Grader (Helped on some lecturing), Spring 2019
CSE 3341: Principles of Programming Languages, Grader, Autumn 2018
CSE 2111: Spreadsheets & DBs, Lab Instructor, Spring/Autumn 2017
CSE 2321: Discrete Structures, Grader, Autumn 2016
CSE 2331: Data Structures & Algorithms, Grader, Autumn 2016

Skills

Programming languages: C/C++, Python, Java, PHP, Javascript, Unix Shell, Latex, HTML/CSS

Awards

Mathematical Modeling Competition of BIT, 1st place
Scholarship for Excellent Student, 1st, 2nd
Northern Scholarship 3rd, Excellent League Member
Excellent Military Training Student, Excellent Student etc.