

Yu-Chia Chen

PH.D. CANDIDATE AT THE UNIVERSITY OF WASHINGTON

Paul Allen Center, 185 E Stevens Way NE AE100R, Seattle, WA 98195

☎ (208) 329-8707 | ✉ yuchaz@uw.edu | 🌐 yuchaz.github.io | 📷 yuchaz | 📺 yuchaz

Summary

Research	Manifold learning, Geometric data analysis, Edge flow learning, Dynamic networks, Embedding
Affiliations	Facebook Inc., Institute for Pure and Applied Mathematics, Microsoft Corporation, University of Washington
Programming Languages	Python (Advanced), MATLAB (Advanced), JavaScript (Intermediate), C++ (Intermediate)
Languages	English (Professional), Mandarin (Native), Taiwanese (Native)

Education

University of Washington

PH.D. IN ELECTRICAL ENGINEERING

- Advisor: Marina Meilă

Seattle, WA

Sep. 2016 - PRESENT

National Taiwan University

B.S. IN PHYSICS

Taipei, Taiwan

Sep. 2011 - Jun. 2015

Experience

Geometric Data Analysis Group (prof. Marina Meilă), University of Washington

PH.D. STUDENT RESEARCHER

Seattle, WA

Apr. 2017 - PRESENT

- Proposed a versatile framework for topological feature discovery and semi-supervised edge flow learning from point cloud data [10]
 - Presented a weight on triangles resembling the VR complex in computational topology
 - Proved the consistency of the discrete 1-Laplacian to its continuous counterpart (Hodge Laplacian)
 - Applied the method on molecular dynamics, oceanology, and RNA single-cell sequencing data to study the propagation of the flow
- Studied a well-known defect of spectral embedding methods on manifolds with large aspect ratios (NeurIPS'19 [1])
 - Provided an efficient criterion based subset selection algorithm to produce independent coordinates for smooth embedding
 - Showed that the criterion, based on the projected volume ratio of the chosen coordinates, asymptotically converged to a KL divergence
 - Discovered the meaningful embedding for the galaxy and molecular dynamics datasets
- Created a tutorial of manifold learning on molecular dynamics (MD) simulation data [11]
- Developed a scalable manifold learning python toolkit for millions of points named **megaman** (<https://github.com/mmp2/megaman>)

Facebook

MACHINE LEARNING INTERN

Seattle, WA

Jun. 2020 - Sep. 2020

- Developed deep learning models to optimize the click-through rate (CTR) based recommendation system for search ads placement
- Investigated various modeling techniques including transfer learning and multi-task learning

Microsoft Research

RESEARCH INTERN

Redmond, WA

Jun. 2018 - Sep. 2018

- Proposed a large scale dynamic network model, based on the stochastic block model (SBM), to study the system evolution (a time series of graphs)
- Obtained the maximum a posteriori (MAP) estimator by auto-grad, enabling the model to be fit on networks with millions of vertices
- Presented a sampling based extension to causal impact, allowing the practitioners to determine the significance of the intervention
- Paper [3] accepted to KDD 2019 research track (acceptance rate 14.2%)

Publications

REFERRED PUBLICATIONS

- [1] **YU-CHIA CHEN** and Marina Meilă. Selecting the independent coordinates of manifolds with large aspect ratios. In *Advances in Neural Information Processing Systems* 32, pages 1086–1095, 2019
- [2] Samson J. Koelle, Hanyu Zhang, Marina Meilă and **YU-CHIA CHEN**. Manifold Coordinates with Physical Meaning. *Second Workshop on Machine Learning and the Physical Sciences (NeurIPS 2019)*, Vancouver, Canada, December, 2019
- [3] **YU-CHIA CHEN**, Avleen S. Bijral, and Juan Lavista Ferres. On Dynamic Network Models and Application to Causal Impact. In *Proceedings of the 25th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*, KDD '19, pages 1194–1204, New York, NY, USA, 2019. ACM

- [4] **YU-CHIA CHEN**, Dominique Perrault-Joncas, Marina Meilă, and James McQueen. Improved Graph Laplacian via Geometric Self-Consistency. *NIPS Workshop on NIPS Highlights (MLTrain)*, *Learn How to code a paper with state of the art frameworks*, Long Beach, CA, December 2017
- [5] Peifeng Jing, Kosuke Winston, **YU-CHIA CHEN**, Benjamin S. Freedman, and Lih Y. Lin. Patterning and Colonizing Stem Cells with Optical Trapping. In *Optics in the Life Sciences Congress (2017)*, *Paper OtM4E.2*, page OtM4E.2. Optical Society of America, April 2017
- [6] **YU-CHIA CHEN**, Cih-Su Wang, Tsung-Yuan Chang, Tai-Yuan Lin, Hsiu-Mei Lin, and Yang-Fang Chen. Ultraviolet and visible random lasers assisted by diatom frustules. *Optics Express*, 23(12):16224–16231, June 2015
- [7] Cih-Su Wang, Chi-Shung Liao, Tzu-Ming Sun, **YU-CHIA CHEN**, Tai-Yuan Lin, and Yang-Fang Chen. Biologically inspired band-edge laser action from semiconductor with dipole-forbidden band-gap transition. *Scientific Reports*, 5:8965, March 2015

PREPRINTS/UNDER REVIEW/TECHNICAL REPORTS

- [8] **YU-CHIA CHEN** and Marina Meilă. The decomposition of the higher-order homology embedding constructed from the k-Laplacian. *arXiv:2107.10970 [stat.ML]*, July 2021
- [9] Timothy Siegler, Wiley Dunlap-Shohl, Yuhuan Meng, Wylie Kau, Preetham Sunkari, Chang-En Tsai, Zachary Armstrong, **YU-CHIA CHEN**, David Beck, Marina Meila, and Hugh Hillhouse. Water-Accelerated Photo-oxidation of CH₃NH₃PbI₃ Perovskite: Mechanism, rate orders, and rate constants. *ChemRxiv*, June 2021
- [10] **YU-CHIA CHEN**, Marina Meilă, and Ioannis G. Kevrekidis. Helmholtzian Eigenmap: Topological feature discovery & edge flow learning from point cloud data. *arXiv:2103.07626 [stat.ML]*, March 2021
- [11] **YU-CHIA CHEN**, James McQueen, Samson J. Koelle, Marina Meilă, Stefan Chmiela and Alexandre Tkatchenko. Modern Manifold Learning Methods for MD data – a step by step procedural overview. <http://students.washington.edu/yuchaz/files/2020-md-manifold.pdf>
- [12] Samson J. Koelle, Hanyu Zhang, Marina Meilă and **YU-CHIA CHEN**. Manifold Coordinates with Physical Meaning. (Under review at JMLR)

Other Experience & Course Projects

Institute for Pure & Applied Mathematics (IPAM), UCLA

Los Angeles, CA

VISITING RESEARCHER

Sep. 2019 - Dec. 2019

- Participated in the *Machine Learning for Physics and the Physics of Learning* long program
- Investigated the plausible intersection of conformal prediction, unsupervised learning, and physical science
- White paper: <https://www.ipam.ucla.edu/news/white-paper-machine-learning-for-physics-and-the-physics-of-learning/>

Department of Electrical & Computer Engineering, University of Washington

Seattle, WA

TEACHING ASSISTANT

Jan. 2017 - Dec. 2017

- Courses: Digital Signal Processing (graduate level), Devices And Circuits, Discrete Time Linear Systems, Fundamentals of Electrical Engineering

Selfie Sensei: Convolutional Neural Network based selfie instructor

Seattle, WA

COURSE PROJECT

Apr. 2017 - Jun 2017

- Built and trained the Google Inception-v3 model on 40 thousand selfies collected from twitter with hashtag #selfie

Large scale medical subject heading (MeSH) term indexing

Seattle, WA

COURSE PROJECT

Jan. 2017 - Mar. 2017

- Constructed a Convolutional Neural Network trained with *skipgram* word2vec embedding to annotate 27k MeSH terms on 12M academic articles

Photonics Lab, University of Washington

Seattle, WA

GRADUATE RESEARCH ASSISTANT

Sep. 2016 - Dec. 2016

- Investigated high accuracy mass sensing using Nanostructure-enhanced laser tweezers and its application to stem cell patterning [5]

Psychological Warfare Group, Ministry of National Defense

Taipei, Taiwan

FRONT-END SOFTWARE ENGINEER (COMPULSORY MILITARY SERVICE)

Aug. 2015 - Jul. 2016

- Lead engineer on cloud-based file exchanging platform, which enabled user to search, view and share streaming media
- Technology used: JavaScript (*react.js*), HTML/CSS

Semiconductor Laboratory (prof. Yang-Fang Chen), National Taiwan University

Taipei, Taiwan

UNDERGRADUATE RESEARCHER

Feb. 2014 - Jun. 2015

- Investigated bio-photonics devices with wide spectrum range [6]
- Studied Perovskite and CdTe core shell quantum dots assisted random laser in bio-inspired materials [7]

Honors & Awards

2019	Student Travel Award , NeurIPS 2019	Vancouver, Canada
2019	Student Travel Award , KDD 2019	Anchorage, AK
2019	Travel Grant , UW Department of Electrical & Computer Engineering	Seattle, WA
2013	Scholarship , Taipower Academic Scholarship	Taipei, Taiwan
2012	Scholarship , Taipower Academic Scholarship	Taipei, Taiwan
2010	Second prizes , Physics Scholastic Ability Contest	Kaohsiung, Taiwan

Selected Talks

Nov. 2020	Seminar Talk , UW UW ML retreat, <i>Higher-order topological feature discovery and edge flow learning</i>	Seattle, WA
Feb. 2020	Seminar Talk , UW Geometric Data Analysis Group, <i>Hodge Laplacians on graphs</i>	Seattle, WA
Dec. 2019	Poster Presentation , NeurIPS'19, <i>Selecting the Independent Coordinates of Manifolds with Large Aspect Ratios</i>	Vancouver, Canada
Oct. 2019	Seminar Talk , IPAM, <i>Selecting the Independent Coordinates of Manifolds with Large Aspect Ratios</i>	Los Angeles, CA
Aug. 2019	Poster Presentation , KDD'19, <i>On Dynamic Network Models and Application to Causal Impact</i>	Anchorage, AK
Sep. 2018	Seminar Talk , Microsoft, <i>On Dynamic Network Models and Application to Causal Impact</i>	Redmond, WA
Jan. 2018	Seminar Talk , UW Geometric Data Analysis Group, <i>Improved Graph Laplacian via geometric self-consistency</i>	Seattle, WA

Coursework

UNIVERSITY OF WASHINGTON

CSE 525 Randomized Algorithm; **EE 546** Learning and Game Theory; **STAT 512** Statistical Inference; **STAT 548** Machine Learning for Big Data; **STAT 538** Statistical Learning; **CSE 599** Interplay between Convex Optimization and Geometry; **MATH 515** Fundamental of Optimization; **EE 576** Computer Vision; **EE 595** Data Science for Sequencing; **CSE 517** Natural Language Processing; **EE 518** Digital Signal Processing

NATIONAL TAIWAN UNIVERSITY (SELECTED)

PHYS 8049 Introduction to Quantum Computation & Information; **PHYS 4001** Optics; **PHYS 3002** Group Theory; **PHYS 3001** Complex Analysis

References

Marina Meilă

DEPARTMENT OF STATISTICS, UNIVERSITY OF WASHINGTON

mmp@stat.washington.edu

Avleen S. Bijral

MICROSOFT CORPORATION

avbijral@microsoft.com

Les Atlas

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING, UNIVERSITY OF WASHINGTON

atlas@u.washington.edu

Yang-Fang Chen

DEPARTMENT OF PHYSICS, NATIONAL TAIWAN UNIVERSITY

yfchen@phys.ntu.edu.tw