Yu-Chia **Chen**

Research Scientist at Facebook

Seattle, WA 98109

(208) 329-8707 | yuchaz@fb.com | yuchaz.github.io | yuchaz | yuchaz

Summary

Research Publications Manifold learning, Geometric data analysis, Edge flow learning, Dynamic networks, Embedding
Published in top-tier Machine Learning conferences (NeurIPS, KDD)

Programming Languages Python (Advanced), MATLAB (Advanced), JavaScript (Intermediate), C++ (Intermediate)
English (Professional), Mandarin (Native), Taiwanese (Native)

Education

University of Washington *Seattle, WA*

Ph.D. in Electrical Engineering *Sep. 2016 - Aug. 2021*

- Advisor: Marina Meilă

National Taiwan University *Taipei, Taiwan*

B.S. in Physics *Sep. 2011 - Jun. 2015*

Experience

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

Graduate Research Assistant *Apr. 2017 - Aug. 2021*

- Thesis: "Learning Topological Structures and Vector Fields on Manifolds with (Higher-order) Discrete Laplacians" [3]
  - Analyzed the decomposibility of the k^{th} homology embedding (the higher-order generalization of spectral clustering) of the discrete k-Hodge Laplacian under matrix perturbation theory (***NeurIPS'21 oral*** [1])
  - Proposed a versatile framework for topological feature discovery and semi-supervised edge flow learning from point cloud data [13]
  - Studied a well-known defect of spectral embedding methods on manifolds with large aspect ratios (***NeurIPS'19*** [5])
- Created a tutorial of manifold learning on molecular dynamics (MD) simulation data [14]
- Developed a scalable manifold learning python toolkit for millions of points: `megaman` [8] (`https://github.com/mmp2/megaman`)

Facebook *Seattle, WA*

Machine Learning Intern *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 *Redmond, WA*

Research Intern *Jun. 2018 - Sep. 2018*

- Studied the evolution of networks with millions of vertices by a dynamic network model extended from the stochastic block model (***KDD'19*** [7])
  - Presented a sampling-based extension to causal impact, which allows the practitioners to determine the significance of the intervention
  - Applied in the social relationships of more than 1000 giraffes in the Tarangire Ecosystem over five years (***Animal Behaviour*** [2])

Publications

Referred Publications

[1] **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. To appear in NeurIPS'21 as an **oral presentation** (acceptance rate 1%).

[2] Juan M. Lavista Ferres, Derek E. Lee, Md Nasir, **Yu-Chia Chen**, Avleen S. Bijral, Fred B. Bercovitch, and Monica L. Bond. Social connectedness and movements among communities of giraffes vary by sex and age class. *Animal Behaviour*, 180:315–328, October 2021

[3] **Yu-Chia Chen**. *Learning Topological Structures and Vector Fields on Manifolds with (Higher-Order) Discrete Laplacians*. PhD thesis, University of Washington, 2021

[4] Samson Koelle, Hanyu Zhang, Marina Meila, and **Yu-Chia Chen**. Manifold Coordinates with Physical Meaning. *arXiv:1811.11891 [stat.ML]*, July 2021. To appear in JMLR.

[5] **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

[6] 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

[7] **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

[8] **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

[9] 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

[10] **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

[11] Cih-Su Wang, Chi-Shung Liau, 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

[12] 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

[13] **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

[14] **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`

Other Experience & 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 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*

- 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 [9]

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 enables user to search, view, and share streaming media
- Technology used: JavaScript (*react.js*), HMTL/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 [10]
- Studied Perovskite and CdTe core shell quantum dots assisted random laser in bio-inspired materials [11]

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