# 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 |
| **Publications** | First author of 2 top-tier Machine Learning conference (NeurIPS, KDD) papers and 1 NeurIPS workshop poster |
| **Affiliations** | Institute for Pure and Applied Mathematics, Microsoft Corporation, University of Washington, National Taiwan University |
| **Programming** | Python (Advanced), MATLAB (Advanced), JavaScript (Intermediate), C++ (Intermediate) |
| **Languages** | English (Professional), Mandarin (Native), Taiwanese (Native) |

## Education

**University of Washington** — *Seattle, WA*
PH.D. IN ELECTRICAL ENGINEERING — *Sep. 2016 - PRESENT*
- 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*
PH.D. STUDENT RESEARCHER — *Apr. 2017 - PRESENT*
- Proposed a versatile framework for topological feature discovery and semi-supervised edge flow learning from point cloud data
  - Presented a triplet-wise similarity kernel 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 COVID-19 pandemic 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 [8]

**Facebook** — *Seattle, WA*
PHD MACHINE LEARNING ENGINEER INTERN — *Jun. 2020 - PRESENT*
- Developed transfer learning & multi-task learning algorithms to optimize search ads placement

**Microsoft Research** — *Redmond, WA*
RESEARCH INTERN — *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 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

[8] **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`

[9] 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*), 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 [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

| | | |
|---|---|---|
| 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*