Michael Chin-Chia Yeh

https://mcyeh.github.io/ ◇ myeh003@ucr.edu

PROFESSIONAL EXPERIENCE

Visa Research Foster City, California
Staff Research Scientist 2018/09 –

- Time Series Data Mining

  Time series data generated from transaction databases can provide critical insights for payment processing companies. To effectively utilize this information, I have developed machine learning models tailored for transactional time series data across various contexts. The following topics were studied in this area: matrix profile, deep learning, foundation models, time series forecasting, spatial-temporal forecasting, time series classification/regression, multi-future prediction, multi-model learning, online learning, motif/discord mining, and anomaly detection.

- Embeddings and Representation Learning

  Embedding learning technologies are essential for unlocking deep insights into entities within databases. My research in this area has focused on three directions for analyzing Visa's data: 1) developing embedding learning frameworks, 2) mitigating the impact of undesirable information within embeddings, and 3) enhancing the scalability of embedding learning. The outcomes of these studies have enabled the development of embeddings for entities such as merchants, merchant categories, and countries, which have been successfully applied to various analytical tasks.

- Machine Learning for Tabular Data

  Transaction data is typically stored as sequential tabular data, which presents unique challenges and opportunities for machine learning applications. My research and prototype efforts have been dedicated to advancing technologies in foundation models and sequential modeling, specifically tailored for tasks such as recommendation, stand-in processing, and fraud detection. By leveraging time series data mining, embedding learning, and sequential modeling techniques, I have developed innovative approaches that enhance the accuracy and efficiency of these tasks. This work has involved not only designing and implementing models but also rigorously evaluating their performance in real-world transactional environments, ensuring their robustness and scalability for large-scale applications.

  I published *48 peer-reviewed papers* and *31 patents* at Visa as of 8/17/2024.
  Supervisor: Wei Zhang, Mahashweta Das

University of California, Riverside (UCR) Riverside, California
Research Assistant 3 Years

- All Pairs Similarity Search for Time Series Subsequences (Matrix Profile)

  The all-pairs-similarity-search (or similarity join) problem has been extensively studied for text and a handful of other data types. However, there has been little progress on similarity joins for time series subsequences. The goal of the project is to develop an efficient/scalable algorithm solving the similarity join problem for time series data and show the utility of such algorithm when it's treated as a primitive operation for time series. The application of time series join includes visualization, motif/discord mining, clustering, etc.

  I published *19 peer-reviewed papers* at UCR.
  Supervisor: Prof. Eamonn Keogh

Research Center for IT Innovation (CITI), Academia Sinica Taipei, Taiwan
Research Assistant 2 Years

- Audio Word Representation of Audio Signals

  Audio word (AW) representation symbolizes any local audio event as a codeword within a pre-constructed dictionary. Over the course of the project, I have conducted a systematic evaluation with various AW extracting configurations on audio classification/auto-tagging systems. Based on the result of the systematic evaluation, I have proposed a framework that aims to standardize the modularization of the AW representation extraction. I have also examined the possibility of incorporating various ideas (e.g., multi-scale feature learning, bagging) into the AW extraction process to learn better AW representation.

  I published *8 peer-reviewed papers* at CITI.
  Supervisor: Prof. Yi-Hsuan Yang

HONORS, AWARDS, AND SERVICE

- Honorable mention for 2019 SIGKDD doctoral dissertation award.
- First place in AALTD' 16 time-series classification challenge
- Travel Award: SDM 2018, KDD 2017, ICDM 2016.
- Program Committee: KDD 2019-2022, MiLeTS 2020-2022, AAAI 2021, ECML-PKDD (ADS) 2020.

EDUCATION

University of California, Riverside (UCR)
Ph.D. in Computer Science

University of California, Los Angeles (UCLA)
M.S. in Mechanical Engineering, Systems and Control

Virginia Polytechnic Institute and State University (Virginia Tech)
B.S. in Mechanical Engineering

PUBLICATION

- **Chin-Chia Michael Yeh**, Yujie Fan, Xin Dai, Uday Singh Saini, Vivian Lai, Prince Osei Aboagye, Junpeng Wang, Huiyuan Chen, Yan Zheng, Zhongfang Zhuang, Liang Wang, and Wei Zhang, "RPMixer: Shaking Up Time Series Forecasting with Random Projections for Large Spatial-Temporal Data," *ACM SIGKDD International Conference on Knowledge Discovery and Data Mining* (KDD), 2024.
- Audrey Der, **Chin-Chia Michael Yeh**, Xin Dai, Huiyuan Chen, Yan Zheng, Yujie Fan, Zhongfang Zhuang, Vivian Lai, Junpeng Wang, Liang Wang, Wei Zhang, and Eamonn Keogh, "A Systematic Evaluation of Generated Time Series and Their Effects in Self-Supervised Pretraining," *ACM International Conference on Information and Knowledge Management* (CIKM), 2024.
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- Audrey Der, **Chin-Chia Michael Yeh**, Yan Zheng, Junpeng Wang, Zhongfang Zhuang, Liang Wang, Wei Zhang, and Eamonn Keogh, "PUPAE: Intuitive and Actionable Explanations for Time Series Anomalies," *SIAM International Conference on Data Mining* (SDM), 2024.

- Junpeng Wang, **Chin-Chia Michael Yeh**, Yujie Fan, Xin Dai, Yan Zheng, Liang Wang, and Wei Zhang, "PromptLandscape: Guiding Prompts Exploration and Analysis with Visualization," *IEEE Pacific Visualization Conference* (PacificVis), 2024.
- Yiran Li, Junpeng Wang, Prince Aboagye, **Chin-Chia Michael Yeh**, Yan Zheng, Liang Wang, Wei Zhang, and Kwan-Liu Ma, "Visual Analytics for Efficient Image Exploration and User-Guided Image Captioning," *IEEE Transactions on Visualization and Computer Graphics* (TVCG), 2024.
- Huiyuan Chen, Zhe Xu, **Chin-Chia Michael Yeh**, Vivian Lai, Yan Zheng, Minghua Xu, and Hanghang Tong, "Masked Graph Transformer for Large-Scale Recommendation," *International ACM SIGIR Conference on Research and Development in Information Retrieval* (SIGIR), 2024.
- **Chin-Chia Michael Yeh**, Xin Dai, Huiyuan Chen, Yan Zheng, Yujie Fan, Audrey Der, Vivian Lai, Zhongfang Zhuang, Junpeng Wang, Liang Wang, and Wei Zhang, "Toward a Foundation Model for Time Series Data," *ACM International Conference on Information and Knowledge Management* (CIKM), 2023.
- **Chin-Chia Michael Yeh**, Huiyuan Chen, Xin Dai, Yan Zheng, Junpeng Wang, Vivian Lai, Yujie Fan, Audrey Der, Zhongfang Zhuang, Liang Wang, Wei Zhang, and Jeff M. Phillips, "An Efficient Content-based Time Series Retrieval System," *ACM International Conference on Information and Knowledge Management* (CIKM), 2023.
- Yujie Fan, **Chin-Chia Michael Yeh**, Huiyuan Chen, Yan Zheng, Liang Wang, Junpeng Wang, Xin Dai, Zhongfang Zhuang, and Wei Zhang, "Spatial-Temporal Graph Boosting Networks: Enhancing Spatial-Temporal Graph Neural Networks via Gradient Boosting," *ACM International Conference on Information and Knowledge Management* (CIKM), 2023.
- Dongyu Zhang, Liang Wang, Xin Dai, Shubham Jain, Junpeng Wang, Yujie Fan, **Chin-Chia Michael Yeh**, Yan Zheng, Zhongfang Zhuang, and Wei Zhang, "FATA-Trans: Field And Time-Aware Transformer for Sequential Tabular Data," *ACM International Conference on Information and Knowledge Management* (CIKM), 2023.
- **Chin-Chia Michael Yeh**, Yan Zheng, Menghai Pan, Huiyuan Chen, Zhongfang Zhuang, Junpeng Wang, Liang Wang, Wei Zhang, Jeff M. Phillips, and Eamonn Keogh, "Sketching Multidimensional Time Series for Fast Discord Mining," *IEEE International Conference on Big Data* (BigData), 2023.
- **Chin-Chia Michael Yeh**, Huiyuan Chen, Yujie Fan, Xin Dai, Yan Zheng, Vivian Lai, Junpeng Wang, Zhongfang Zhuang, Liang Wang, Wei Zhang, and Eamonn Keogh, "Ego-Network Transformer for Subsequence Classification in Time Series Data," *IEEE International Conference on Big Data* (BigData), 2023.
- **Chin-Chia Michael Yeh**, Huiyuan Chen, Xin Dai, Yan Zheng, Yujie Fan, Vivian Lai, Junpeng Wang, Audrey Der, Zhongfang Zhuang, Liang Wang, and Wei Zhang, "Temporal Treasure Hunt: Content-based Time Series Retrieval System for Discovering Insights," *IEEE International Conference on Big Data* (BigData), 2023.
- Audrey Der, **Chin-Chia Michael Yeh**, Yan Zheng, Junpeng Wang, Huiyuan Chen, Zhongfang Zhuang, Liang Wang, Wei Zhang, and Eamonn Keogh "Time Series Synthesis Using the Matrix Profile for Anonymization," *IEEE International Conference on Big Data* (BigData), 2023.
- **Chin-Chia Michael Yeh**, Xin Dai, Yan Zheng, Junpeng Wang, Huiyuan Chen, Yujie Fan, Audrey Der, Zhongfang Zhuang, Liang Wang, and Wei Zhang, "Multitask Learning for Time Series Data with 2D Convolution," *IEEE International Conference on Machine Learning and Applications* (ICMLA), 2023.
- Yujie Fan, **Chin-Chia Michael Yeh**, Huiyuan Chen, Liang Wang, Zhongfang Zhuang, Junpeng Wang, Xin Dai, Yan Zheng, and Wei Zhang, "Spatial-Temporal Graph Sandwich Transformer for Traffic Flow Forecasting," *Joint European Conference on Machine Learning and Knowledge Discovery in Databases* (ECML-PKDD), 2023.
- Huiyuan Chen, **Chin-Chia Michael Yeh**, Yujie Fan, Yan Zheng, Junpeng Wang, Vivian Lai, Mahashweta Das, and Hao Yang, "Sharpness-Aware Graph Collaborative Filtering," *International ACM SIGIR Conference on Research and Development in Information Retrieval* (SIGIR), 2023.

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- Vivian Lai, Huiyuan Chen, **Chin-Chia Michael Yeh**, Minghua Xu, Yiwei Cai, and Hao Yang, "Enhancing Transformers without Self-supervised Learning: A Loss Landscape Perspective in Sequential Recommendation," *ACM Conference on Recommender Systems* (RecSys), 2023.
- Huiyuan Chen, Xiaoting Li, Vivian Lai, **Chin-Chia Michael Yeh**, Yujie Fan, Yan Zheng, Mahashweta Das, and Hao Yang, "Adversarial Collaborative Filtering for Free," *ACM Conference on Recommender Systems* (RecSys), 2023.
- Huiyuan Chen, Kaixiong Zhou, Kwei Herng Lai, **Chin-Chia Michael Yeh**, Yan Zheng, Xia Hu, and Hao Yang, "Hessian-aware Quantized Node Embeddings for Recommendation," *ACM Conference on Recommender Systems* (RecSys), 2023.
- **Chin-Chia Michael Yeh**, Mengting Gu, Yan Zheng, Huiyuan Chen, Javid Ebrahimi, Zhongfang Zhuang, Junpeng Wang, Liang Wang, and Wei Zhang, "Embedding Compression with Hashing for Efficient Representation Learning in Large-Scale Graph," *ACM SIGKDD International Conference on Knowledge Discovery and Data Mining* (KDD), 2022.
- **Chin-Chia Michael Yeh**, Yan Zheng, Junpeng Wang, Huiyuan Chen, Zhongfang Zhuang, Wei Zhang, and Eamonn Keogh, "Error-bounded Approximate Time Series Joins Using Compact Dictionary Representations of Time Series," *SIAM International Conference on Data Mining* (SDM), 2022.
- Huiyuan Chen, **Chin-Chia Michael Yeh**, Fei Wang, and Hao Yang, "Graph Neural Transport Networks with Non-local Attentions for Recommender Systems," *ACM Web Conference* (WWW), 2022.
- Prince Osei Aboagye, Yan Zheng, Jack Shunn, **Chin-Chia Michael Yeh**, Junpeng Wang, Zhongfang Zhuang, Huiyuan Chen, Liang Wang, Wei Zhang, and Jeff Phillips, "Interpretable Debiasing of Vectorized Language Representations with Iterative Orthogonalization," *International Conference on Learning Representations* (ICLR), 2022.
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- Jiarui Sun, Mengting Gu, **Chin-Chia Michael Yeh**, Yujie Fan, Girish Chowdhary, and Wei Zhang, "Dynamic Graph Node Classification via Time Augmentation," *IEEE International Conference on Big Data* (BigData), 2022.
- Prince O Aboagye, Yan Zheng, **Chin-Chia Michael Yeh**, Junpeng Wang, Zhongfang Zhuang, Huiyuan Chen, Liang Wang, Wei Zhang, and Jeff Phillips, "Quantized Wasserstein Procrustes Alignment of Word Embedding Spaces," *Biennial Conference of the Association for Machine Translation in the Americas* (AMTA), 2022.
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- Junpeng Wang, Liang Wang, Yan Zheng, **Chin-Chia Michael Yeh**, Shubham Jain, and Wei Zhang, "Learning-From-Disagreement: A Model Comparison and Visual Analytics Framework," *IEEE Transactions on Visualization and Computer Graphics* (TVCG), 2022.
- Bo Dong, Yuhang Wu, **Chin-Chia Michael Yeh**, Yusan Lin, Yuzhong Chen, Hao Yang, Fei Wang, Wanxin Bai, Krupa Brahmksri, Yimin Zhang, Chinna Kummitha, and Verma Abhisar, "Semi-supervised Context Discovery for Peer-Based Anomaly Detection in Multi-Layer Networks," *International Conference on Information and Communications Security* (ICICS), 2022.
- Jingzhu He, Yuhang Lin, Xiaohui Gu, **Chin-Chia Michael Yeh**, and Zhongfang Zhuang, "PerfSig: Extracting Performance Bug Signatures via Multi-modality Causal Analysis," *International Conference on Software Engineering* (ICSE), 2022.
- **Chin-Chia Michael Yeh**, Zhongfang Zhuang, Junpeng Wang, Yan Zheng, Javid Ebrahimi, Ryan Mercer, Liang Wang, and Wei Zhang, "Online Multi-horizon Transaction Metric Estimation with Multi-modal Learning in Payment Networks," *ACM International Conference on Information and Knowledge Management* (CIKM), 2021.
- Huiyuan Chen, Lan Wang, Yusan Lin, **Chin-Chia Michael Yeh**, Fei Wang, and Hao Yang, "Structured Graph Convolutional Networks with Stochastic Masks for Recommender Systems," *International ACM SIGIR Conference on Research and Development in Information Retrieval* (SIGIR), 2021.
- Prince Osei Aboagye, Yan Zheng, **Chin-Chia Michael Yeh**, Junpeng Wang, Wei Zhang, Liang Wang, Hao Yang, and Jeff Phillips, "Normalization of Language Embeddings for Cross-Lingual Alignment," *International Conference on Learning Representations* (ICLR), 2021.
- Junpeng Wang, Wei Zhang, Hao Yang, **Chin-Chia Michael Yeh**, and Liang Wang, "Visual Analytics for RNN-Based Deep Reinforcement Learning," *IEEE Transactions on Visualization and Computer Graphics* (TVCG), 2021.
- Jingzhu He, **Chin-Chia Michael Yeh**, Yanhong Wu, Liang Wang, and Wei Zhang, "Mining Anomalies in Subspaces of High-dimensional Time Series for Financial Transactional Data," *Joint European Conference on Machine Learning and Knowledge Discovery in Databases* (ECML-PKDD), 2021.
- **Chin-Chia Michael Yeh**, Zhongfang Zhuang, Yan Zheng, Liang Wang, Junpeng Wang, and Wei Zhang, "Merchant Category Identification Using Credit Card Transactions," *IEEE International Conference on Big Data* (BigData), 2020.
- **Chin-Chia Michael Yeh**, Zhongfang Zhuang, Wei Zhang, and Liang Wang, "Multi-future Merchant Transaction Prediction," *Joint European Conference on Machine Learning and Knowledge Discovery in Databases* (ECML-PKDD), 2020.
- **Chin-Chia Michael Yeh**, Dhruv Gelda, Zhongfang Zhuang, Yan Zheng, Liang Gou, and Wei Zhang, "Towards a Flexible Embedding Learning Framework," *IEEE International Conference on Data Mining Workshop on Multi-Source Data Mining* (MSDM), 2020.
- Yan Zhu, **Chin-Chia Michael Yeh**, Zachary Zimmerman, and Eamonn Keogh, "Matrix Profile XVII: Indexing the Matrix Profile to Allow Arbitrary Range Queries," *IEEE International Conference on Data Engineering* (ICDE), 2020.
- Yan Zhu, Shaghayegh Gharghabi, Diego Furtado Silva, Hoang Anh Dau, **Chin-Chia Michael Yeh**, Nader Shakibay Senobari, Abdulaziz Almaslukh, Kaveh Kamgar, Zachary Zimmerman, Gareth Funning, Abdullah Mueen, and Eamonn Keogh, "The Swiss Army Knife of Time Series Data Mining: Ten Useful Things You Can Do with the Matrix Profile and ten Lines of Code," *Data Mining and Knowledge Discovery* (DMKD), 2020.

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- **Chin-Chia Michael Yeh**, Yan Zhu, Hoang Anh Dau, Amirali Darvishzadeh, Mikhail Noskov, and Eamonn Keogh, "Online Amnestic DTW to allow Real-Time Golden Batch Monitoring," *ACM SIGKDD International Conference on Knowledge Discovery and Data Mining* (KDD), 2019.
- Shaghayegh Gharghabi, **Chin-Chia Michael Yeh**, Yifei Ding, Wei Ding, Paul Hibbing, Samuel LaMunion, Andrew Kaplan, Scott E. Crouter, and Eamonn Keogh, "Domain Agnostic Online Semantic Segmentation for Multi-dimensional Time Series," *Data Mining and Knowledge Discovery* (DMKD), 2019.
- Hoang Anh Dau, Anthony Bagnall, Kaveh Kamgar, **Chin-Chia Michael Yeh**, Yan Zhu, Shaghayegh Gharghabi, Chotirat Ann Ratanamahatana, and Eamonn Keogh, "The UCR Time Series Archive," *IEEE/CAA Journal of Automatica Sinica*, 2019.
- **Chin-Chia Michael Yeh**, "Towards a Near Universal Time Series Data Mining Tool: Introducing the Matrix Profile," University of California, Riverside, 2018.
- Alireza Abdoli, Amy C. Murillo, **Chin-Chia Michael Yeh**, Alec C. Gerry, and Eamonn J. Keogh, "Time Series Classification to Improve Poultry Welfare," *IEEE International Conference on Machine Learning and Applications* (ICMLA), 2018.
- Nader S. Senobari, Gareth J. Funning, Eamonn Keogh, Yan Zhu, **Chin-Chia Michael Yeh**, Zachary Zimmerman, and Abdullah Mueen, "Super-Efficient Cross-Correlation (SEC-C): A Fast Matched Filtering Code Suitable for Desktop Computers," *Seismological Research Letters*, 2018.
- Yan Zhu, **Chin-Chia Michael Yeh**, Zachary Zimmerman, Kaveh Kamgar, and Eamonn Keogh, "Matrix Profile XI: SCRIMP++: Time Series Motif Discovery at Interactive Speeds," *IEEE International Conference on Data Mining* (ICDM), 2018.
- Yan Zhu, Zachary Zimmerman, Nader S. Senobari, **Chin-Chia Michael Yeh**, Gareth Funning, Abdullah Mueen, Philip Brisk, and Eamonn Keogh, "Exploiting a Novel Algorithm and GPUs to Break the Ten Quadrillion Pairwise Comparisons Barrier for Time Series Motifs and Joins," *Knowledge and Information Systems* (KIS), 2018.
- **Chin-Chia Michael Yeh**, Yan Zhu, Liudmila Ulanova, Nurjahan Begum, Yifei Ding, Hoang Anh Dau, Zachary Zimmerman, Diego F. Silva, Abdullah Mueen, and Eamonn Keogh, "Time Series Joins, Motifs, Discords and Shapelets: a Unifying View that Exploits the Matrix Profile," *Data Mining and Knowledge Discovery* (DMKD), 2018.
- Shaghayegh Gharghabi, Yifei Ding, **Chin-Chia Michael Yeh**, Kaveh Kamgar, Liudmila Ulanova, and Eamonn Keogh, "Matrix Profile VIII: Domain Agnostic Online Semantic Segmentation at Superhuman Performance Levels," *IEEE International Conference on Data Mining* (ICDM), 2017.
- **Chin-Chia Michael Yeh**, Nickolas Kavantzas, and Eamonn Keogh, "Matrix Profile VI: Meaningful Multi-dimensional Motif Discovery," *IEEE International Conference on Data Mining* (ICDM), 2017.
- **Chin-Chia Michael Yeh**, Nickolas Kavantzas, and Eamonn Keogh, "Matrix Profile IV: Using Weakly Labeled Time Series to Predict Outcomes," *Proceedings of the VLDB Endowment* (VLDB), 2017.
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- **Chin-Chia Michael Yeh**, Ping-Keng Jao, and Yi-Hsuan Yang. "AWtoolbox: Characterizing Audio Information Using Audio Words," *ACM International Conference Multimedia* (MM), 2014.
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- Ping-Keng Jao, **Chin-Chia Michael Yeh**, and Yi-Hsuan Yang, "Modified LASSO Screening for Audio Word-based Music Classification Using Large-scale Dictionary," *IEEE International Conference on Acoustics, Speech and Signal Processing* (ICASSP), 2014.
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PATENT

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- Huiyuan Chen, Mahashweta Das, **Michael Yeh**, Yujie Fan, Yan Zheng, Wang Junpeng, Vivian Lai, and Hao Yang, "Method, System, and Computer Program Product for Improving Training Loss of Graph Neural Networks Using Bi-Level Optimization," US Patent App. 18/426,717.
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RELEVANT SKILL

Programming Language

- Proficient: MATLAB, Python, and LaTeX
- Familiar: Java, C#, and C++

Natural Language

- Bilingual Proficiency: English, Mandarin Chinese