ZHEXIN(TONY) WU

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EDUCATION

CFA Program Level I   **Jan 2025**

Management, Technology and Economics, ETH Zürich   **Master of Science, Sep 2023 - Present**
                                                                                                                         GPA: 5.89/6.00

Information Technology and Electrical Engineering, ETH Zürich   **Master of Science with Distinction, Sep 2021 - Jul 2023**
Major: Signal Processing and Machine Learning   **GPA: 5.76/6.00**

Electrical and Computer Engineering, University of Michigan - Ann Arbor   **Master of Science Program, Sep 2020 - May 2021**
Major: Signal and Image Processing and Machine Learning (SIPML)   **GPA: 4.00/4.00**

Yuan Shen Honors College, Beihang Univ.   **Bachelor of Engineering, Sep 2015 - Jul 2019**
Major: Electronic and Information Engineering   **GPA: 3.80/4.00, Ranking: 15/209**

Chengdu No.7 High School   **Sep 2012 - Jun 2015**

INTERNSHIPS

IPO Internship   **Analyst**
Sinolink Securities[code]   *Jun 2024 to Sep 2024*
- Developed scraper programs to collect and analyze the latest data on IPO statuses, prospectuses and inquiry letters from public websites
- Developed a custom GPT to construct structured industry and company analysis reports

Quantitative Internship in Factor Investment   **Quantitative Analyst**
China Securities[code]   *Feb 2024 to Mar 2024*
- Constructed CSI 300 and CSI 500 factor database using Tushare data terminal
- Developed trading strategy with information-coefficient-weighted factor using Zipline framework

RESEARCH EXPERIENCE

Multi-Agent Reinforcement Learning for Market Microstructure and Optimal Execution   **Master's Thesis**
With Dr. Jean-Loup Dupret and Prof. Patrick Cheridito[paper]   *Feb 2025 to Present*
- Developed a novel multi-agent reinforcement learning (MARL) framework based on the Kyle model to study strategic interactions among heterogeneous groups of market participants and market efficiency through limit order book (LOB) dynamics
- Extended the Almgren-Chriss model with RL-based agents and an endogenous price process for optimal execution
- Refactored ABIDES-Gym to enable multi-agent training and asynchronous execution in a simulated LOB market

In-Vivo Fetal Thalamus Parcellation   **Project Collaborator & Software Developer**
With Dr. Hui Ji and Prof. András Jakab[paper][code]   *Mar 2023 to Dec 2023*
- Unsupervised fetal thalamus functional group recognition with clustering algorithms
- Feature engineering using coordinate and spherical harmonic coefficient from diffusion MRI
- Optimized for high reproducibility between scan and re-scan data with image registration and Bayesian optimization
- Implemented scree plot, silhouette score and gap statistic for choosing optimal number of clusters

MR Image Reconstruction with Diffusion Models and Implicit Neural Representations   **Master's Thesis**
Advised by Dr. Valery Vishnevskiy and Prof. Sebastian Kozerke
[paper][slides]code (diffusion models)[code (implicit NR)]   *Oct 2022 to Jun 2023*
- Developed score-based diffusion models for 2D and 2D + time CMR image reconstruction with high acceleration rates
- Proposed proximal mapping for complex-valued image reconstruction algorithm with score-based diffusion models
- Conducted extensive ablation study on type of algorithm (sampling or MAP), choice of prior (model-based or data-driven) and patching-artefacts removal strategies
- Developed implicit neural representations for 2D, 2D + time and higher dimensional CMR image reconstruction

Sequence Models in 3D MRI Brain Metastases Detection   **Semester Thesis**
Advised by Prof. Ender Konukoglu [paper][slides][code]   *Apr 2022 to Jul 2022*
- Task: Brain metastases detection in T_1-weighted 3D MR images
- Revealed statistical significance of sequence models by training simple continuous patch-sequence classifier
- Reduced false positives by incorporating active learning
- Investigated the use of deep reinforcement learning agent

Effects of Data Augmentation and Semi-Supervised Learning in Domain Generalization   **Semester Thesis**
Advised by Prof. Ender Konukoglu [paper][slides][code]   *Oct 2021 to Mar 2022*
- Task: 2D MRI cardiac image segmentation under domain-shift
- Investigated using consistency loss as both auxiliary loss for training and proxy loss for test-time adaptation
- Proposed a new inversion-based data augmentation
- Conducted rich experiments on different data augmentation schemes
- Investigated the use of meta-learning

Manifold Optimization & Neural Collapse   **Research Assistant**
Advised by Prof. Qing Qu[paper] [code]   *Jan 2021 to Jun 2021*
- Created a smooth introduction to Riemannian submanifold optimization, with geometric illustration and concrete algorithmic examples.
- Participated in project *A Geometric Analysis of Neural Collapse with Unconstrained Features* and proof-read the script.
- Carried out experiments on neural collapse of CNN's last layer with oblique-manifold constraints on features and/or layer weights.

PROJECTS

Walmart Sales Prediction   **Course Project**
[executive summary][slides][code]   *Mar 2024 to May 2024*
- Developed machine learning pipeline following CRISP-DM, with an emphasis on explanatory model analysis
- Created executive recommendation from model prediction and variable importance

Model Fusion for Medical Image Segmentation via Optimal Transport   **Course Project**
[paper][code]   *Sep 2022 to Jan 2023*
- Extension of model fusion via optimal transport from cascade-like architecture (VGG, ResNet &etc) to more general architecture whose computational graph has richer adjacency structure
- Proposed model fusion approaches for prevalent U-Net and Transformer architectures used for medical image segmentation
- Comprehensive ablation study on fusion weighting scheme for typical medical data scenarios including distributed learning and domain-shift issue

Permutation-Invariant Variational Network for 2D + Time Cardiac Image Reconstruction   **Course Project**
[paper][code]   *May 2022 to Jun 2022*
- Implemented permutation-invariant variational network in PyTorch
- Implemented 2D and 3D variational network to make comparison with permutation-invariant variational network
- Re-organized derivation of optimization steps for loop-unrolling

Monitoring Social Distancing and Mask Wearing   **EECS 504 Course Project**
[paper] [video][code]   *Nov 2020 to Dec 2020*
- Selected the topic and created the framework of the pipeline
- Responsible for human instance segmentation and face detection; proposed a chin locator based on the results of instance segmentation via Mask R-CNN
- Augmented face dataset with Gaussian Pyramid and integrated multiple datasets
- Improved the performance of mask classifier by designing a upsampler based on DCGAN with a group member
- Created prototype of social distance circle mapping using homography with a group member

Michigan Tourist Guide   **SI 507 Course Project**
[report] [video] [code]   *Mar 2021 to Apr 2021*
- Gathered data from multiple sources with web APIs and web crawling with BeautifulSoup4.
- Created a full-stack web app with Flask with rich interactive functionalities.

The 13th Mathematical Modeling Contest of Beijing Normal University   **Team Leader, Second Prize**
Advised By Assoc. Prof. Yingzhe Wang   *Apr 2017 to May 2017*
Project: Tourist-flow Prediction at South Luogu Lane in Beijing, China

- Constructed cellular automata model to simulate the changes in tourist-flow with MATLAB
- Later improved theoretical basis of the paper for the contest by constructing a model based on PDEs (Partial Differential Equations) with varied boundary conditions (compared to the original map); the polished work as the final course project achieved 1/209 of the whole class

SELECTED ONLINE COURSES AND PROJECTS

A full list of online courses & projects can be viewed here

- ***Sparse Representations in Signal and Image Processing (by Technion)***   *Jul 2021 to Aug 2021*
  - ***Topics:*** Theoretical analysis of P_0 problem and guarantee of pursuit algorithms' stability; greedy pursuit algorithms and L_1 relaxation; FISTA and K-SVD algorithms(Dictionary Learning); application of sparseland model in image denoising, morphological components analysis(MCA), super resolution & etc.
  - ***Projects in Python:*** OMP & Basis Pursuit for solving P_0; Image Reconstruction with OMP; Unitary Dictionary Learning; Image Denoising with Dictionary Learning; Image Deblurring

AWARDS

- National Scholarship for 2016-2017 academic year
- Merit Student for 2015-2016, 2016-2017 and 2017-2018 academic year
- First Prize of Learning Merit Scholarship for 2015-2016 and 2016-2017 academic year
- University Excellent Student for 2016-2017 academic year
- Second prize of The 13th Mathematical Modeling Contest of Beijing Normal University
- Third Prize of Academic Competition Scholarship
- First Prize of Excellent Social Work
- The 27th and 28th National High School Student Chemistry Competition, Second Prizes

SKILLS SUMMARY

Programming Languages Python, C/C++, Julia, MATLAB, Bash Script, Java, LaTeX
Quant Frameworks Backtrader, VNPY, Zipline, Qlib
Machine Learning PyTorch, TensorFlow, JAX, OpenCV
Statistical Analysis R, Stata, SPSS, Excel VBA
Financial Data Terminals LSEG Workspace, Wind Financial Terminal
Database Management SQL, PySpark
Web Development HTML5, CSS3, JavaScript, BootStrap4, Django, Flask, Ruby on Rails
Hobbies Classical Piano, English Literature
Languages Chinese (Native), English (Fluent), Deutsch (Anfänger)

GRADUATE COURSES AT ETH ZÜRICH

401-3629-00L Quantitative Risk Management
363-0584-00L International Monetary Economics
363-1080-00L Responsible Leadership
401-3915-73L Machine Learning in Finance and Insurance[code]
401-4623-00L Time Series Analysis
363-0585-00L Intermediate Econometrics
363-1021-00L Monetary Policy
363-0560-00L Financial Management
363-0570-00L Principles of Econometrics
363-1098-00L Business Analytics[code]
363-0515-00L Decisions, Markets, and Games
363-0575-00L Economic Growth, Cycles and Policy
363-1063-00L Academic Writing Course
363-0711-00L Accounting for Managers
363-0503-00L Principles of Microeconomics
363-0565-00L Principles of Macroeconomics
363-0541-00L Economic Dynamics and Complexity
363-1004-00L Operations Research
363-0453-00L Strategic Supply Chain Management
363-0341-00L Introduction to Management
363-0403-00L Introduction to Marketing

263-3210-00L Deep Learning[code]
263-5210-00L Probabilistic Artificial Intelligence[code]
401-4944-20L Mathematics of Data Science
851-0252-15L Network Analysis
252-0220-00L Introduction to Machine Learning [code]
227-0391-00L Medical Image Analysis
227-0424-00L Model- and Learning-Based Inverse Problems in Imaging[code]
227-0948-00L Magnetic Resonance Imaging in Medicine
227-0449-00L Seminar in Biomedical Image Computing
401-3901-00L Linear & Combinatorial Optimization
401-3621-00L Fundamentals of Mathematical Statistics
227-0447-00L Image Analysis and Computer Vision
MOB-001 Basic German 1; A1: Intensive Course / Sprachenzentrum der UZH und der ETH Zürich

GRADUATE COURSES AT UMICH

EECS 501 Probability and Random Processes
EECS 559 Optimization Methods in Signal Processing and Machine Learning
SI 507 Intermediate Programming[code]
EECS 551 Matrix Methods for Signal Processing, Data Analysis and Machine Learning
EECS 504 Foundations of Computer Vision[code]

AUDITED COURSES

401-3904-22L Convex Optimization
EECS 598-005 Deep Learning for Computer Vision[code]