

# 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: 5.75/6.00
Information Technology and Electrical Engineering, ETH Zürich Major: Signal Processing and Machine Learning	Master of Science with Distinction, Sep 2021 - Jul 2023 GPA: 5.76/6.00
Electrical and Computer Engineering, University of Michigan - Ann Arbor Major: Signal and Image Processing and Machine Learning (SIPML)	Master of Science Program, Sep 2020 - May 2021 GPA: 4.00/4.00
Yuan Shen Honors College, Beihang Univ. Major: Electronic and Information Engineering	Bachelor of Engineering, Sep 2015 - Jul 2019 GPA: 3.80/4.00, Ranking: 15/209
Chengdu No.7 High School	Sep 2012 - Jun 2015

## INTERNSHIPS

<b>IPO Internship</b> <i>Sinolink Securities</i> [code]	<b>Analyst</b> Jun 2024 to Sep 2024
<ul style="list-style-type: none"><li>Developed scraper programs to collect and analyze the latest data on IPO statuses, prospectuses and inquiry letters from public websites</li><li>Developed a custom GPT to construct structured industry and company analysis reports</li></ul>	
<b>Quantitative Internship in Factor Investment</b> <i>China Securities</i> [code]	<b>Quantitative Analyst</b> Feb 2024 to Mar 2024
<ul style="list-style-type: none"><li>Constructed CSI 300 and CSI 500 factor database using Tushare data terminal</li><li>Developed trading strategy with information-coefficient-weighted factor using Zipline framework</li></ul>	

## RESEARCH EXPERIENCE

<b>In-Vivo Fetal Thalamus Parcellation</b> <i>With Dr. Hui Ji and Prof. András Jakab</i> [paper][code]	<b>Project Collaborator &amp; Software Developer</b> Mar 2023 to Dec 2023
<ul style="list-style-type: none"><li>Unsupervised fetal thalamus functional group recognition with clustering algorithms</li><li>Feature engineering using coordinate and spherical harmonic coefficient from diffusion MRI</li><li>Optimized for high reproducibility between scan and re-scan data with image registration and Bayesian optimization</li><li>Implemented scree plot, silhouette score and gap statistic for choosing optimal number of clusters</li></ul>	
<b>MR Image Reconstruction with Diffusion Models and Implicit Neural Representations</b> <i>Advised by Dr. Valery Vishnevskiy and Prof. Sebastian Kozerke</i> [paper][slides]code (diffusion models)[code (implicit NR)]	<b>Master's Thesis</b> Oct 2022 to Jun 2023
<ul style="list-style-type: none"><li>Developed score-based diffusion models for 2D and 2D + time CMR image reconstruction with high acceleration rates</li><li>Proposed proximal mapping for complex-valued image reconstruction algorithm with score-based diffusion models</li><li>Conducted extensive ablation study on type of algorithm (sampling or MAP), choice of prior (model-based or data-driven) and patching-artefacts removal strategies</li><li>Developed implicit neural representations for 2D, 2D + time and higher dimensional CMR image reconstruction</li></ul>	
<b>Sequence Models in 3D MRI Brain Metastases Detection</b> <i>Advised by Prof. Ender Konukoglu</i> [paper][slides][code]	<b>Semester Thesis</b> Apr 2022 to Jul 2022
<ul style="list-style-type: none"><li>Task: Brain metastases detection in <math>T_1</math>-weighted 3D MR images</li><li>Revealed statistical significance of sequence models by training simple continuous patch-sequence classifier</li><li>Reduced false positives by incorporating active learning</li><li>Investigated the use of deep reinforcement learning agent</li></ul>	
<b>Effects of Data Augmentation and Semi-Supervised Learning in Domain Generalization</b> <i>Advised by Prof. Ender Konukoglu</i> [paper][slides][code]	<b>Semester Thesis</b> Oct 2021 to Mar 2022
<ul style="list-style-type: none"><li>Task: 2D MRI cardiac image segmentation under domain-shift</li><li>Investigated using consistency loss as both auxiliary loss for training and proxy loss for test-time adaptation</li><li>Proposed a new inversion-based data augmentation</li><li>Conducted rich experiments on different data augmentation schemes</li><li>Investigated the use of meta-learning</li></ul>	

## Manifold Optimization & Neural Collapse

Advised by Prof. Qing Qu[paper] [code]

Research Assistant

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

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### Walmart Sales Prediction

[executive summary][slides][code]

Course Project

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

[paper][code]

Course Project

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

[paper][code]

Course Project

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

[paper] [video][code]

EECS 504 Course Project

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

[report] [video] [code]

SI 507 Course Project

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

Advised By Assoc. Prof. Yingzhe Wang

Team Leader, Second Prize

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

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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

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- 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

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**Programming Languages** Python, C/C++, Julia, MATLAB, Bash Script, Java,  $\text{\LaTeX}$

**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

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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

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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

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401-3904-22L Convex Optimization

EECS 598-005 Deep Learning for Computer Vision[code]