# Pengcheng Xu

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## EDUCATION

**University of Illinois Urbana-Champaign** Master, in Computer Engineering, GPA: 3.7/4.0 Aug 2022 - Dec 2023

**Core Courses:** Distributed Systems, Communication Network(A+), Computer Vision(A).

**University of Michigan - Shanghai Jiao Tong University Joint Institute** Sep 2018 - Aug 2022

B.S. in Electrical and Computer Engineering, Minor in Data Science. Outstanding Graduate (School Level).

**Core Courses:** Data structures and Algorithms, Intro to Computer Organization (A, Teaching Assistant), Computational Methods for Statistics and Data Science (A+), Intro to Operating Systems, Advanced Embedded Systems, Intro to Data Science (A), Intro to Engineering(A+), Undergraduate Research (A+).

## RESEARCH EXPERIENCE

**Multi-modal target detection with zero-shot depth estimation, Multi-modal NAS** May 2022 – Oct 2022

Shanghai AI Lab | Intelligent Photoelectric Department | Multi-modal Cognitive Computing Algorithm Intern

- Literature review on nature/science papers on multi-modal learning, and conference papers on Neural Architecture Search, multi-modal learning, image and sound feature fusion.
- The model inputs image and 2 audio channels, and outputs the behavior category and distance. Improve the estimation of distance using zero-shot monocular depth estimation like MiDaS added to the model structure.

**Multi-task learning based interpretable gene-level methylation estimations** |Research Assistant Sep 2021 - Present

Advisor: Hongyi Xin, Associate Professor of UM-SJTU Joint Institute, Shanghai Jiao Tong University

- Explored adaptable and interpretable end-to-end neural network method to estimate gene-level methylation given sites.
- Designed a variant of Auto-Encoder to support gene-level embedding shared among datasets to obtain multi-task learning.
- Ran further experiments and worked on a paper to be submitted in 2023.

**Augmented reality simulation of cardiovascular interventional surgery** | Research Assistant Mar 2020 - May 2021

Advisor: Lixu Gu, Professor of Biomedical Engineering, Shanghai Jiao Tong University

- Developed the framework of an augmented reality surgery training assistant system.
- Predicted the operation trajectory using LSTM and used KD-Tree to calculate the distance for operation safety warning.
- Displayed the vascular model in AR with OpenGL and designed the UI interface to support translation of the model.
- Used the aruco library in OpenCV to coordinate positioning of the QR code.
- Published *Vascular Intervention Training System Based on Electromagnetic Tracking Technology* on ICVRV as second author.

**Normal fundus image generation based on Generative Adversarial Network** | Research Assistant Apr 2019 - Oct 2019

Advisor: Lisheng Wang, Associate Professor at SEIEE, Shanghai Jiao Tong University

- Utilized GAN to design an image generation system to generate normal fundus image for comparisons to identify lesion areas.
- Used datasets including MESSIDOR-2 for data preprocessing like normalization, contrast enhancement, de-noising, clipping.
- Implemented a U-Net-based segmentation network to identify and remove fundus blood vessels as part of de-noising process.
- Built a CycleGAN framework based on segmentation to generate the normal fundus image to identify the lesion area.

## PUBLICATIONS

(To be submitted) Jinpu Cai*, **Pengcheng Xu***, Hongyi Xin, "Multi-task learning based interpretable gene-level methylation estimations",2023.

Zhikai Yang, **Pengcheng Xu**, Yufeng Chen, Dekun Yang, "Vascular Intervention Training System Based on Electromagnetic Tracking Technology", ICVRV, 2020. https://ieeexplore.ieee.org/document/9479727

## PROFESSIONAL EXPERIENCE

**4Paradigm Co., Ltd | OpenMLDB** | GitLink Code Camp 2022 | Open-Source Developer | Shanghai July 2022 – Oct 2022

- Developed an automated feature engineering pipeline, including feature generation and selection, based on AutoX and OpenMLDB sql with Python. Code is completed as a pull request https://github.com/4paradigm/OpenMLDB/pull/2381
- The program automatically generates sql query which meets OpenMLDB standard and get data from it through web request.
- The data is transformed by OpenMLDB sql to get time series and statistics features, and then we select the most important k features based on some algorithms like Adversarial Validation, GRN feature selection or Reinforcement Learning.

**Intel Co., Ltd** | DL Model Opt Department | Deep Learning Software Engineer Intern | Shanghai Nov 2021 - June 2022

- Debugged and added new features to Intel® Neural Compressor (https://github.com/intel/neural-compressor ), like Cross Layer Equalization feature which is a data free quantization to rescale different layer's weight range to reduce the drop in model accuracy after quantization, and editing manual.
- Studied the open-source software like Triton Inference Server and AI Model Efficiency Tool and gave presentations to the colleagues to introduce the design and technique detail of them.
- Cooperated to design and implement AI inference server software, which enables the team to deploy trained AI models from multiple frameworks and deploy more models on GPU or CPU based infrastructure (cloud, data center or edge), so as to simplify AI inferencing.
- Tested the correctness of code and the throughput of the deep learning models of TensorFlow.

**SHUKUN (Beijing) Technology Co., Ltd** | R & D Department | Algorithm Intern | Shanghai Dec 2020 - Apr 2021

- Implemented multi-node and multi-GPU training with **horovod** framework, NVIDIA clara train sdk, OpenMPI, and NCCL2.
- Compared the efficiencies of models like 3D-UNet when multi-node training with different GPU configurations in Python and wrote the configuration environment and training process documents.
- Used Java to add multi-machine and multi-GPU training functions to the company's back-end web page.

**Far East Horizon Co., Ltd** | R & D Department | Software Engineer Intern | Shanghai Aug 2018 - Sep 2018

- Designed a web component to implement batch login with automatic verification code identification.
- Achieved batch login by simulating password input and trigger button click events using Python's selenium library.
- Managed and maintained the database in MySQL. Implemented stress test with JMeter and wrote the manual.

## COURSE PROJECTS

**CS 425 Distributed Systems** Aug 2022 – Dec 2022

- Project1: Distributed Grep. Use C++ to implement a distributed grep query program. Among 10 machines, we can choose any one to be client and others to be servers, connecting with TCP socket. The query supports multi-thread and is fault tolerant.
- Project2: Distributed Group Membership System. Used C++ and multi-threading to implement a SWIM-like membership protocol through udp and a ring structure. The system can detect failure of machine in the group and update membership lists of all machines in the group within certain time and has low false positive rate and bandwidth.
- Project3: Distributed File System. Used Python to develop a scalable distributed file system tolerant up to three simultaneous machine failures. Read returns the latest written values. Totally order all updates to each file and return recent n versions.
- Project4: Distributed Machine Learning System. It satisfies fair-time inference which can make each job query rate within 20% difference. Also, it's fault-tolerance and can recover when certain number of members and coordinator leave.

**CS 543 Computer Vision (A)** Aug 2022 – Dec 2022

- Project1: Use Python to implement a multi-scale algorithm to align three channels of an image, evaluating with NCC.
- Project2: Use Python to design a Fourier-based color channel alignment. Implemented a scale-space blob detection with a Laplacian scale space using Laplacian of Gaussian filter, and performed non-maximum suppression in scale space
- Project3: Stitching pairs of images using OpenCV, SIFT descriptors and RANSAC to estimate a homography mapping one image onto the other. Implemented shape from shade algorithm to reconstruct 3D surface from image of different shades.

**CS 438 Communication Network (A+)** Aug 2022 – Dec 2022

- Project1: Use C++ to implement a http server and client which uses TCP and allows multiple clients requesting simultaneously.
- Project2: Use C++ to implement a transport protocol with properties equivalent to TCP based on unreliable UDP, which includes states of slow start, congestion-avoidance, and fast-recovery. It can tolerate packet drops, allow other concurrent connections a fair chance, and should not give up the entire bandwidth to other connections

**ECE4730J Advanced Embedded System (Major Design Experience, Thesis)** Sep 2021 – Dec 2021

Project name: sonar detection water pipe state system based on machine vision and neural network compression.

Instructor: Zou An, Assistant Professor of UM-SJTU Joint Institute, Shanghai Jiao Tong University

- Processed the source data of sonar as a matrix and use Python to generate polar images in real time.
- Used OpenCV to perform subtraction and corrosion operations to complete hole or bulge detection.
- Designed a compressed and binarized YOLO architecture to realize defect area detection with accuracy 99%.
- Used HLS to deploy to FPGA, matrix parallel operation, real-time embedded system is implemented.

**VE482 Introduction to Operating Systems** Sep 2021 - Dec 2021

- Project1 (130/100): Implemented UNIX like shell in C language: support single and double quotation marks and Bash style

input-output redirection parsing; Support multiple pipe parallel instructions; Self implement pwd, cd and other built-in instructions; Support & running tasks in the background and viewing multiple tasks; Support error reporting of common errors.

- Project2: Used C + + to implement some functions of database and realize multi-threaded accelerated SQL database. The instruction is parallel with read / write lock, and each table is divided into N sections to compute in parallel.
- Project3: Modified the minix 3.2.1 kernel code to implement EDF and lottery scheduling and test the performance.

## HONORS & AWARDS

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| 2021 Microsoft Imagine Cup Global Competition - Third Prize in China | Jan 2021 |
| 2020 Mathematical Contest in Modeling - Meritorious Winner (Top 6%) | Apr 2020 |
| 2020 "Jidong Cup" CCVR China Virtual Reality Competition, Product Creative Group - Second Prize | Nov 2020 |
| 2018-2019 Academic Year Undergraduate Excellence Scholarship | Nov 2019 |

## SKILLS

- **Programming:** C/C++ (Proficient), Python (Proficient), MATLAB, R, Verilog, Java, RISC-V Assembly Language, SQL, Shell.
- **Developer Tools:** Docker, Git, LaTeX, PSpice, Linux.
- **Frameworks & Libraries:** PyTorch, TensorFlow, horovod, Keras, Sk-learn, Pandas, NumPy, OpenCV, Matplotlib, Selenium.