XUAN (TOM) ZHAO

Tel: Removed due to spam ◇ Email: xz1919@ic.ac.uk ◇ Website: tomzhao.me
Github: github.com/zhao-xuan ◇ LinkedIn: linkedin.com/in/zhaoxuan0914

EDUCATION

Imperial College London September 2019 - June 2023

Year 4 Master of Engineering student at Department of Computing First Class Honour in all years

Year 1/2 Topics: Calculus, Linear Algebra, Graph & Algorithm I/II, Probability & Statistics, Computer Architecture, Database, Haskell, Java, C, Operating System, Compiler, Software Design, Network & Communication

Year 3/4 Topics: Intro to Machine Learning, Advanced Computer Architecture, Graphics, Computer Vision, ML for Imaging, Robotics, Reinforcement Learning, Deep Learning, Natural Language Processing

Thesis Title: High-Fidelity Image Synthesis from Pulmonary Nodule Lesion Maps using Diffusion Models

TECHNICAL SKILLS

Languages	C, Python, Java/Kotlin, JavaScript, Haskell, Armv8/x86-64, Bash, Scala
Utilities	Linux, VSCode/IntelliJ, MongoDB, Git, qemu, Docker, Figma, Office, LaTeX
Libraries & Frameworks	PyTorch, Tensorflow, Numpy, pandas, React, Flutter, flask/FastAPI

ACHIEVEMENTS

Imperial Computing Year 3 Dean's List	2022
IC Hack 22: Best Entertainment Hack Prize	2022
Year 3 Computer Graphics & Robotics Prize	2022
LeetCode Spring Group Contest: Top 100/3.4%	2021
LeetCode Fall Solo Contest: Top 500/4.7%	2020
Imperial Year 1 Best Overall C Group Project	2020

PUBLICATION

Xuan Zhao, Benjamin Hou. High-Fidelity Image Synthesis from Pulmonary Nodule Lesion Maps using Semantic Diffusion Model MIDL 2023 Short Paper Track Submission

- In this paper, we explore the use of Semantic Diffusion Models (SDM) to generate high-fidelity pulmonary CT images from segmentation maps and perform quantitative evaluation of the quality of images using performance of two downstream models and FID score with comparison of SPADE-generated images.

WORK EXPERIENCE

Microsoft UK April 2022 - September 2022

Software Engineer at Azure for Operators/Network Software Team On-site intern at London Enfield Office

- Enhanced `sigtrace_v2` tool for analysing data packets/signals used in process communications in the NBASE system. Added a new functionality of `looking up route info based on full-length IP address` in the Metaswitch dataplane/framewave product using `C`, `C++`, and `Scala`.
- Using `Python` face_recognition library and `socketio`, developed a face recognition demo for the MECnet edge computing team: connecting multiple cameras to a central server via IP to perform parallel face detection.

Arm Ltd. Full-time during July 2021 - September 2021, Part-time from October 2021

Linux Kernel Engineer in Morello Kernel Team Remote Intern for the Cambridge Office

- Learned about Armv8 ISA and architecture, including Armv8 exception model, security state and TrustZone technology, memory & cache model and management, and Armv8 Linux booting procedure. Worked with `Linux kernel signal handling`, `glibc/musl system call` invocation, and `Armv8 exception handling`.
- Involved in the development of `Morello kernel` related to CHERI technology, including `writing kernel test cases` for Morello kernel `system calls` using `Linux kernel ksefltest` framework.

Adaps Photonics September 2020 - January 2021

Computer System Engineer & Software Engineer On-site Intern at Shanghai Office

- Finished designing of `Linux driver`(written in `C`) on `96Boards` for the next generation mobile depth sensor/camera, involving `v4l2, I2C` drivers in Linux kernel. Designed the DevOps page and CI/CD(`Jenkins`) for all teams.

- Developed a sensor manager and integrated it with Android Hardware Abstraction Layer(`HAL`) controlling exposure and data stream of the dToF sensor. Customizing the kernel of Android Open Source Project(`AOSP`) based on `codeaurora`, main objective is to utilize Digital Signal Processor(`DSP`) with Qualcomm `Hexagon` to perform fast computation and design communication between `DSP` and `CPU`.

Pulse Secure July 2020 - September 2020

Software Engineer & UI Testing Engineer Remote Intern for the Cambridge Office

- Wrote a syntax transformer/parser in `Python` and `bash` for migrating mocha/chai test cases to `Jest` with `Enzyme`, `reduced 50-day workload into one week`. Wrote a simple test case generator based on component features.
- Used `React.js`, `Storybook`, `Jest`, and `Jenkins` to build and test UI components which will be used across all company products. Used Google `Puppeteer` to perform visual regression testing and integrated with `Jenkins`.
- Tested/created components involving `Javascript asynchronous` callbacks, animation libraries and factories, `React hooks`, `refs`, and `portals`, as well as more complex `JS/React` structures

Swift Assist (Part-time) March 2021 - June 2021

Frontend & Backend Developer Remote Part-time

- Developed company finance management platform for both manager end and employee end. Used `React.js` and `ant design` for frontend development, `flask` for backend framework, `mongodb` for the database and `flask_restx` as well as `jwt` for login and verification.
- Used `opencv-python` to implement QR code scan feature with high precision.
- Main functionalities include creating form templates, creating form processing procedure, managing employee accounts and bank information, and recording employee expense and compensation status.

PROJECTS

AiRNote Hack Cambridge Atlas Project Finalist

A collaborative AR notes app for iOS *https://github.com/lambda-shuttle/Airnote*

- A proof-of-concept augmented reality-based iOS application for collaborative note-taking in a shared workspace. Allows users to transcribe their voice notes in real-time using `Deepgram's API` and convert them into AR stickies
- Used iOS `RealityKit` and `Blender` to compose the models AR sticky note and pins. Used `ARKit` and `SwiftUI` to develop the main interface.

Magic Wand ICHACK 22 Best Entertainment Hack

A gesture-based cursor control application *https://github.com/danieldeng2/idiurus*

- It's a `gesture-based cursor control` application that allows you to operate your devices without using a trackpad or a mouse. You can open/close a tab in Chrome, or drag a window around using a click and drag gesture, as well as scrolling a webpage and even take a screenshot.
- Developed it in `Python` using the `mediapipe` library to detect and map interest point of a hand, `pynput` to control the mouse, and `QtforPython` (or `PySide6`) to write nice GUI window.

Computer Graphics Ray Tracing Task Year 3 Graphics Coursework

An image with 5 spheres rendered using recursive ray tracing *Link to the demo*

- Implemented ray tracing with environmental mapping, soft shadows and refraction in the Year 3 Computer Graphics ray tracing task using GLSL 2.
- Won the Computer Graphics 2022 Prize.

Investigation on Instruction Level Parallelism Advanced Computer Architecture Coursework

in the Fast Fourier Transform Program *Link to the report*

- Investigated on the effect of changing the configurations of an `out-of-order execution CPU` on a simulator, including experimenting with different sizes/configurations of the `RUU (Register Update Unit)`, `branch predictor`, `load/store queue`, L1/2 caches, the number of ALUs, and the number of instructions fetche/issue/decode.

- The goal is to develop a `systematic strategy on quickly identifying the configuration that produces the lowest energy cost` while maintaining a reasonable instructions-per-cycle speed.

MTTKRP Program Optimization on Raspberry Pi — Advanced Computer Architecture Coursework

MTTKRP: Matricized Tensor Times Khatri-Rao Product — *Link to the report*

- Inspected the effect of `compiler optimization`, `cache usage pattern` in the program, `SIMD optimization` on Arm Cortex A72, `loop unrolling + loop fusion`, `hardware multi-threading` and `overclocking` on the execution time of the MTTKRP program.
- The experiment is conducted on a Raspberry Pi with Arm Cortex A72, with a systematically designed strategy and carefully selected steps to carry out the optimizations.

Image Processing Engine with GUI — Third Year Group Project

Desktop Image Processing Software Built for Research Purposes — *https://github.com/G14-Y3/IPEwG*

- Developed an image processing software in `Kotlin` and used `JavaFX` as the GUI framework. My work includes several advanced features such as `neural style transfer`, `depth estimation`, `steganography`, `neural-network-based denoise`, and `false coloring`.
- Used `Pytorch` to train/trace the denoise, depth detection models and used `lib-torch` to load the model in Kotlin and perform forward pass. Used `mmdnn` to `convert Tensorflow/Keras model to Pytorch model`.
- `Trained 6 different neural style transfer models` using `Pytorch with cuda` on Nvidia GPU, and used `jit tracing` to convert pth models into pt models.

Pintos — Second Year Group Project

A Simple Operating System implemented Using C — *github.com/zhao-xuan/pintos_45*

- Developed a simple operating system with three other group members. Implementation includes a `Round-Robin process scheduler` and a `priority-based scheduler` based on CPU time of each process, the synchronization mechanisms (including `lock`, `semaphore`, and `monitor`).
- Enabled execution/running of `user-space programs` and several standard Unix system calls, such as `open()/close()`
- Implemented `virtual memory` and page management, including `page allocation`, `copy-on-write` and shared-pages, `memory-mapped files`, and `page swapping` based on `Second-Chance algorithm`. All implementations choices related to memory management are original by our team.

WACC Compiler — Second Year Group Project

A WACC Language Compiler Implemented Using Java — *http://blog.tomzhao.me/?p=572*

- Implemented a WACC language compiler capable of generating both `Armv6`/Arm11 architecture assembly and `Intel x86-64`. WACC is a simple language whose syntax is like C/Pascal designed for educational purpose.
- Used `ANTLR` tool to generate the language parser and used the generated parser to construct syntax tree, during which `symbol table` is constructed and `syntax and semantic checks` are performed, as well as the generation of error messages if any `syntax or semantic errors` occur.
- The WACC compiler supports basic control flows, including `if-else`, `for/while` loops, `switch` and `break/continue`. It supports basic, pointer, and `struct` types, as well as functions and `nested functions`. It also supports `import`, native `List/Map/Set`, `system calls` (`read`, `print`, `exit`, etc.) and `-O1` level compiler optimization.

ARM11 Emulator/Assembler — First Year C Group Project

Running four basic types of ARM11 instructions on x86-64 machines — *http://blog.tomzhao.me/?p=572*

- Built `ARM11 emulator` and `assembler` that support four basic types of `ARMv6`/ARM11 instruction set.
- Used `function pointer`, macro functions in both emulator and assembler. Implemented a `decoder` to decode binary in emulator. Implemented `hash-table` and `tokenizer` to convert assembly lines to binary codes in assembler.
- Used advanced `Makefile` techniques such as `MMD` flag that drastically reduced bugs and development time. Fully utilized `git` issues/merge requests and other git features for group work.

Tetris++ — First Year C Group Project Extension

Human Playing Tetris Using Accelerometer Against AI — *github.com/zhao-xuan/TetrisPlusPlus*

- Responsible for building the AI using `genetic algorithm` and fine-tuned it for both a conservative AI and a risky AI. Implemented another AI using `reinforcement learning` as well. Used `ncurse` to build the command line interface.
- Implemented `Raspberry Pi` version using `C`. People can play it using different sensors on an LED screen.

LinguoMusic ICHack 2020 Group Project
A Music Player Helping People Learn New Languages *github.com/zhao-xuan/LinguoMusic*

- Built the scrolling lyric with word-by-word translation interface and player using `React.js`. Used `Netease Music Box` to access music and lyric data. Used `Python` and `jiagu` library to tokenize lyrics and perform word categorization.

Niched Second Year Design for Real People Project
An Interest-based Micro-community Platform *github.com/zhao-xuan/Niched-Frontend*

- Niched is a web app helping students discover micro-communities within their college. They can create new community/spaces, initiate and organize activities, post text or media and create comments.
- Used `Vue.js` and `Element+` UI library to develop the frontend pages, including using new features in `Vue 3`.
- Used `FastAPI` and `MongoDB` to quickly build backend, including login, register, and verification using `JWT`. Support real-time commenting.

Igloo App Part-time Development
A Social Media Helping People Find Similar Minds

- Igloo is a social media for students and youngsters to discover new groups and locations with similar interests.
- Used `React Native` to develop the initial version of the frontend, including login/register page, space and channel page, personal account page, find and add friends, etc.
- Used `Flutter` to develop a second version of frontend and `wrote a re-usable UI library`.

MIT NuVu Studio: Neural Networks Team Leader and Programmer
A Self-driving Robot github.com/zhao-xuan/MITNuVu2018

- Built a self-driving bot on a `Raspberry Pi` running Linux.
- Used `Python` and `opencv-python` to implement `Hough Transformation` to realize edge detection for images captured by the PiCamera. Programmed motor movements based on detected lines to achieve self-driving.
- Used `Convolutional Neural Network` to implement object detection by the PiCamera.

Robot 3149 Team Leader and Programmer
High school robot team for 3 years *github.com/zhao-xuan/FTC2019*

- Competed 3 years in First Tech Challenge and used `Java` with FTC libraries to program the robot.
- In the first year, we built a robot that can click beacons using mechanical hand, raise yoga balls to a certain height, and locate particles and carry them to a designated destination.
- In the second year, we added ability to `detect colors` on its rotatable mechanical hand. In the third year, we added a hook that can lift the robot off the ground.

PERSONAL SKILLS & HOBBIES

Currently learning Japanese, French, Russian, and Arabic. I'm proficient in `Mandarin (native)`, `English`, and `Japanese (conversational level)`

Playing piano and `accordion`, mountain/road biking, running, badminton.

Traveling, photography, R&B music and movies