

Zhicheng (Frederick) Zou

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🎓 Education

- PhD Computer Science**, *University of Bristol* 2025/09 – Present | Bristol, UK
Creative industries contributed £110bn to the UK economy in 2021. Although 40% of global natural history films are produced in Bristol, the demand for increasingly challenging content means that we must innovate to enhance audience experiences, to maintain our world-leading position and to drive inward investment. This project will support creative technologies, developing novel tools for video enhancement for challenge environments, such as heat haze. The objective is to establish a framework for jointly optimising inverse problems. The techniques will be formulated based on probability theory, linear algebra, and numerical analysis, with a focus on perceptual significance. The outcomes of the project will not only enhance the visual quality of the videos but also improve our understanding of the depicted scenes, enabling better monitoring of wildlife behaviour and facilitating conservation efforts.
- Msc Security and Resilience: Science and Technology, Pass with Merit** 2024/09 – 2025/09 | London, UK
Imperial College London 
- **Long Summer Project (A*)**, **Cyber-Physical System Security (A)**, **Behaviour Research Methods (B)**, **Behaviour Science and Security (C)**, **Security in Context (B)**, **Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE): The Physical Threat Space (C)**, **Sensors: Electronic and Natural (B)**, **Infrastructure and Transport Security (D)**, **Computer Graphics (60)**, **System and Web Security (65)**.
- BSc Computer Science, Pass with Upper Second Class Honours**, *University of Bristol* 2021/09 – 2024/09 | Bristol, UK
• **Individual Project (80)**, **Mathematics for Computer Science B (80)**, **Concurrency and Distributed Systems (77)** (*outstanding attempt for the implementation, and incredible report*), **Software Engineering Project (75)**, **Interaction and Society (75)**, **Data-Driven Computer Science (72)**, **Imperative and Functional Programming (72)**, **Cryptology (71)**, **Operating Systems and Security (69)**, **Computer Graphics (67)**, **Image Processing and Computer Vision (67)**, **Object-Oriented Programming and Algorithms (65)**, **CGI (62)**.
- International Foundation Course, Pass with Distinction** 2020/09 – 2021/05 | London, UK
Kaplan International College London 
- **Intermediate Mathematics (88)**, **Information Technology (78)**, **English for Academic Purposes (65)**, **Extended Project (56)**.
- Advance Placement (AP)**, *Canadian International School of Hefei* 2017/04 – 2020/06 | Hefei, China
• **Calculus (5/5)**, **Computer Science A (4/5)**, **Physics II (4/5)**
- High School**, *The Phelps School* 2016/09 – 2017/02 | Malvern, US
Overall Grade: 3.5/4
- Middle School**, *Shouchun Middle School* 2014/09 – 2016/06 | Hefei, China

🏆 Awards

- Achievement Award**, *Computer Graphics Contest 2025, Imperial College London* 2025/05
Developed a real-time ray tracing shader in GLSL, implementing physically based rendering (PBR), soft shadows, one-bounce global illumination, and BRDF-based material interactions. Optimised with multi-sampling, stochastic sampling, and cosine-weighted hemisphere sampling for realistic lighting and reflections. Score: 99.5 / 100
- People Choice Prize**  , *2023 CSS GAME-JAM, University of Bristol* 2023/10
Two days of coding, collaboration, and creativity resulted in a game we're incredibly proud of, "Toxic Tide," centered around the 2023 GameJam themes of contamination and the sub/theme, scary.
- Bristol Plus Award**  , *Ms Paula Coonerty & Professor Judith Squires, University of Bristol* 2023/04
This prestigious recognition celebrates the dedication to extracurricular activities and skill development throughout our degree program. I am grateful for the invaluable experiences in teamwork, problem-solving, communication, and leadership that have enriched my university life.

📖 Publications

- MMDL-Net: A Multimodal Deep Learning Network for Post-Collision Injury Prediction and Triage Support**  2026/06
SSRN Preprint
- Developed a multimodal deep learning model that integrates vehicle sensor data, crash metadata, and images to predict post collision injury risk and support triage decisions. Conducted large-scale experiments on real-world crash datasets, demonstrating the value of combining heterogeneous data sources for reliable, clinically relevant predictions.

Asian Conference on Computer Vision 2024

This paper introduces a novel framework for mitigating atmospheric turbulence in long-range imaging, which significantly affects image quality across fields like long-range terrestrial video surveillance and air-to-ground imaging. The approach combines geometric restoration and enhancement using a pyramid architecture with deformable 3D convolutions to align frames, followed by a multi-scale 3D Swin Transformer architecture to reconstruct sharp, clear images. Demonstrated superior performance over existing methods, this framework offers a balance of speed and model efficiency, suitable for both synthetic and real-world scenarios.

Work Experience

Graduate Teacher Level 1 & Demonstrator, University of Bristol

2023/09 – 2024/09 | Bristol, UK

Graduate Level 1 Teaching Assistant for COMS20008 - Computer System A, and Demonstrator for COMS20012 - Computer Systems B, assisted in facilitating academic support, enriching student understanding, and ensuring effective course delivery. Leading Y2 students to delve deep into concurrent and distributed programming with Go language, and dive deep into the world of OS and its nuances in security!

Software Developer (Part of UoB Project), Synoptix

2022/10 – 2023/05 | Bristol, London

During my contract on the Metacrypt project under the University of Bristol's guidance, I designed and developed a secure web application using React for the frontend. On the backend, I implemented file metadata encryption using PyCryptodome to ensure robust encryption algorithms. I significantly optimised the code, reducing API response times by 64%. Additionally, I developed and deployed an advanced logging system to enhance incident response security. The project was rigorously verified and validated to exceed client expectations, ensuring full compliance with their requirements.

Projects and Experiences

Real-time Atmospheric Turbulence Mitigation and Object Recognition

2025/09 – Present

Currently working on a long-range imaging research project on real-time atmospheric turbulence mitigation and object recognition, aiming to deploy an efficient end-to-end system that can stabilise and sharpen challenging long-distance footage while reliably detecting and recognising objects for applications such as surveillance, navigation, and environmental monitoring.

Multimodal Deep Learning Network for Post Collision Injury Prediction (MMDLNet), in Python

2025/06 – Present

Developed a multimodal deep learning model that integrates vehicle sensor data, crash metadata, and images to predict post collision injury risk and support triage decisions. Conducted large scale experiments on real world crash datasets, demonstrating the value of combining heterogeneous data sources for reliable, clinically relevant predictions.

Autonomous Sensing System for Tsunami Disaster Response

2025/01 – 2025/06

As part of Group 9, I helped design a wearable sensing system to support search-and-rescue teams following a catastrophic tsunami. The device integrates GPS, UWB, Bluetooth, health sensors, and gas sensors to locate survivors and detect hazards when traditional communication networks fail. My main focus was the communication system, where I designed a layered network using satellite-based GPS for approximate positioning, a Network Emergency Response Vehicle to relay data within a fifteen-kilometre range, UAVs to strengthen coverage in weak-signal areas, and longer-term support through high-altitude platforms. Once rescuers reach the site, Bluetooth and UWB allow precise localisation of survivors. Our solution was tested in simulated disaster scenarios and achieved an A grade (70+) for the final presentation.

Ghetto Formation Problem and Mitigation Methods, in Python and Academic Writing

2024/09 – 2025/06

Worked in a three member research team on “Ghetto Formation Problem and Mitigation Methods” focusing on London, with a case study of the Bengali Muslim community in Tower Hamlets. We reviewed academic literature and UK policy documents on economic, policing, housing, media and education drivers of ghettoisation, and analysed how immigration and housing legislation, school segregation and biased media narratives reinforce social and economic exclusion. Based on this, we proposed mitigation strategies including fair housing allocation and mixed income developments, stronger welfare and urban infrastructure investment, community based empowerment, and education reforms such as better funding for disadvantaged schools, targeted scholarships and technology supported tutoring systems to narrow the attainment gap. My main contribution focused on the education dimension and technology driven solutions for more equal access to learning.

Cyber-Physical Security in the Energy Sector: Risks and Challenges in Electricity Transmission and Distribution

2025/01 – 2025/05

As part of my MSc in Security and Resilience at Imperial College London, I collaborated with a team to analyze and address the cybersecurity challenges within electricity transmission and distribution networks.

This project involved:

- Investigating vulnerabilities in converged IT/OT systems, including legacy OT devices and insufficient network segmentation.
- Critically assessing issues such as real-time intrusion detection, resilience gaps, IoT endpoint security, and the challenges of simulating cyber-physical attacks.
- Exploring cutting-edge research and practical approaches, including software-defined networking, AI-driven monitoring, self-healing grid technologies, and secure IoT protocols.

- Emphasizing the need for a holistic security framework that integrates robust cyber defenses, physical protections, and coordinated response strategies to safeguard critical energy infrastructure.

Network and Web Security

2025/01 – 2025/05

Built a virtual penetration testing lab using Kali Linux and vulnerable VMs (password leaker, listener, DVWA) to explore core network and web security attacks. Analysed real web server HTTP logs to identify scanning, brute force and injection attempts, and correlated them with typical attacker behaviour. Used tools such as Wireshark, Nmap, John the Ripper and Netcat to perform password cracking, privilege escalation with a DirtyCow kernel exploit, custom DNS and ARP spoofing, reverse shells and exploitation of command injection and insecure file upload vulnerabilities in DVWA. Overall Score: 81/100

Real-Time Ray Tracing Cornell Box - Graphics 2025, in C++

2025/01 – 2025/05

Developed a real-time ray tracing shader in GLSL, implementing physically based rendering (PBR), soft shadows, one-bounce global illumination, and BRDF-based material interactions. Optimised with multi-sampling, stochastic sampling, and cosine-weighted hemisphere sampling for realistic lighting and reflections.

Award: Achievement Award Winner, Computer Graphics Contest 2025, Imperial College London. Score: 99.5 / 100 (Overall Coursework Score)

Enhancing Long-Range Imaging through Deep Learning: Mitigating Atmospheric Turbulence *in Python*

2024/01 – 2025/01

Developed an advanced technique adapting existing methods to correct atmospheric turbulence in images and videos, employing 3DConvs, UNets, and Swin3D Transformers. Generated synthetic data for model training and conducted evaluations using real-world datasets. Achieved first-class honours with a score of 80/100. The work is slated for publication at ACCV 2024.

3D from Stereo Vision , *in Python*

2023/09 – 2023/12

Created a Python-based stereo vision system for the “3D from Stereo” project during the Image Processing and Computer Vision course at the University of Bristol. This system utilizes OpenCV and Open3D libraries to perform 3D reconstructions from stereo images. It processes images to detect spheres, estimates their positions and radii, and reconstructs their 3D spatial configuration. Designed for adaptability, the system features command-line operability for dynamic parameter adjustments.

Computer Graphics in Cornell Box , *in C++*

2023/09 – 2023/12

Developed a custom 3D rendering engine using C++ for the Cornell Box, supporting various rendering modes such as Wireframe, Rasterization, and Ray Tracing. The engine manages object transformations, camera control, lighting computations, and texture mapping, facilitating detailed and customizable 3D visualizations.

Dartboard Detector , *in Python*

2023/09 – 2023/12

The Dartboard Detector is a Python application designed to identify dartboards within images. It employs Sobel edge detection, Hough Circle Transform, and the Viola-Jones method to ensure precise detection. This application accepts an image as input, identifies dartboards, and returns the image with dartboards delineated by bounding boxes.

Game-Jam , *in Java*

2023/10 – 2023/10

As a member of our team triumphed with the People's Choice Award at the University of Bristol CSS 2023 GameJam! In just two days, we poured our coding skills, collaborative spirits, and creative minds into developing “Toxic Tide,” a game inspired by this year's themes of contamination and scariness.

Datathon, in Python

2023/03 – 2023/03

As a programmer and team member of VME50 in an Intramural competition, I utilized specified road traffic data to predict the likelihood of fatal or serious casualties. My primary focus was on analyzing data concerning the casualty, accident, and involved vehicles. Through rigorous data examination and implementation of predictive algorithms, I contributed to our team's efforts to discern patterns and indicators that determine the severity of outcomes in road traffic incidents.

Hackathon , *in C#, 3DS Max, CAD, Maya*

2023/02 – 2023/02

As a member of the !BBQ team competing in an Intramural competition, my primary responsibility lies in modeling for our virtual world project. Utilizing industry-standard software such as 3DS Max, Maya, and CAD, I craft intricate 3D models and textures integral to our virtual realm. This encompasses the meticulous design and creation of diverse assets, ranging from grandiose buildings and landscapes to distinct characters. My proficiency in 3D modeling and texturing is pivotal, allowing me to actualize our team's conceptual vision, thereby amplifying the immersive experience for players. Ensuring the high-quality benchmark of our virtual world project remains paramount in my role.

SignWave – The Sign Language Real-Time Translator

2023/01 – 2023/04

Academic Writing · Human Computer Interaction

Prototype for a real-time machine learning device, SignWave that translates sign language to spoken languages. Exploration is focused on ethical consideration and the HCI process. In a team of six, I participated in the development of a prototype named SignWave for a school project. This real-time machine learning device is designed to translate sign language into spoken languages. Central to our exploration was the ethical consideration surrounding such a tool and the intricacies of the Human-Computer Interaction (HCI) process. My specific contributions to this initiative included writing the foundational paper, using Blender to design the product's exterior, and recording and editing the project's presentation video.

Concurrency & Distributed Programming of Conway's Game of Life , in Go language 2022/11 – 2022/12

As one of two core team members in a school project, I actively collaborated on developing the Game of Life in Golang. Our innovative approach harnessed multiple worker goroutines on a single machine, ensuring parallel calculations for optimized performance. Further enhancing our project, we designed a distributed implementation using multiple AWS nodes. These nodes collaboratively calculated the new state of the Game of Life board and communicated inter-machine states via a broker. Our commitment to elevating the project's efficiency and reliability was reflected in our subsequent improvements, where we integrated Halo-Exchange, Fault Tolerance, and Memory Sharing features.

Novel method for multi-layer meta-data encryption 2022/10 – 2023/05

in Python, Typescript & Supabase, working with Synoptix

As a key participant in a school project for Synoptix, I played an integral role in both frontend and backend testing of an internal encryption tool. This tool was innovatively designed to address the critical issue of unencrypted metadata in sensitive files, such as location, author, and creation date. My responsibilities encompassed developing code to extract metadata from uploaded files and implementing processes for its encryption and decryption. By leveraging the Advanced Encryption Standard (AES), we ensured not only the protection of primary file content but also its accompanying metadata, upholding the principles of the CIA triad: Confidentiality, Availability, and Integrity.

Object-Oriented Programming and Algorithms of Scotland Yard and Game AI , in Java language 2022/02 – 2022/04

Experience in the collaborative development of a board game in Java and building an AI player by adopting knowledge in game theory including constructing decision tree using Minimax algorithm with Alpha-Beta Pruning. In a personal project, I took the lead in collaboratively developing a board game using Java. My primary role involved writing the main codebase and architecting the game's logic. A significant feature of our game was the integration of an AI player. I utilized knowledge in game theory to design and implement this AI, particularly by constructing a decision tree using the Minimax algorithm enhanced with Alpha-Beta Pruning. This AI capability ensured a challenging and engaging gameplay experience.

Develop web-based data-driven applications 2021/09 – 2021/12

In a personal endeavor, I took the initiative to construct a front-end web application employing the fundamental trio of web technologies: HTML, RESTful JavaScript (REST JS), and CSS. The project's depth extended beyond mere visual elements as I incorporated a robust relational database backend, demonstrating my proficiency with SQL language. Serving as the principal developer, I penned the main code, ensuring that both the front-end and database integration were seamlessly interconnected.

Imperative and Functional programming , in C 2021/09 – 2021/12

In a personal initiative, I authored the primary code for a C program that efficiently converts Skencil files to PGM format. This project, focused on a streamlined yet optimized algorithm, involved intricate pixel traversal techniques using commands like DATA, DX, DY, TARGETX, and TARGETY. Recognized with a 73% grade for its impeccable testing performance and successful image transformations, the converter notably achieved impressive file compression sizes for both `bands.sk` and `fractal.sk`.

Languages

English — IELTS 6.5

Chinese — Native Speaker