

# ZIBANG NIE

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Research Interests: Computer Vision, Natural Language Processing

## EDUCATION

### Central South University (Project 985)

Changsha, China

B.Eng. in Computer Science & Technology

Sep 2022 - Jun 2026 (Expected Graduation)

GPA: 3.7/4 | Average Score: 87/100

### University of Dundee (Dual-Degree Program)

Dundee, UK

B.Sc. (Hons.) in Computing Science

Sep 2022 - Jun 2026 (Expected Graduation)

GPA: 3.7/4 | Average Score: 87/100

## ACHIEVEMENTS

### Journal/Conference:

Zhong, Y., Tang, Z., Zhang, H., Dai, Z., \*Nie, Z.\*, Xie, Y. "Pulp Grade Monitoring Using Binocular Image Through Multi-Scale Feature Cross-Attention Fusion Network and Saliency Map Constraint," Advanced Engineering Informatics, 2024. DOI: 10.1016/j.aei.2024.102780. (SCI Q1, IF $\approx$ 6.1)

Luo, J., Tang, Z., Zhang, H., Fan, Y., Xie, Y., \*Nie, Z.\*, Gui, W. "A Defocused Calibration Method Using ROI-Patched MAM-UNet and Progressive Training for Froth Flotation Process," IEEE/ASME Transactions on Mechatronics, 2025. DOI: 10.1109/TMECH.2025.3545743. (SCI Q1, IF $\approx$ 6.8)

\*Nie, Z.\*, Fan, Y., He, F. "Robustness Analysis of Visual Transformer Based on Adversarial Attacks," Applied and Computational Engineering, 2024. DOI: 10.54254/2755-2721/41/20230737.

Luo, H., Tang, Z., Zhang, H., Xie, Y., \*Nie, Z.\* "TS-DDPD: A Transfer Strategy with Differential Distribution and Progressive Distillation for Working Condition Monitoring in Froth Flotation Process," SSRN Preprint, 2025. DOI: 10.2139/ssrn.5184198. (Under Review)

### Patents:

Tang, C., Ma, W., Zhang, H., Su, Y., \*Nie, Z.\* "Data-Fusion-Based Method for Building a Flotation Key Indicator Monitoring Model." China National Invention Patent Application, Pub. No. CN118887587A, Published 2024.

Zhang, H., Tang, C., Ma, W., Tang, H., \*Nie, Z.\* "Foam-Video Key-Frame Extraction Method Based on Average Foam Velocity." China National Invention Patent Application, Pub. No. CN118887586A, Published 2024.

## RESEARCH EXPERIENCE

### Efficient Pipeline-Parallel Training & ViT Adversarial Robustness

Research Assistant

Jun 2023-Sep 2023

Problem: Single-GPU memory limits and idle "bubbles" slow large-scale Transformer training; ViT robustness vs. CNNs under attacks unclear.

Method: Implemented vPipe (swap-recompute-partition) on multiple GPUs; ran FGSM/I-FGSM attacks on CIFAR-10 comparing ViT-Base and ResNet-18.

Outcome: vPipe delivered  $\approx 2\times$  throughput over PipeDream and trained  $1.2\times$  larger models; ViT suffered 50 % less accuracy drop than CNNs at  $\epsilon = 0.3$ ; results published in Applied and Computational Engineering (2024).

### Enhancing Large Language Models with Specialized Knowledge Base

Research Assistant

Dec 2023-Apr 2024

Problem: Traditional large language models struggle with domain-specific knowledge, often delivering generalized or imprecise answers in professional fields like medicine, law, and science.

Method: Developed a plugin integrating a specialized local knowledge base with the Wenxin Yiyan LLM. This system used Langchain structure, utilized text embedding, vector similarity search, and customized response

generation to improve accuracy and domain expertise.

Outcome: The plugin enabled the LLM to deliver answers with significantly higher professional accuracy in subjects like physics and law, outperforming standard LLMs. It was tested on over 10,000 queries and integrated successfully into educational platforms and research tools. The project won several provincial-level awards in university student competitions.

## Deep Learning for Natural Language Processing

*Student Researcher*

*Mar 2024-Jun 2024*

Problem: Create an end-to-end pipeline that cleans raw text and predicts topics/similarity for ad-tech and fintech datasets.

Method: Used Python to implement tokenisation, stop-word removal, stemming, TF-IDF vectors, PCA dimensionality reduction, and Jaccard / cosine-similarity metrics; wrapped the workflow in utils.py functions and processed > 10 k documents.

Outcome: Pipeline extracted top keywords per topic and reached 0.82 macro-F1 on unseen data; course project graded 92/100 with completion certificate signed by Prof. Patrick Houlihan.

## Industrial Froth-Flotation Field Study, Fan-kou Lead-Zinc Mine

*Student Researcher*

*Jul 2024 – Aug 2024*

Problem: Monocular froth imaging struggled to predict pulp grade; calibration degraded under defocus; public pretrained models transferred poorly to flotation imagery.

Method: Deployed a **binocular** rig at rougher cells; synchronized image streams with **DCS tags**, operator logs, and lab assays; curated ≈8,000 high-res froth images. Supported algorithmic studies by preparing **saliency priors** and running evaluations of **multi-scale cross-attention fusion** (Video-Transformer backend) for grade prediction; assisted **defocus-robust calibration** experiments using **ROI-Patched MAM-UNet with progressive training**; implemented **TS-DDPD** transfer/distillation training runs and industrial validation on real zinc rougher data.

Outcome: Paper in **AEI'24**, **T-Mech'25**, a **2025 preprint**, and **two CN patents** (*CN118887586A*; *CN118887587A*).

## HONORS & AWARDS

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### Academic Honors

Third-Class Scholarship, Central South University | 2023

University “Outstanding Student”, Central South University | 2023

### Academic Competitions

- Provincial Third Prize (Top 20 %), 15th China College Students Service-Outsourcing Innovation & Entrepreneurship Competition | 2024

- Provincial Third Prize (Top 15 %), China International College Students “Internet+” Innovation & Entrepreneurship Competition | 2024

- Provincial Grant (Top 20 %), National Undergraduate Innovation & Entrepreneurship Training Program | 2024

## SKILLS

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### Languages:

Chinese (Native), English (TOEFL 110: Reading30, Listening28, Speaking23, Writing29)

### Technical Skills:

- Programming Languages: Python · C++ · Java · MATLAB
- Deep-Learning Frameworks: PyTorch · TensorFlow · Hugging Face Transformers · CUDA
- Data / CV Libraries: NumPy · Pandas · OpenCV
- Dev Tools: Git · Docker · Linux (Ubuntu)

References available upon request.