

ZHENGZHAO LAI

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EDUCATION

Northeastern University, China

Sep. 2021 – Expected Jun. 2025

Bachelor of Functional Materials

- GPA: 85.57/100; Rank: 11/46 (Top 24%)
- Minor Courses: Data Structures, Principles of Computer Composition, Operating Systems

RESEARCH INTERESTS

Science for GenAI; AI for Science; Multimodal LLMs;

RESEARCH EXPERIENCE

Large Language Models for Chemistry and Molecule

Aug. 2024 - Dec. 2024

Visiting Student & Intern Advisor: **Prof. Benyou Wang** (CUHK, Shenzhen)

🔗 code

- Conducted research on existing large language models in chemistry and molecule and related downstream tasks. Researched advancements in AI for molecular representation and retrosynthesis.
- Developed scripts to process collected data according to the team's needs and communicated with the team. Reimplemented the ChemLLMBench code to facilitate the team's evaluation of our model.

In-Context Learning Enhanced Molecule Property Prediction via LLMs *Jul. 2024 - Aug. 2024*

Summer Camp Organizer: The NLP Research Group at Nanjing University

🔗 code

- Experimented with LLMs using zero-shot and few-shot In-Context Learning in an unsupervised manner to select samples across various settings, including random selection and fingerprint-based methods (MACCS, RDKit, Morgan) with Tanimoto and Cosine similarities.
- Adapted the Efficient Prompt Retrieval algorithm for supervised sample selection. Trained a retriever with contrastive learning to select more accurate ICL samples during testing, yielding modest improvements.

AI-Driven Approaches to Retrosynthesis Prediction

May 2024 - Jun. 2024

Personal Survey

🔗 review

- Review the field of AI-driven retrosynthesis in organic molecular synthesis, including past literature and methodologies of one-step and multi-step retrosynthesis prediction.
- Summarized the historical deep learning approaches to retrosynthesis, along with my own understanding and insights into this domain.

Photo Geography Localization Inference via Multimodal LLMs

Mar. 2024 - May 2024

Core Member Advisor: Prof. Miao Fang (Northeastern University)

🔗 code

- Designed prompts for large multimodal models such as GPT-4V and Gemini, leveraging techniques such as scene graph analysis, top-5 predictions, the TenCrop method, and utilizing satellite images of candidate locations for supplementary matching purposes.
- Experimented with different approaches and analyzed results, the inference effect and performance are improved and enhanced compared to traditional specially designed models.

Video Semantic Segmentation for Unsupervised Domain Adaptation

Jun. 2023 - Jan. 2024

Research Assistant Advisor: Prof. Dayan Guan (Nanyang Technological University)

- Implemented a simple yet effective approach to mitigate domain shift issues by applying histogram matching to frames instead of relying on additional style-transferred models, demonstrating a stable improvement.


- Explored modifications to the Class-Mix technique by varying the placement of mixed objects and investigated the incorporation of Contrastive Learning to enhance the model's ability to learn shared features across source and target domains.

PROJECT EXPERIENCE

RAG&Vision Enhanced CUDA Coding Agents

Jun. 2024 - Jul. 2024

Personal Project

 code

- Utilized RAG enhancement technology to vectorize and store the NVIDIA CUDA Programming Guide as an external document, enabling the search for answers related to questions in official documents and the programming of CUDA code according to user needs.
- Leveraged external vision-language models to parse images for analysis, and based on the image content to program CUDA code meets the requirements.

Road Damage Object Detection - AI Algorithm Competition

Oct. 2023 - Dec. 2023

Team Leader

- Conducted analysis of the dataset and developed scripts to process the data, employed copy-paste technique to tackle unbalanced classes problem.
- Explored a range of mainstream object detection models to identify the most suitable ones for the task. Enhanced detection by adjusting multi-scale training and multi-class thresholds. Improved final performance through advanced algorithms such as weighted box fusion and model ensemble strategy.

Armor Detection in Robot Vision - RoboMaster Competition

Jun. 2022 - Jan. 2024

Head of Deep Learning Group in Vision Sector

- Collected and analyzed datasets of armor plates, and developed scripts for datasets processing. Studied object detection models such as YOLO, customized yolov5-face into a four-keypoint model, and introduced Normalized Mean Error metric to optimize and enhance the model's performance.
- Deployed the model using C++ and ROS2 framework, leveraged CUDA and TensorRT libraries to accelerate model inference speed on NVIDIA Jetson series edge development boards. Achieved rapid and precise detection of armor plate categories and key point locations.

INTERNSHIP EXPERIENCE

Shenyang YaTrans Network Technology Co., Ltd.

Speech Algorithms Intern

Jan. 2024 - Feb. 2024

- Gained expertise in speech and text translation algorithms and studied existing end-to-end speech-to-speech translation models.
- Engaged in team meetings to discuss IWSLT tasks and contributed to the creation of scripts for processing and analyzing speech data in preparation for the tasks.

HONORS AND AWARDS

Scholarship

- Third Prize Scholarship (twice)

2023-2024

Contest

- Second Prize, National Campus AI Algorithm Elite Competition
- Third Prize, National RoboMaster Competition (twice)

Dec. 2023

2023-2024

SKILLS

- **Programming:** C/C++, Python, CUDA, Pytorch, OpenCV, Linux, ROS, Git
- **Language:** English (IELTS: 6.5), Mandarin (Native), Cantonese (Intermediate)