

# Jiachen Jiang

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## EDUCATION

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### The Ohio State University

Columbus, USA

*Degree: Ph.D in Computer Science Engineering; GPA: 4.00/4.00*

*Aug 2023 – May 2028*

- **Area:** Artificial Intelligence; Network Security; Graphics
- **Research Focus:** Advised by Prof. Zhihui Zhu on representational learning, low-dimensional models, LLMs, multimodal LLMs, and in-context learning.

### University of Michigan

Ann Arbor, USA

*Degree: Master in Electrical and Computer Engineering; GPA: 3.990/4.00*

*Sep 2020 – Apr 2022*

- **Area:** Signal Processing and Machine Learning;
- **Coursework:** Probability and Random Process; Computer Vision; Matrix Method for Signal Processing; Machine Learning; Image Processing; Optimization Method; Natural Language Processing; Computer Architecture

### Beihang University

Beijing, China

*Degree: Bachelor in Electrical Engineering; GPA: 3.793/4.00*

*Sep 2016 – Jun 2020*

- **Honors:** Second Prize in National Undergraduate Electronics Design Contest, 08/2019; First Prize in Beijing Integrated Circuit Design Competition, 06/2019; Group Silver Award of Youth Entrepreneurship Competition, 06/2018; Second Prize of Mathematical Modeling Competition, 05/2018; Third Prize of Fengru Cup Creative Thesis Competition, 09/2017

## INTERNSHIP

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### Microsoft Research, Applied Sciences Group

Redmond, USA

*Summer Research Intern*

*Jun 2024 – Sep 2024*

- Worked with Tianyu Ding on project about efficient all-in-one image restoration, including image denoising, dehazing, deraining, deblurring and light-enhancement.
- Implement a content-aware and task-aware all-in-one image restoration method that adaptively processes detailed areas using attention and plain areas using convolution.

### Institute of Automation, Chinese Academy of Sciences

Beijing, China

*Undergraduate Research Assistant*

*Jul 2019 – Sep 2019*

- Main research direction: Human Concentration level detection based on EEG signal; In charge of most of the programming tasks, including model building, model refinement, algorithm implementation, and debugging.
- Wrote the summary part in the patent writing and described the technical route of the algorithm.

## RESEARCH

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### Generalized Neural Collapse for a Large Number of Classes | ICML 24 | [Paper](#)

- This paper extends neural collapse theory to settings with high class counts—where the number of classes exceeds feature dimensions, as commonly seen in language modeling and face recognition. We introduce the softmax code concept and provide both empirical and theoretical evidence for its occurrence under specific conditions.

### Tracing Representation Progression: Analyzing and Enhancing Layer-Wise Similarity | ICLR 25 | [Paper](#)

- This paper demonstrates that simple sample-wise cosine similarity effectively captures layer-wise representation similarity in transformers, aligns with Centered Kernel Alignment (CKA), and explains saturation events. Based on these findings, we propose an aligned training method that enhances shallow layer effectiveness and enables efficient multi-exit models using a single classifier.

### Cat-AIR: Content and Task-Aware All-in-One Image Restoration | Under Review | [Paper](#)

- Cat-AIR, a novel all-in-one image restoration framework, leverages content- and task-aware attention alongside a smooth learning strategy to handle diverse degradations efficiently. This approach achieves state-of-the-art performance while reducing computational costs.

### Analyzing Fine-Grained Alignment and Enhancing Vision Understanding in Multimodal LLMs

- This work analyzes how projectors in multimodal LLMs compress and align visual embeddings with language. We find that current methods yield weak patch-level alignment, and propose a new patch-aligned training approach that significantly improves alignment. This enhancement boosts performance across captioning, grounding, and instruction-following tasks.

### **From Compression to Expansion: A Layerwise Analysis of In-Context Learning**

- This work uncovers a consistent Layerwise Compression-Expansion pattern in in-context learning (ICL), where early LLM layers compress task information and later layers expand it for prediction; the study shows this dynamic improves performance and robustness, and provides a theoretical bias-variance analysis explaining how attention enhances learning with more demonstrations.

## **PROJECTS**

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### **Hyperspectral Images Denoising via a Tensor Dictionary | [GitHub](#)**

- This project focuses on denoising hyperspectral images (HSIs) using MATLAB. HSIs, as 3rd order tensors, provide richer scene representations than RGB or grayscale images, improving computer vision task performance. Our approach uses a Tensor Dictionary Model that leverages nonlocal spatial similarity and global spectral correlation. We enhance patch clustering and optimization by introducing a sparse global dictionary representation, solving the resulting nonconvex Lagrange dual problem through iterative optimization.

### **Monitoring Social Distancing and Mask Wearing with Person Detection and Tracking | [GitHub](#)**

- A real-time COVID-19 safety monitoring system using computer vision and deep learning. The system tracks social distancing and mask wearing through video feeds. Key components include human detection, face detection, mask classification, and 6-feet social distance visualization using computer vision techniques like Mask-RCNN, homography transformation, and binary classification.

### **A City Search Engine Website Design Based on Flask | [GitHub](#)**

- A website using HTML and Python that displays the top 5 most populous cities for any selected country. Users can sort cities by population or distance from Ann Arbor, viewing data like WikiData ID, coordinates, population, and distance. Real-time tweets about each city are also displayed.

### **Racing on a Pre-Defined Map with Unknown Obstacles with PID Controller | [GitHub](#)**

- MATLAB project for bicycle control optimization. Two main tasks: 1) Design a controller to navigate a pre-defined track quickly, and 2) Develop an algorithm to avoid runtime obstacles. Focused on task 2, implementing modules for obstacle avoidance, reference trajectory generation, and PID control.

### **Dual Multi-head Co-Attention For Abstract Meaning Reading Comprehension | [GitHub](#)**

- A Natural Language Processing project for SemEval-2021 Task 4, a cloze-style task where systems select abstract concepts from five candidates to fill question placeholders. Using ELECTRA as our encoder with Dual Multi-head Co-Attention (DUMA) classifier, we achieved competitive results: 3rd place in task 1 and 5th place in task 2, with accuracies of 89.95% and 91.41% respectively.

### **A 3-way Superscalar Out-of-Order CPU with P6 style Register Renaming | [GitHub](#)**

- A 6-stage CPU design project in Verilog implementing P6-style register renaming. The pipeline includes: Fetch (3 instructions in-order), Dispatch (decode and register read), Issue (zero-dependency instructions from RS), Execute (3 ALUs, 3 multipliers), Complete (LSQ for memory operations), and Retire (ROB head to register file).

## **SKILLS**

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**Programming:** C, C++, Java, Python, MATLAB, MySQL, Html, Verilog

**Technologies:** Pytorch, Git, Linux, STM-32, Solidworks, Xilinx ISE

**Languages:** Chinese(Native), English (TOFEL:101, GRE: 320+3.5)