

AI Summer Camp – Week 5

Dates: Aug 24th – Aug 28st (Mon-Fri)

Instructor: Prof. Ping Chen, Department of Computer Science, University of Massachusetts Boston

Format: Hybrid — 2 in-person days (Mon & Fri) + 3 remote days (Tue–Thu)

5-Day AI Summer Camp for High School Students

From Curiosity to Creation: Build Your First AI Project & Research Portfolio

Program Structure

- Daily schedule:
 - **3-hour professor lecture** (concepts & big ideas)
 - **3-hour PhD-led lab** (hands-on building)
 - Final goal: A **complete AI project + research-style write-up + presentation**
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Program Outcomes (What Students Will Achieve)

By the end of the 5-day camp, each student will have:

1. A Portfolio-Ready AI Project

- A working project (interpretability, creative AI, chatbot, or classifier)
 - Demo (video, slides, or live)
 - Optional: GitHub repository
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2. A Research-Style Write-Up

Students will produce a structured document including:

- Research question
- Background/context
- Method/design
- Results and observations

- Reflection and limitations

This can be used for:

- College applications (activities & essays)
 - Research competitions (ISEF, Regeneron STS, etc.)
 - Future research opportunities
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3. A Beginner-Friendly Research Framework

Students will learn how to:

- Ask strong, original questions
 - Search and evaluate information
 - Design simple experiments
 - Interpret results logically
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4. Communication & Presentation Skills

- Present technical ideas clearly
 - Tell a compelling project story
 - Build a strong academic narrative
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DAY 1 — What is Intelligence? + How to Do Research (Beginner-Friendly)

Learning Objectives

- Understand what AI is (and isn't)
 - Compare human vs machine intelligence
 - Learn how to think like a researcher from scratch
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Special Session: How to Do Research (Designed for Beginners)

“From Zero to One: How to Start Research”

This session is designed specifically for students with no prior research experience.

Using stories, real-world examples, and guided exercises, students will learn:

- What research really is (not complexity, but asking meaningful questions)
- How to observe the world and turn curiosity into questions
 - Example: Why do AI models hallucinate?
 - Why do models show bias?
- How to formulate a strong research question
- How to find and use resources (intro-level paper reading & search strategies)
- How to design a simple experiment
- How to analyze results and draw conclusions

By the end of this session, each student will:

- Develop **one original AI-related research question**
- Use it as the foundation for their final project

Mini-Lectures

- What is Intelligence?
- How neural networks learn
- Word embeddings as “vibes in math space”
- Why large models feel intelligent (patterns vs true understanding)

Hands-On Lab

- **Embedding Playground**
 - Explore analogies like: “king - man + woman = ?”
- **Build a Tiny Neural Network**
 - Visual or beginner-friendly Python demo
- **Vibe Classifier**

- Classify text (e.g., happy, academic, chaotic)
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Day 1 Deliverable

- A clearly defined **research question**
 - Initial idea for final project
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DAY 2 — Inside the Black Box: Mechanistic Interpretability

Learning Objectives

- Understand transformers and attention intuitively
 - Learn what “features” and “circuits” are
 - Explore how we interpret model behavior
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Mini-Lectures

- How transformers process text
 - Attention heads as circuits (copying, matching patterns)
 - Neuron activations and features
 - The “grokking” phenomenon
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Hands-On Lab

- **Attention Heatmap Visualization**
 - **Neuron Exploration**
 - Investigate what activates specific neurons
 - **Tiny Transformer Demo**
 - Interpret layers on a toy task
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Day 2 Deliverable

- Add an **interpretability component** to project (e.g., explaining how the model makes decisions)
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DAY 3 — Consciousness, Minds & Theories of Thought

Learning Objectives

- Explore major theories of consciousness
 - Compare AI representations with human cognition
 - Understand limitations of current AI systems
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Mini-Lectures

- Global Workspace Theory
 - Integrated Information Theory
 - Representation vs experience
 - Can machines be conscious?
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Hands-On Lab

- **Chinese Room Simulation**
 - **Concept Embedding Exploration**
 - **Self-Awareness Tests**
 - Prompt-based experiments
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Day 3 Deliverable

- Add a **conceptual or philosophical dimension** to the project (useful for essays and interviews)
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DAY 4 — Vibes, Aesthetics & Creative AI

Learning Objectives

- Understand generative AI (text and images)
 - Explore latent space and style
 - Create meaningful AI-generated artifacts
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Mini-Lectures

- Latent space as a “vibe landscape”
 - Style transfer techniques
 - Ethics and safety in generative AI
 - Multi-agent creativity systems
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Hands-On Lab

- **Image Style Mixing**
 - **Text “Vibe Transfer”**
 - **Multi-Agent Story Creation**
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Day 4 Deliverable

- Build the **core output** of the final project (visual, narrative, or interactive)
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DAY 5 — Build, Polish & Present

Learning Objectives

- Finalize and refine project
 - Learn how to present like a researcher
 - Understand responsible AI development
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Mini-Lectures

- AI alignment basics
 - Evaluating AI behavior
 - How to present technical + creative work
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Final Project Options

Interpretability Project

- Visualize attention or embeddings
- Explain how a model solves a task

Creative AI Project

- AI-generated storybook or art portfolio
- Custom “vibe” classifier

Philosophy Project

- Design a consciousness test
- Explain a thought experiment using AI

Mini Application

- Chatbot persona
 - Simple retrieval (RAG) system
 - Mood/topic classifier
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Final Presentations

- Focus on:
 - Clarity
 - Creativity
 - Insight
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Final Showcase

- Mini expo for parents, peers, or other students
 - Demo + poster-style presentations
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Why This Program Strengthens College Applications

Students leave with **three strong advantages**:

1. Demonstrated Initiative

- Developed an original research question
 - Completed a self-directed project
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2. Technical + Creative Portfolio

- A tangible AI project (beyond standard coursework)
 - Evidence of interdisciplinary thinking
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3. Strong Personal Narrative

Students can write compelling essays about:

- Discovering how AI “thinks”
 - Investigating model limitations
 - Building and reflecting on their own system
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Optional Enhancements

- GitHub & portfolio-building workshop
- “How to email professors” session
- Overview of research competitions (ISEF, Regeneron, etc.)