Sungheon Jeong

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Research Interests

AI agent, Multimodal large language model and hallucination, Multimodal Learning, Geometrical analysis, Probabilistic theory.

Education

Ph.D. UC Irvine
2023 – 2027 (Expected)
GPA: 3.82 / 4.0
Advisor: Mohsen Imani

Master UC Irvine
2023 – 2025
GPA: 3.82 / 4.0
Advisor: Mohsen Imani

B.S. Pusan National University
2016 – 2022
GPA: 3.58 / 4.0
Advisor: Youngin Kim

Publications

- *Draft and Refine with Visual Experts.* **CVPR 2026 Highlight**. [Paper] [Link] [Code]
- *Understanding the Visual Projection Space of Multimodal LLMs.* **WACV 2026**. [Paper]
- *Cross-Modal Event Encoder: Bridging Image–Text Knowledge to ...* **WACV 2026**. [Paper] [Code]
- *Exploiting Boosting in Hyperdimensional Computing for Enhanced ..* **DATE 2025**. [Paper]
- *State-Centric Decision Process.* (Under Review) [Paper]
- *Internal Flow Signatures for Self-Checking and Refinement in LLMs.* (Under Review) [Paper] [Code]
- *Uncertainty-Weighted Image-Event Multimodal Fusion for Video Anomaly Detection.* (Under Review) [Paper] [Code]

Research Experience

Graduate Researcher @ UC Irvine 2023–Present

- **State-Centric Decision Process for Language Agents** *Under Review*
  Proposed a decision-making framework that replaces MDPs for LLM agents by shifting the unit of planning from actions to states, reformulating execution around state proposal, action realization, and observation validation. Demonstrated that this inversion eliminates the need for an explicit transition kernel in open-ended language environments and naturally decomposes agent failures into interpretable error modes.
- **Hallucination Refinement via Geometric Flow Signatures** *Under Review*
  Formulated depth-wise geometric flow diagnostics to analyze internal decision trajectories of transformers, enabling targeted refinement of hallucinated reasoning in large language models. Implemented probing metrics over multi-layer representations and validated across multiple LLM families.
- **Training-Free Multimodal Agent with Visual Experts** *CVPR 2026 Highlight*
  Designed a training-free LVLM agent that quantifies question-specific visual dependence via relevance-guided masking and dynamically routes to expert visual tools, reducing hallucinations without fine-tuning large foundation models.
- **Uncertainty-Weighted Image–Event Fusion** *Under Review*
  Developed a probabilistic multimodal fusion framework with heavy-tailed noise modeling and temporal state updates, improving robustness of weakly supervised video anomaly detection under distribution shifts.
- **Event-CLIP: Cross-Modal Event Encoding** *WACV 2026*
  Architected an event encoder aligned with CLIP embedding space using distribution alignment losses, enabling zero-shot recognition and retrieval across image, text, and event modalities.
- **Industry Collaboration – NXP Semiconductors** (2022–2024)
  Co-developed resource-efficient perception systems for embedded platforms, focusing on model compression and hardware-aware optimization under strict memory and latency constraints. [IEEE]

Sejong Fellowship Researcher (National Research Foundation of Korea) 2022–2024
Investigated multimodal AI systems integrating vision and EEG signals for assistive technologies. [Springer]

Researcher @ Semyung University 2022–2023

- **Representation-Aware Vision Architecture Design** IEEE Access
  Designed vision architectures informed by analytic properties of latent vector spaces, leveraging geometric and statistical structure to guide model construction. [IEEE]
- **Geometry of Vision–Language Projection Spaces** *WACV 2026*
  Proposed latent–token alignment and intrinsic dimensionality metrics to characterize cross-modal coupling in frozen multimodal LLMs, providing quantitative diagnostics of representation reliability.

Researcher @ KAIST 2022–2023

- **Multi-Agent Reinforcement Learning for Social Cooperation and Competition**
  Studied emergent cooperative and competitive behaviors in multi-agent reinforcement learning environments, analyzing equilibrium dynamics and strategy adaptation under social interaction settings.
- **Energy-Based Out-of-Distribution Detection**
  Investigated energy-based modeling for reliable OOD detection, improving robustness of deep neural networks under distribution shifts.

Technical Skills

Programming: Python, Bash
ML / DL Frameworks: PyTorch, TensorFlow, PyTorch Lightning, HuggingFace, OpenMMLab
Tools & Infrastructure: Vim, Git, Docker, Linux, CUDA, tmux, Weights & Biases, Hydra, pytest