

Joongwon Chae

Master's Student Researcher · Training-Free Anomaly Detection · Memory-Augmented Inference · Medical AI

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RESEARCH INTERESTS

I develop training-free visual systems around a central question: which reference evidence should a frozen model retain, route, and trust? My work spans memory composition, projection-consistent selection, continual routing, and retrieval-to-prompt segmentation.

EDUCATION

Tsinghua University - Shenzhen International Graduate School (SIGS) 2024-2027 (expected)
M.S. in Electronic Information (Biomedical Engineering), Institute of Biopharmaceutical and Health Engineering · Advisors: Peiwu Qin and Runming Wang · Shenzhen, China

Shanghai Jiao Tong University (SJTU) - Department of Automation 2018-2024
B.S. in Automation · Shanghai, China

RESEARCH EXPERIENCE

Master's Student Researcher - Tsinghua University (SIGS) 2024-present
Leading method development under the supervision of Peiwu Qin and Runming Wang.

- **BoundarySupport.** I showed that clean images miss useful near-defect normal states and introduced a clean-only altered-context intervention for fixed-budget memory and reconstruction. Near-defect normal patches raised MVTEC P-AP from 73.34 to 76.95, with a two-cell band recovering 94.70% of the gain; P-AP improved in all six settings across three paired seeds.
- **CLEANCON.** I introduced an out-of-bag cross-image support gate that scores each image from the top 0.5% of soft-projection patch residuals while holding the encoder, memory budget, builder, and inference fixed. At a 1% budget, Global FF amplified sparse contamination by 16.04 to 40.61 times; CLEANCON drove memory contamination to approximately zero and improved macro P-AP in all 12 matched comparisons.
- **ProCon, GCR, and Memory-SAM.** I developed soft-projection residuals with bank and depth consensus, 32-patch nearest-prototype routing, and foreground-minus-background DINOv3 contrast that selects three SAM2 prompts. Memory-SAM also releases 2,155 de-identified image-mask pairs; earlier versions averaged 24/28 at ICASSP 2026 and 4.0/5.0 at MICCAI 2026.

Clinical ML study - gallbladder-cancer T-staging 2024-2025
First-authored the Frontiers in Oncology study; designed classical ML baselines, SMOTE analysis, AUROC evaluation, and 1,000-sample bootstrap confidence intervals across 232 patients.

Multimodal medical-AI systems (TCM) - co-first author 2024
Co-led ViTCM-LLM and MMIR-TCM; co-developed MedTCM, designed the TDEU evaluation metric, and contributed retrieval-augmented reasoning and safety constraints.

PEER-REVIEWED PUBLICATIONS

1. **Joongwon Chae**, Zhenyu Wang, Duanpo Wu, Lian Zhang, Alexander Tuzikov, Magrupov Talat Madiyevich, Min Xu, Dongmei Yu, Peiwu Qin. "Pre-operative T-stage discrimination in gallbladder cancer using machine learning and DeepSeek-R1." *Frontiers in Oncology*, 15, Article 1613462, 2025. [link](#)
2. Lihui Luo*, **Joongwon Chae***, Yang Liu, Igor Pantic, Vladan Devedzic, Zhumei Sun, Zelin Zeng, Sanatbek Matlatipov, Xiaoming Yin, Peiwu Qin. "ViTCM-LLM: A Multimodal RAG Framework for Advanced TCM Clinical Decision Support." *2025 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*, pp. 3894-3899. (* Equal contribution) [link](#) / [code](#)

PREPRINTS & MANUSCRIPTS

3. **Joongwon Chae**, Runming Wang, Peiwu Qin. "What Remains Normal? Clean Images Miss Useful Near-Defect Normal Patches for Anomaly Detection." *Under review at ICLR; arXiv:2608.23299 [cs.CV], 2026. [link](#) / [code](#)*
4. **Joongwon Chae**, Runming Wang, Peiwu Qin. "What Memory Composition Does Not Tell Us About Anomaly Detection." *Under review at ICLR; arXiv:2608.23295 [cs.CV], 2026. [link](#) / [code](#)*
5. **Joongwon Chae**, Lihui Luo, Yang Liu, Dongmei Yu, Peiwu Qin, Runming Wang, Ilmoon Chae. "ProCon: Projection-Consistency Memory for Training-Free Anomaly Detection." *Under review; arXiv:2607.04894 [cs.CV], 2026. [link](#) / [code](#)*
6. **Joongwon Chae**, Lihui Luo, Yang Liu, Runming Wang, Dongmei Yu, Zeming Liang, Xi Yuan, Dayan Zhang, Zhenglin Chen, Peiwu Qin, Ilmoon Chae. "GCR: Geometry-Consistent Routing for Task-Agnostic Continual Anomaly Detection." *Under review; arXiv:2601.01856 [cs.CV], 2026. [link](#) / [code](#)*
7. **Joongwon Chae**, Lihui Luo, Yang Liu, Runming Wang, Dongmei Yu, Zeming Liang, Xi Yuan, Dayan Zhang, Zhenglin Chen, Peiwu Qin, Ilmoon Chae. "StructCore: Structure-Aware Image-Level Scoring for Training-Free Unsupervised Anomaly Detection." *Under review at WACV; arXiv:2602.17048 [cs.CV], 2026. [link](#) / [code](#)*
8. **Joongwon Chae**, Lihui Luo, Yang Liu, Xi Yuan, Dongmei Yu, Zhenglin Chen, Runming Wang, Ilmoon Chae, Lian Zhang, Peiwu Qin. "Memory-SAM: Human-Prompt-Free Tongue Segmentation via Retrieval-to-Prompt." *Under review at AAAI 2027; arXiv:2510.15849 [cs.CV], 2025. [link](#) / [code](#)*
9. Lihui Luo, **Joongwon Chae**, Ziyang Chen, Yang Liu, Siyi Cheng, Weihang Gao, Zelin Zeng, Xiaoming Yin, Samaneh Beheshti Kashi, Dongmei Yu, Lian Zhang, Jing Sui, Zeming Liang, Jiansong Ji, Peter E. Lobie, Peiwu Qin. "MMIR-TCM: Memory-Integrated Multimodal Inference and Retrieval for TCM Clinical Decision Support." *Major revision at IEEE JBHI; arXiv:2607.01814 [cs.AI], 2026. [link](#)*
10. **Joongwon Chae**, Runming Wang, Chen Xiong, Gong Yunhan, Lian Zhang, Ji Jiansong, Dongmei Yu, Peiwu Qin. "Auditable Context-Aware HFMD Forecasting with Structured LLM Agents." *Under review at IEEE BIBM; arXiv:2511.23276 [cs.LG, cs.MA], 2025. [link](#)*
11. Lihui Luo*, **Joongwon Chae***. "ViGen: Video-based Generation with GRPO for Dynamic Image Editing." *Under review at AAAI, 2026. (* Co-first author)*

HONORS & SCHOLARSHIPS

- **Excellent Student Scholarship, First Class** (International Students), Tsinghua University, 2024
- **Yingcai First-Class Scholarship**, Institute of Biopharmaceutical and Health Engineering, Tsinghua University, 2025
- **Tsinghua University International Graduate Tuition Scholarship**, 2025-2026
- **Shenzhen Universiade International Scholarship Foundation Scholarship**, 2026

INDUSTRY RESEARCH EXPERIENCE

Ratel Soft - Research Intern

Jul 2025-present

Developed vision anomaly-detection pipelines for collaborative-robot assembly-line inspection, benchmarking frozen foundation-model features against task-specific baselines and building PyTorch data-processing and evaluation tools. Performed on-site robot teaching and achieved over 99% assembly accuracy with vision-guided positioning error below 0.1 mm. The resulting algorithm was commercialized through a RMB 150,000 sale. Also provided Chinese-Korean simultaneous interpretation for dozens of online technical meetings and two on-site assignments at a Visionox (维信诺) assembly line in China.

TECHNICAL SKILLS

- **Programming:** Python, PyTorch, scikit-learn, OpenCV
- **Foundation models:** DINOv2/v3, SAM/SAM2, CLIP; Hugging Face Transformers, PEFT/LoRA, LLaMA-Factory
- **Systems:** Docker, DeepSpeed, multi-GPU training, RAG pipelines, industrial machine-vision cameras

LANGUAGES

Korean (native) · English (IELTS 6.5) · Chinese (HSK 6) · Japanese (JLPT N2)