Sungrae Hong

Ph.D. Candidate, Graduate School of Data Science, KAIST
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Research Interests

Medical image analysis, multiple instance learning (MIL) for computational pathology, uncertainty calibration and selective prediction, trustworthy AI, and LLMs for medical findings and report generation.

Education

Korea Advanced Institute of Science and Technology (KAIST) — Daejeon, South Korea
Ph.D. Candidate, Graduate School of Data Science (GSDS) | Advisor: Prof. Mun Yong Yi — *Sep. 2023 – Present*

Korea Advanced Institute of Science and Technology (KAIST) — Daejeon, South Korea
M.S., Graduate School of Data Science (GSDS) | Advisor: Prof. Mun Yong Yi — *Sep. 2021 – Aug. 2023*

Seoul National University of Science and Technology (SeoulTech) — Seoul, South Korea
B.S., Industrial Engineering — *Mar. 2015 – Aug. 2021*

Publications

*Equal contribution †Corresponding author

International Conferences

[C1] **Every Error has Its Magnitude: Asymmetric Mistake Severity Training for Multiclass Multiple Instance Learning**
Sungrae Hong, Jiwon Jeong, Jisu Shin, Donghee Han, Sol Lee, Kyungeun Kim, Mun Yong Yi†
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2026 | [Paper] [arXiv]

[C2] **RaLMPH: Reliability-aware Learning for Multi-Pathologist Harmonization in Whole-Slide Image Classification**
Sungrae Hong, Jiwon Jeong, Soeun Cheon, Donghee Han, Sol Lee, Jisu Shin, Kyungeun Kim, Mun Yong Yi†
Medical Image Computing and Computer Assisted Intervention (MICCAI), 2026 | [Paper] [arXiv]

[C3] **DiagMIL: Uncertainty-Gated Coarse-to-Fine Multi-Resolution MIL for WSI Diagnosis**
Jiwon Jeong, **Sungrae Hong**, Donghee Han, Jisu Shin, Kyungeun Kim, Mun Yong Yi†
Medical Image Computing and Computer Assisted Intervention (MICCAI), 2026 | **Early Accept** (top 9% of 4,601 submissions) [Paper]

[C4] **Missing Modality-Aware Calibration for Trustworthy Brain Tumor Segmentation**
Sol Lee, Hyeonji Kim, **Sungrae Hong**, Donghee Han, Mun Yong Yi†
Medical Image Computing and Computer Assisted Intervention (MICCAI), 2026 | **Early Accept** (top 9% of 4,601 submissions) [Paper] [arXiv]

[C5] **Reasoning Trace Divergence: An Empirical Signal for Trustworthy Black-Box MLLMs in Histopathology Classification**
Anastasiia Kazmina, Constantin Venhoff, Bryan Wong, **Sungrae Hong**, Yutong Xie, Mun Yong Yi†
Medical Image Computing and Computer Assisted Intervention (MICCAI), 2026 | [Paper]

[C6] **Diagnose Like A REAL Pathologist: An Uncertainty-Focused Approach for Trustworthy Multi-Resolution Multiple Instance Learning**
Sungrae Hong, Sol Lee, Jisu Shin, Jiwon Jeong, Mun Yong Yi†
IEEE/CVF Winter Conference on Applications of Computer Vision (WACV), 2026 | [Paper] [arXiv]

[C7] **SAFE: A Plug-and-Play Framework for Prompt Optimization in Text-to-Image Safety**
Jisu Shin, Sol Lee, **Sungrae Hong**, A Young Kim, Mun Yong Yi†
Conference on Empirical Methods in Natural Language Processing (EMNLP), Main Conference, 2026 | [Paper]

[C8] **Every Preference Has Its Strength: Injecting Ordinal Semantics into LLM-Based Recommenders**
Jiwon Jeong, Donghee Han, **Sungrae Hong**, Woosung Kang, Mun Yong Yi†
ACM SIGIR Conference on Research and Development in Information Retrieval (SIGIR), 2026 | [Paper] [arXiv]

[C9] **Towards Classifying Histopathological Microscope Images as Time Series Data**
Sungrae Hong, Hyeongmin Park, Youngsin Ko, Sol Lee, Bryan Wong, Mun Yong Yi†
IEEE International Symposium on Biomedical Imaging (ISBI), 2025 | [Paper] [arXiv]

[C10] **Rethinking Pre-Trained Feature Extractor Selection in Multiple Instance Learning for Whole Slide Image Classification**
Bryan Wong, **Sungrae Hong**, Mun Yong Yi†
IEEE International Symposium on Biomedical Imaging (ISBI), 2025 | [Paper] [arXiv]

[C11] **Uncertainty-based Data-wise Label Smoothing for Calibrating Multiple Instance Learning in Histopathology Image Classification**
Hyeongmin Park, **Sungrae Hong**, Chanjae Song, Jongwoo Kim, Mun Yong Yi†
IEEE/CVF Winter Conference on Applications of Computer Vision (WACV), 2025 | **Oral** [Paper]

International Journals

[J1] **Sample-Centric Adversarial Masking for Robust Multimodal Learning under Missing Modalities**
Sol Lee, **Sungrae Hong**, Chanjae Song, Jisu Shin, Jiwon Jeong, Mun Yong Yi†
Neurocomputing, 2026 (IF: 6.7) | [Paper]

[J2] **Beyond Creative Generation: A Deep Generative Framework for High-Fidelity Pseudo-Virtual Prototyping and Design Evaluation**
Sol Lee, **Sungrae Hong**, Jisu Shin, Mun Yong Yi†
Journal of Intelligent Manufacturing, 2026 (IF: 7.4) | [Paper]

International Workshops

[W1] **DRCoD: Toward Robust Continual Learning of Diffusion Models for Tire Manufacturing Prototyping**
Jisu Shin, Sol Lee, **Sungrae Hong**, A Young Kim, Youngbin You, Jeongheon Park, Jungsoo Oh, Mun Yong Yi†
CVPR Workshop on Vision Intelligence for Real-world Challenges (AI4RWC), 2026 | [Paper]

[W2] **Priority-Aware Clinical Pathology Hierarchy Training for Multiple Instance Learning**
Sungrae Hong, Kyungeun Kim, Juhyeon Kim, Sol Lee, Jisu Shin, Chanjae Song, Mun Yong Yi†
MICCAI Student Board (MSB) EMERGE Workshop, 2025 | **Oral, Best Paper Award** [Paper] [arXiv]

[W3] **TireDiff: A Framework for Conditional Tire Footprint Images Generation from Manufacturing Tabular Data**
Sol Lee, Jisu Shin, **Sungrae Hong**, Chanjae Song, Youngbin Yoo, Jeongheon Park, Jungsoo Oh, Mun Yong Yi†
AAAI Workshop on AI to Accelerate Science and Engineering (AI2ASE), 2025 | [Paper]

Preprints

[P1] **CP-Dilatation: A Copy-and-Paste Augmentation Method for Preserving the Boundary Context Information of Histopathology Images**
Sungrae Hong, Sol Lee, Mun Yong Yi†
arXiv, 2023

Domestic Conferences (Korea)

[D1] **Calibrating MIL in Histopathology with Uncertainty-Aware Label Smoothing via Evidential Learning**
Juheon Kim*, **Sungrae Hong***, Chanjae Song, Mun Yong Yi†
Korea Computer Congress (KCC), 2025

[D2] **Metadata-Aware Multimodal MIL with Reliable Calibration for Histopathology Diagnosis**
Chanjae Song, **Sungrae Hong**, Junheon Kim, Minkyu Jeong, Mun Yong Yi†
Korea Computer Congress (KCC), 2025 | **Best Presentation Award**

[D3] **Sensitivity-Aware Fine-Tuning: Enhancing Parameter Importance with Hessian Connections**
Nahyeon Lee, Sol Lee, **Sungrae Hong**, Mun Yong Yi†
Korea Artificial Intelligence Association (KAIA) Conference, 2024

[D4] **Image Augmentation Based Self-supervised Learning for Music Genre Classification**
Hyeongmin Park, **Sungrae Hong**, Sol Lee, Taemi Kim, Mun Yong Yi†
Korea Computer Congress (KCC), 2024

[D5] **MATE: The Multimodal Model Using Audio and Text for Emotion Recognition**
Sungrae Hong, Taemi Kim, Sol Lee, Jongwoo Kim, Mun Yong Yi†
Korea Computer Congress (KCC), 2022 | **Oral, MSIT Minister's Award** [Paper]

[D6] **A Simple Cut Augmentation for Medical Pathology Image**
Sungrae Hong, Taemi Kim, Sol Lee, Mujin Kim, Bumho Lee, Youngsin Ko, Yumi Choi, Mun Yong Yi†
Korean Institute of Industrial Engineers (KIIE) Conference, 2022

[D7] **Weakly Supervised Segmentation of Histopathology Images (in Korean)**
Taemi Kim, **Sungrae Hong**, Sol Lee, Mujin Kim, Bumho Lee, Youngsin Ko, Yumi Choi, Mun Yong Yi†
Korean Institute of Industrial Engineers (KIIE) Conference, 2022 | **Oral**

Research Experience

Graduate Researcher & Project Manager Sep. 2021 – Present
Knowledge System Lab, GSDS / ISE, KAIST (Advisor: Prof. Mun Yong Yi) *Daejeon, South Korea*
- Led three consecutive industry projects with Seegene Medical Foundation as project manager, translating clinical requirements into technical specifications
- Multiple instance learning for multi-class and multi-resolution whole-slide images, mistake-severity-aware training, and decision making under uncertainty
- Currently extending the line of work to LLM-based automated interpretation of comprehensive blood tests

Undergraduate Research Assistant Jul. 2020 – Jul. 2021
Data Intelligence Lab, IE, SeoulTech (Advisor: Prof. Sangheum Hwang) *Seoul, South Korea*
- Time-series modeling and anomaly detection for IoT sensor streams in industrial safety monitoring

Research Projects

LLM-Based Automated Interpretation System for Comprehensive Blood Tests 2026 – 2028
Seegene Medical Foundation | Developer & Project Manager
- Transitioning a complex rule-based diagnostic system into an LLM-based one that generates interpretation reports
- Keeping generated findings faithful to the underlying lab values

Multimodal AI-Based CAD System for Gastrointestinal Endoscopic Biopsies Mar. 2024 – Mar. 2026
Seegene Medical Foundation | Developer & Project Manager
- Led the full project lifecycle for a WSI-based diagnostic model targeting non-malignant colon biopsies
- Built the large-scale WSI pre-processing pipeline, priority-aware diagnosis, and rejection of uncertain predictions
- Resulted in publications at CVPR 2026, WACV 2026, MICCAI 2026, and MICCAI Workshop 2025 (Best Paper)

Next-Generation Medical Diagnosis System Based on AI Jul. 2021 – Feb. 2024
Seegene Medical Foundation | Project Manager & Lead Developer (follow-up study)
- Benign vs. dysplasia classification of gastric and colorectal biopsies on gigapixel WSIs
- Led the microscopy diagnosis team; modeled pathologists' microscope observations as time series with a DTW-based distance (ISBI 2025)
- The developed solution is deployed in clinical settings to cross-verify pathologists' diagnoses

IoT-Based Safety Monitoring Model for Subminiature Sensors Jul. 2020 – Jul. 2021
IITP | Research Assistant
- Deep learning-based early fire detection from time-series sensor streams

Awards & Honors

CVPR 2026 Outstanding Reviewer – *Top 5% among 17,491 reviewers* 2026

Best Paper Award, MICCAI Student Board (MSB) EMERGE Workshop – *NVIDIA DGX Spark awarded as supplementary prize* 2025

Excellent Prize, KAIST ISE Research Day 2024, 2025

Special Award (GenesisLab), Military AI Competition (MAICON) 2023

MSIT Minister's Award, ETRI Human Understanding AI Paper Competition 2022

Best Prize (2nd), KAIST IE Research Day 2022

Grand Prize, SeoulTech IE Capstone Design Competition 2020

Scholarships

Academic Excellence Scholarship, SeoulTech – *GPA 4.5/4.5* 2021

Academic Excellence Scholarship, SeoulTech – *GPA 4.37/4.5* 2020

Academic Scholarship, SeoulTech (two semesters) – *GPA 4.0/4.5, 4.11/4.5* 2019

Betterment in Ability Scholarship, SeoulTech – *Merit-based* 2019

Admission with Highest Distinction, SeoulTech – *Full tuition* 2015

Academic Service & Activities

Conference Reviewer – *CVPR (Outstanding Reviewer), MICCAI, ECCV, NeurIPS* 2026

AI Solution Mentor, KAIST OverEdge Startup Program – *Advising two founders on building AI into their products* 2026

Teaching Assistant, DS545 Business Intelligence – *KAIST GSDS* 2023

Teaching Assistant, Hankook Tire AI Education – *KAIST IE* 2023

Military Service

Republic of Korea Army, III Corps – *Inje, Gangwon Province* Aug. 2016 – May 2018