Joonwoo Kwon

Website

Research Scientist
at Seoul National University (SNU)

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Research Interests

Computer Vision, Multimodal Understanding, and Generative AI

I am interested in developing foundation models that leverage multimodal data while capturing their physical and semantic representations. My research specifically focuses on AI-driven multimedia creation that adapts dynamically to user needs and contexts.

Summary of Qualifications

- **Expertise in developing generative AI models for multimodal data, including images, video, text, and audio,** across various application domains such as art, advertising, healthcare, and the semiconductor industry.
- Co-first author of seven publications, including a paper accepted at AAAI-2024 (23.75% acceptance rate)
- Extensive experience in leading interdisciplinary projects and collaborating with global institutions, including Brookhaven National Laboratory and Samsung Advanced Institute of Technology.

Education

03/2021 – 02/2023
Seoul, South Korea

Seoul National University (SNU)
M.S. in Applied Bioengineering GPA: 3.88 / 4.0 **(Top 3%)**
Thesis: Improving the Stylization Quality of Neural Style Transfer using Octave Convolution

03/2015 – 02/2021
Suwon, South Korea

SungKyunKwan University (SKKU)
B.S. in Electronic and Electrical Engineering GPA: 3.75 / 4.5 (3.585 / 4.0 | **Top 8%)**
Senior Capstone: An Appreciation Aid Tool for the Visually Impaired via Synesthetic Perception

Research Experience

02/2023 – Present
Seoul, South Korea

SNU Connectome Lab (Advisor: Prof. Jiook Cha)
Research Associate | Neuroscience & Generative Modeling

- Developed a new neural style transfer method **(C1)** for aesthetic-aware stylization.
- Designed an image-to-image translation model **(P1)** for cross-modal MRI synthesis.
- Proposed a novel generation task, dataset, and a multimodal framework **(C2)** for reconstructing video with music contextualized by human affect from brain signals.

02/2023 – Present
Upton, NY (Remote)

Brookhaven National Lab (Advisor: Prof. Shinjae Yoo, Prof. Yuewei Lin)
Research Associate | Computer Vision & Multimodal Learning

- Developed a training-free approach for music style transfer **(P2)** by directly manipulating the self-attention features of pre-trained diffusion models.
- Designed viscosity-aware style optimization and brushstroke parameterization **(P3)** to emulate the physical and textural properties of oil painting and watercolor.
- Proposed a brain-to-text generation model **(P4)** and showed its versatility (e.g., composable brain decoding), inspired by how the brain perceives the visual world.

03/2022 – 06/2022
Seoul, South Korea

Samsung Advanced Institute of Technology (SAIT) (Research Capstone)
Student Researcher | Image-to-image translation, Semiconductor, and 3D Depth

- Led research on an image-to-image translation model utilizing U-NET and PatchGAN to synthesize 3D depth maps from SEM imaging.

Professional Experience

01/2025
Upcoming

Hanhwa Systems Co., Ltd. (Aerospace and Defense)
Research Scientist (Full-time) | *Generative Modeling, Military Satellite Imaging (SAR)*

- Developed generative AI systems for satellite imaging and avionics device analysis.

10/2024 – 12/2024
Seoul, South Korea

Planningo Inc.
Research Engineer (Part-time; AI Research Partnership) | *Advertising Photography*

- Developed an image harmonization and relighting framework **(P5)** that resolves inconsistencies in lighting, textures, and color when combining advertising product photos with AI-generated backgrounds for commercial photography applications.

12/2019 – 02/2020 **ITECH Industrial Systems**
Suwon, South Korea *Software Developer Intern | Blockchain System, Smart Factory*

- Led a team of three developers to create a new blockchain management system that enhanced the transparency and validity of the cement transportation process.

Manuscript in Preparation

(* denotes equal contributions)

[P5]. An Instance-Adaptive Photorealistic Style Optimization for Relightful Image Harmonization
Kwon, J.*, Kim, S.*, Kim, S., Shin, J., Yoo, S., Lin, Y.†, & Cha, J. †

[P4]. Visual Attention Guidance Enables A Composable Brain-To-Text Decoding
Kim, S.*, **Kwon, J.***, Park, M.*, Seo, J., Ro, W., Yoo, S., Kim, S. †, Lin, Y. †, & Cha, J. †

[P3]. A Viscosity-guided Artistic Style Optimization via Brushstroke Parameterization
Kwon, J.*, Kim, S.*, Lee, S.*, Yoo, S., Lin, Y. †, & Cha, J.†

Publications

(† denotes corresponding author)

[P2]. A Training-Free Approach for Music Style Transfer with Latent Diffusion Models
Kim, S.*, **Kwon, J.***, Wang, H.*, Yoo, S.†, Lin, Y.†, & Cha, J.†
Preprint, 2024.

[P1]. Macro2Micro: Cross-modal Magnetic Resonance Imaging Synthesis Leveraging Multi-scale Brain Structures
Kim, S.*, **Kwon, J.***, Kwon, J.*, Bae S., Yoo, S.†, Lin, Y.†, & Cha, J.†
Preprint, 2024.

[C2]. Revisiting Your Memory: Reconstruction of Affect-Contextualized Memory via EEG-guided Audiovisual Generation
Kwon, J.*, Wang, H.*, Lee, J.*, Kim, S.*, Yoo, S., Lin, Y.,† & Cha, J.†
AAAI 2025 Workshop on Artificial Intelligence for Music (AI4Music)

[C1]. AesFA: An Aesthetic Feature-Aware Arbitrary Neural Style Transfer
Kwon, J.*, Kim, S.*, Yoo, S.†, Lin, Y.†, & Cha, J.†
AAAI 2024. Acceptance Rate: 23.75% (2342/12100).

Selected Projects

10/2024 **The Recollection of Your Most Cherished Experience Utilizing AI and Neural Signals**

- Proposed a multimodal AI framework for synthesizing personalized video with music using generative AI and neural signals (EEG).

09/2023 – Present **Affect-Contextualized Perception Decoding with Cross-Species Multiscale Neuroscience Foundation Model**

- Developed a composable brain-to-text/image model using brain signals (fMRI)

09/2020 – 12/2020 **An Appreciation Aid Tool for the Visually Impaired via Synesthetic Perception**

- Developed an Arduino-based tool for the visually impaired, converting object colors and brightness into musical notes to enable synesthetic perception.

Honors and Awards

2024 **The Grand Prize,** AI & Art Hackathon ($1,000 USD), AI Art Research Center, SNU
2020 **Academic Excellence Scholarship for Outstanding Research** (25% tuition), SKKU
2020 **Corporate Partner Scholarship** (75% tuition), SKKU, ITECH Industrial Systems
2018 **The 2nd Winner for the 9th Engineering Competition for Local Impact**, SKKU
2018 **Korean Patent** (Applied; Public Telephone Booth for Sightseeing)

Invited Talks Exhibition and Teaching

10/2024 **ART DIFFUSION**, Tech to Art Platform (TAP) Prequel, SNU Museum of Art
09/2024 **Invited Talks:** A Composable Brain Decoding, Annual Meetings on Brain Decoding, SNU
08/2018 – 12/2018 **Exchange Student Mentoring,** SKKU, (Electronic Circuits I; Introduction to Automatic Control)

Skills

Communications **English** (Fluent; TOEFL 110; R30 L29 S24 W27), **Korean** (Native)
Programming Python, PyTorch, TensorFlow, MATLAB
Others **Hardware Languages** Verilog (intermediate), VHDL (intermediate)