

Proposal

Digital Art Research : Algorithmic Textures Inspired by Korean Traditional Patterns

OVERVIEW

This project stems from my summer internship at Hypertriangle in Korea, where I developed an AI-based texture generator using ComfyUI—an AI node-based application that produces images or videos based on text prompts. Traditionally, 3D artists either photograph or hand-paint textures, taking hours. As part of the R&D team, I built AI generator workflows that create realistic texture maps in minutes, automating the process for faster production. However, I noticed the lack of cultural nuance in the generated outputs—an opportunity to engage AI not only as a tool of efficiency but also as a lens for cultural reinterpretation.

Following the internship, I participated in a study abroad program with the Information School in South Korea (Early Fall 2025), led by Professor Nam-ho Park, where I visited "Heritage: The Future Fantasy" at Dongdaemun Design Plaza.¹ The exhibition showcased Korea's national heritage through digital technology²—3D projections of Joseon-era royal protocols, reimagined Korean pagodas, and multimedia presentations of traditional craft techniques. This inspired me to reconsider traditional patterns not only as historical artifacts but also as living design languages being reintroduced for the digital age: bojagi patchwork in fashion,³ jagae patterns in modern furniture and accessories,⁴ and dancheong and saekdong patterns on building facades.⁵

Guiding my peers through Korean cultural sites, I observed my own heritage with new eyes: geometric precision and algorithmic logic handcrafted into deeply symbolic designs, encoded with cultural meaning. As an Informatics student at UW studying the intersection of people, technology, and data, I will investigate how generative AI reinterprets traditional patterns and how critical ethical questions rise around visual translation and authorship.

Centered on the question of what it means to translate Korean art and textures into a digital texture system, I will explore how AI can reframe and reimagine historical designs—bridging ancient patterns and modern rendering technologies rather than mechanically replicating styles. Hence, this research contributes to three interconnected research areas:

- Human-Computer Interaction (HCI) and Design Computing
- Digital Humanities and Cultural Computing
- AI and Creative Authorship Studies

By documenting which structural elements—geometric, color, and material logic—transfer effectively across different pattern categories, the comparative data will address questions of visual translation and computational modeling of cultural design systems. Beyond creating a usable texture library, this project will also produce an examination of authorship—the degree of human creative control throughout the preparation, execution, and finalization phases—in AI-generated cultural patterns (Fritz 354-364). Deliverables include a visual portfolio of texture maps and a research paper analyzing authorship questions and proposing an open-source licensing framework that recognizes shared cultural heritage while supporting contemporary creative use.

RESEARCH

I will use a systematic experimental design to collect image data for each pattern category. This requires both visual reference materials and scholarly literature to establish cultural context. I will review two key literature sources: Chung-sik Choi's 아름다운 우리 무늬 (*Our Beautiful Patterns Series*) and Gyu-seok Kim's 마음으로 새긴 우리 무늬 (*Our Patterns*

Carved in the Heart)—comprehensive documentations of traditional Korean patterns categorized by historical context and symbolic meanings (Choi; Kim). These authenticated examples will serve as reference standards for evaluating AI-generated outputs. During this phase, I will document technical workflows, prompts, model parameters, generated outputs, and qualitative assessments of cultural accuracy.

Timeline

Phase 1 (Nov - Dec): Pattern Documentation—Review scholarly sources for 4 pattern categories and curate reference dataset (100 images each), establish taxonomy, and set up technical infrastructure: ComfyUI workflows, Stable Diffusion, LoRA training pipeline

Phase 2 (Jan - Feb): Generation Experiments—Test 3 methods (prompt based, image conditioned, fine-tuned) across the curated dataset (40 outputs each)

Phase 3 (Mar-Apr): Evaluation & Refinement—Score outputs on structural fidelity, symbolic integrity, material logic, technical usability; conduct comparative analysis; convert top 20 outputs to PBR maps and test in Blender

Phase 4 (May): Synthesis & Presentation—Package texture library with metadata

Throughout my research, Professor Nam-ho Park, who led the study abroad program in South Korea, will provide mentorship through biweekly hour-long sessions aligned with project milestones. While I will independently lead the technical development (AI pipelines), mentorship will focus on research framing, methodology design, and critical reflection. Early meetings will consist of addressing systematic documentation approaches and discussing research challenges and evaluation criteria. Later sessions will shift to data analysis: identifying patterns in data and connecting findings to broader discussions about AI and authorship.

¹ DDP is a major Seoul cultural institution designed by Zaha Hadid, hosting exhibitions, and design events.

² "Heritage: The Future Fantasy" ran August 23-September 17, 2025, jointly organized by the Korea Heritage Service and Korea Heritage Agency. See "Digital Exhibition Showcasing Korea's Heritage to Open at DDP," The Korea Herald, 5 Aug. 2025, <https://www.koreaherald.com/article/10547337>.

³ Bojagi (보자기): Traditional Korean patchwork cloths with geometric patterns and symbolic color combinations.

⁴ Jagae (자개): Pearl inlay technique from the Goryeo Dynasty (918-1392), traditionally used on lacquerware.

⁵ Dancheong (단청): Multi-colored architectural painting following five-element color theory. Saekdong (색동): Rainbow-striped pattern in ceremonial textiles.

References

Choi, Chung-sik. Areumdaun Uri Munui [Our Beautiful Patterns Series]. Daewonsa, 2005.

Fritz, Johannes. "Understanding Authorship in Artificial Intelligence-Assisted Works." Journal of Intellectual Property Law & Practice, vol. 20, no. 5, May 2025, pp. 354-364, <https://doi.org/10.1093/jiplp/jpae119>.

Kim, Gyu-seok. Maeumeuro Saegin Uri Munui [Our Patterns Carved in the Heart]. Youlhwadang, 2008.

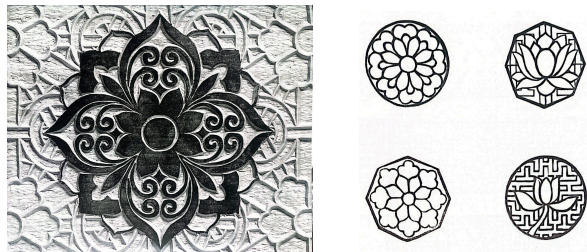


Figure 1 & 2 : Examples of traditional (woodwork) patterns that will be collected

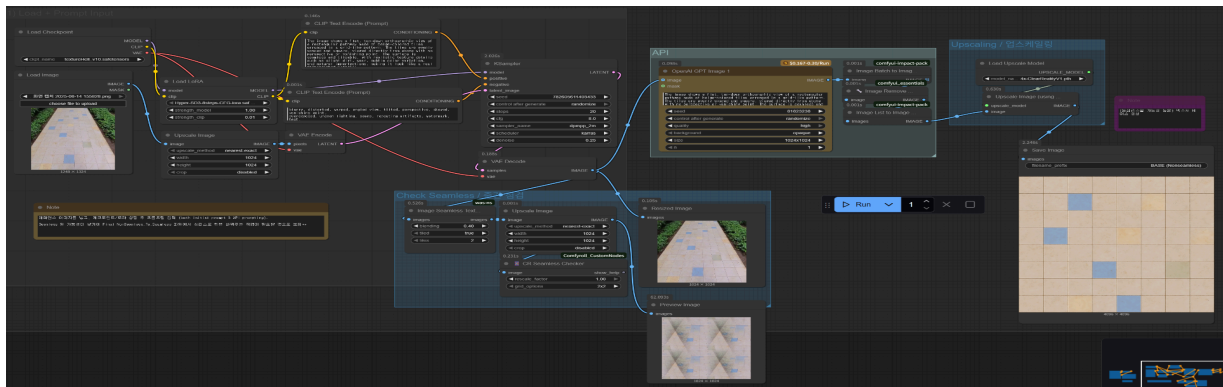


Figure 3: Sample Workflow Diagram: Reference Image → AI (API) Generation

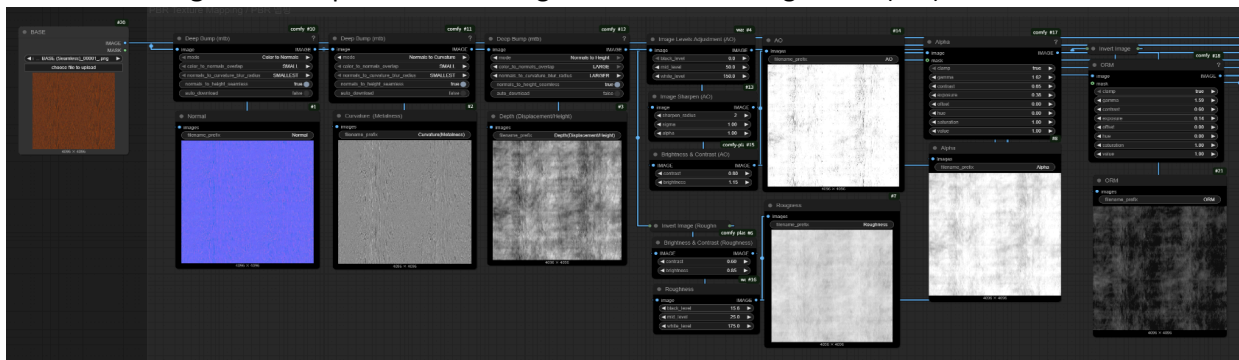


Figure 2: Sample Workflow Diagram: AI-Generated Image File → PBR Texture Mapping

References

Zhou, Mi, et al. "Bias in Generative AI." arXiv, 5 Mar. 2024, <https://arxiv.org/abs/2403.02726>

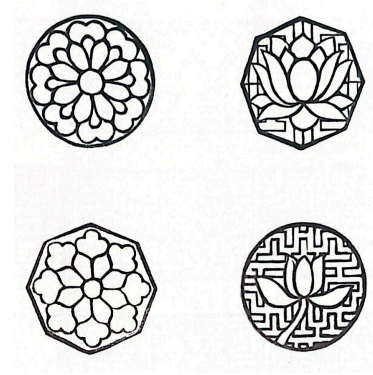


Figure 1 & 2 : Examples of traditional woodwork patterns demonstrating intentional geometric, asymmetrical design details

