

Research report

Solutions for texture projection

Problem analysis

The goal of the research phase is to explore potential solutions for the texture projection problem :

| a way to project a texture on a 3D model, given a 2D image of the texture and a 3D model of the object and then get the UV coordinates of the projection.

Two different scenarios are to be considered :

1. The LLM with input [obj and prompt describing the texture]) output a complete solution (e.g. UV coordinates + texture)
2. The LLM only outputs sides views of the texture and a separate module is responsible for projecting it on the 3D model

Scenario 1 is the one to focus on as it is a complete solution.

Research

1. Online research showed that solutions to scenario 1 exists since few years and are commercially available. For example, Scenario's Texture¹ is a web-app that can generate textures from images and apply them to 3D models. However, those web solutions are not open source nor free to use. Thus, researchs has been oriented toward a local solution that can be integrated in our pipeline.
2. A publication : TEXTure: Text-Guided Texturing of 3D Shapes² provide potential solution. The paper describes an iterative framework leveraging a pretrained depth-to-image diffusion model to synthesize, edit, and transfer high-fidelity 3D textures. This finding is promising thus to be explored.

TEXTure exploration

- An local analysis of the forked repo showed that possible outputs are fitting our need :
 1. `mesh.obj` : containing the 3D model of the object with the UV coordinates corresponding to the texture projection and a section with the UV coordinates of the projection.
 2. `albedo.png` : texture image
- Conducted tests showed that :
 1. The librairies used are poorly documented
 2. The [model used](#) is not anymore hosted on the given link in their GitHub repo.

Conclusion

Although TEXTure seemed like a promising solution, it's oldness (2023), lack of documentation (librairies) and unhosted model incline me to conclude against this solution.

¹<https://www.scenario.com/blog/ai-texture-generation>

²<https://texturepaper.github.io/TEXTurePaper/>

More recent and promising one's have been found by the GenAI team, thus closing this investigation.

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Resources consulted

Fundamentals

- [UV Mapping and Mesh Parameterization Concepts \(Wikipedia\)](#)

Implementation ideas

- [OpenGL Texture Mapping Architecture and Workflows \(StackOverflow\)](#)
- [Approaches to UV Texture Mapping Implementations in Python \(StackOverflow\)](#)
- [Algorithmic Generation of Texture Mapping Images \(StackOverflow\)](#)

Possible tools

- [xatlas: Open-source Mesh Parameterization and UV Unwrapping Library \(GitHub\)](#)