

Title: Reverse Weathering

Masters or Engineering Internship (6 months)

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Objectives and Methodology

Over the last years (e.g., Chen et al. 2005, Wang et al. 2006), there has been a significant body of work in simulating aging and weathering (see the recent SIGGRAPH class for a quick overview (Dorsey et al. 2008)). We are interested here in physically-based modeling approaches, such as that of simulating flow (Dorsey et al. 1996), and in particular the effect of dirt stains and water. One problem of these methods is that they have a number of parameters which need to be determined. For the case of flow simulation, we need to know the surface adhesion rate, surface solubility rate, absorptivity etc. Our high-level goal is to estimate such parameters from photographs, so that we can apply the same weathering effect onto other synthetic models.



Left: Example of rea-world stain and flow effects. Right: Simulation using (Chen et al. 2005)

The high level goal is of course very ambitious. We will thus restrict our attention to a specific case in the context of this internship. Specifically, we will consider 1 or 2 photographs which contain an example of staining and washing by flow, on a simple façade. The façade will be chosen for simplicity, so that we can create a plausible 3D model of it simply; in addition, we will take enough photographs to ensure that we have a good example of the unweathered material (typically from a hidden part of the building). We will then apply texture synthesis (e.g., (Wei and Levoy 20001)) to re-generate an “unweathered” version of the façade, based on the “unweathered” sample. Using image differences and other image-processing operations, we will create an estimate of staining and flow. We will then attempt to find the parameters of the flow using a standard optimization or learning technique, possibly using techniques similar to (Wang et al. 2006) or (Fattal 2008).

The end goal will then be to re-apply the staining and flow effects onto a different geometry, hopefully creating a similar visual effect.

Requirements

The successful candidate should have taken courses in computer graphics and have experience in computer graphics programming, with knowledge of OpenGL or DirectX, and some experience with shading languages such as GLSL/HLSL/Cg.

INRIA provides a student stipend for living expenses.

References

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Y. Chen et. al 2005, *Visual simulation of weathering by γ -ton tracing*, SIGGRAPH '05
<http://research.microsoft.com/users/xtong/gammaton.pdf>

J. Wang et al. 2006 *Appearance manifolds for modeling time-variant appearance of materials*, SIGGRAPH '06. http://research.microsoft.com/users/xtong/img_weather.pdf

L-Y. Wei and M. Levoy, 2001, *Texture synthesis over arbitrary manifold surfaces*, SIGGRAPH '01 <http://graphics.stanford.edu/papers/texture-synthesis-sig01/texture.pdf>

R. Fattal 2008, *Single Image Dehazing*, Proc. SIGGRAPH 2008.
<http://www.cs.huji.ac.il/~raananf/projects/defog/index.html>