Example-Based Material Transfer Between Images

Master degree subject - M2R - MOSIG - GVR

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Location/duration: Maverick team, Inria (655 Avenue de l'Europe, 38334 Montbonnot), 5-6 months **Keywords:** Computer Graphics, Image analysis, Texture synthesis, Material edition, Visual perception.

Context. If many algorithms and filters exist for manipulating particular features such as colors or textures in still images, it is still extremely difficult to modify object appearances unless you are an expert designer. Consider the Buddha object in the left image. What should we do for automatically modifying its appearance so that its material looks like the bronze of the Hand object? This is in fact an ill-posed problem: we cannot recover the true material, shape and lighting properties from a single input image. These characteristics are all "mixed" together to produce the final picture. Related works rely on drastic assumptions (such as "dark is deep") in order to recover the physical components before re-synthesizing a novel image [KRFB06] or use a limited bank of filters in a multi-scale fashion to modify low-level material properties such as highlight intensities and roughness [BBPA15].



Source



Goal. The goal in this project will be to automatically transfer the material of an object in an image (lets say the bronze Hand on the right) into another object (the Buddha on the left). We will then start from 2 input images (a source and a reference) and their corresponding object's masks as input. Input images will be either computer-generated (to precisely control the transfer and make the life simpler) or simple photographs.

Approach. We will take inspiration from recent patch-based texture synthesis algorithms [KEBK05, LJWF12, DBP+15] to transfer material properties (color, roughness, micro-details, etc). Particular attentions will have to be paid to (i) preserve a plausible shape in the source and (ii) transfer convincing material characteristics from the reference. To that end, a bibliography stage about image-based material editing, texture synthesis and shape/material perception will first be conducted. we will then rely on simple but perceptually plausible image descriptors to guide the transfer. More precisely, the energy function used to synthesize the result will have to take into account image statistics related to the perception of shape (silhouettes, compression, flows, etc) [VBBF16] and other statistics related to the perception of material (histogram, skewness, etc) [Fle14]. A good balance will have to be found to synthesize a coherent result. This project will hopefully provide a powerful tool for manipulating materials in images. It will also help to better understand which visual cues participate in our comprehension of shape and material characteristics.

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