Crowd-Powered Parameter Analysis for Computational Design Exploration

Yuki Koyama Daisuke Sakamoto Takeo Igarashi

The University of Tokyo

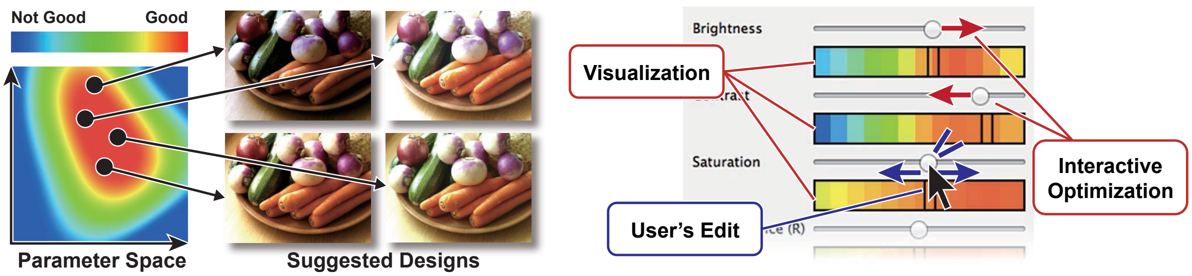

Figure 1: *Two user interfaces for visual design exploration enabled by our crowd-powered analysis. (Left)* ***Smart Suggestion****: The user can obtain appropriate parameter sets as suggestions. (Right)* ***VisOpt Slider****: The user can adjust each parameter effectively by the visualization (Vis) near the slider and the optimization (Opt) that gently guides the current parameters to the better direction.*

1 Introduction

Exploring various visual designs by tweaking parameters is a common practice when designing digital content. For example, if we want to clean up a photo for use at the top of a web page, we adjust the design parameters—brightness, contrast, saturation, etc.—to explore which combination of parameters provides the best result. Similar situations can be found anywhere in computer graphics applications, such as tweaking shader parameters for game development.

We present a new computational design method, which was recently presented in the HCI (*human-computer interaction*) community. This method is aiming at facilitating visual design exploration; more specifically, design parameter tweaking. The basic idea is to utilize *human computation* based on *crowdsourcing*. This idea has been recently used to solve various problems, including problems in computer graphics [Gingold et al. 2012]. Our method is one of such series, but specifically aimed at design parameter tweaking.

We offer two primary contributions: (1) A technique to analyze target design spaces by using crowdsourced human computation. (2) Two user interfaces for efficient design exploration enabled by our analysis: *Smart Suggestion* and *VisOpt Slider* (Fig. 1). Our method can be applied to various design domains, such as photo color correction and shader design.

2 Design Exploration Method

Crowd-Powered Analysis Let n be the number of the target design parameters. The goal here is to analyze the n-dimensional design space, and obtain a *goodness function*, a scalar-valued function $f : \mathbb{R}^n \rightarrow \mathbb{R}$ which takes any point in this space as an input, and computes how *good* the corresponding design is. To do this, we first generate many sampling points in this space. We then show pairs of these sampled designs to crowd workers, and ask them to provide relative scores according to their preference. Using these pairwise comparison data, we obtain a goodness function, i.e. a continuous distribution of *goodness* in this design space.

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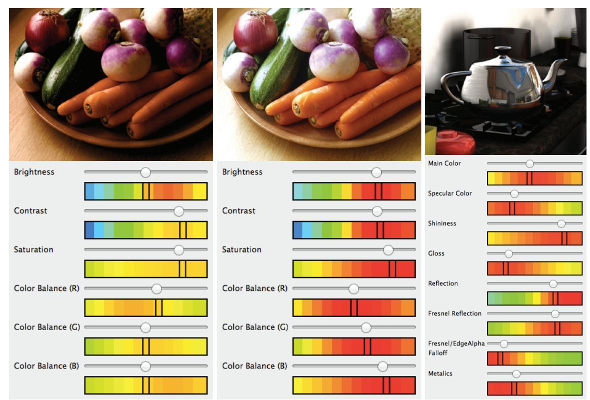

Figure 2: *(Left and Middle) Photo color correction. (Right) Shader.*

User Interface Smart Suggestion (Fig. 1 (left)) is a suggestive interface that provides users with reasonable design candidates based on the goodness. VisOpt Slider (Fig. 1 (right)) is an extension of the conventional slider component, in which the distribution of goodness values is directly visualized on sliders, and it can interactively update the visualization based on the current slider values. The slider values are interactively and continuously optimized to a better direction as the user is editing.

3 Applications

One of the advantages of our method is its wide applicability; As our analysis does not use any domain-specific features, it can be applied to arbitrary design domains. We applied our method to four practical scenarios from various design domains: photo color correction ($n = 6$), shader ($n = 8$), camera and light setting ($n = 8$), and *blendshape* facial expression ($n = 53$). Fig. 2 shows VisOpt Slider in the first two scenarios. To obtain these results, it took about 4 USD and 30 min for each crowdsourcing.

References

GINGOLD, Y., SHAMIR, A., AND COHEN-OR, D. 2012. Micro perceptual human computation for visual tasks. *ACM Trans. Graph. 31*, 5 (Sept.), 119:1–119:12.

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