論 文 の 内 容 の 要 旨

論文題目　　　Computational Design Driven by Visual Aesthetic Preference
（見た目の審美的好ましさを指標とするコンピュテーショナルデザイン）

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Tweaking design parameters is one of the most fundamental tasks in many design domains, including 2-dimensional graphic design and 3-dimensional product design. The purpose of such parameter tweaking tasks is to maximize the quality of designed objects based on some criterion. Especially in visual design domains, *aesthetic preference*, *i.e.*, how aesthetically preferable the designed object looks, is often used as the criterion. For example, in photo color enhancement, a designer tweaks several parameters such as “brightness” or “contrast”, such that the color of the target photograph becomes aesthetically best. However, aesthetic preference is tied with human perception, so that it is difficult to mathematically quantify this criterion using simple rules or equations.

In this thesis, we seek computational design support methods for parameter tweaking tasks in which aesthetic preference is used as a criterion. First, we investigate methods of estimating a preference distribution in the target design space using computational techniques. The estimated preference distribution can be then used for facilitating manual design exploration. Second, we investigate methods of directly finding the best parameter set from the target design space using computational techniques. These two approaches collect necessary data about human preference exploiting two difference sources: *crowdsourced human computation* and *editing history*. Crowdsourced human computation techniques provide “general” preference data generated by a large number of undefined crowds in an on-demand manner, while editing history of a single target user provides “personal” preference data of the user.

Specifically, we propose the following three computational design methods.

1. The first method estimates a preference distribution in the target design space using

crowdsourced human computation. The estimated preference distribution is then used in a novel design interface to facilitate manual design exploration.

2. The second method also estimates a preference distribution and uses it for facilitating manual exploration, but the estimation is based on the editing history of the target user. Along with this history-based preference estimation technique, we also propose a workflow to effectively gather and utilize the user's editing history in practical scenarios.
3. The third method directly searches the target design space for the best parameter set that maximizes aesthetic preference, without requiring the user of this method to manually tweak parameters. This is enabled by constructing an optimization framework using crowdsourced human computation.

We evaluated these three methods mainly in the scenario of photo color enhancement, but we also demonstrate applications to other various design domains, including lighting design for 3-dimensional computer graphics and facial expression modeling of a virtual avatar. The results showed that every proposed method was able to computationally handle either general or personal aesthetic preference, and worked in meaningful ways for supporting design activities. We envision that these methods and the lessons learned through this study will become fundamentals of future researches on computational design methods for more complex design scenarios beyond parameter tweaking.