論 文 内 容 の 要 旨

博士論文題目　A Conversational System for Interactive Image Editing
　　　　　　（自然言語を用いた対話型画像編集システム）

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（論文内容の要旨）

　Interactive image editing is a task to provide an interactive support for non-skilled users in image creation. This thesis presents an interactive image editing system that communicates with users using natural language. Interactive image editing system with natural language interface has a challenging problem. It has to handle various natural language editing requests, which include difficult requests for a slight change of images. This thesis addresses the problem with two approaches.

　In the first approach, we propose an interactive image editing framework based on neural network image generative models. The model can directly estimate and generate a new image from a pair of source image and natural language editing request. Although it can edit source image according to the editing request in artificially created handwritten digit edit dataset but suffer from inaccurate edit in created avatar edit dataset annotated by human. We demonstrate that our proposed source image masking mitigates this difficulty.

　The second approach tackles a problem to handle the uncertainty of the generated images due to the diversity of editing requests. Machine learning models are trained with the limited dataset, and in general, the users have different knowledge, skills, and cultures. Therefore, confirmation process is necessary to ground the intentions between user and system. A naive confirmation strategy is showing the generated images from different editing models to confirm the most relevant image to the user's request every time. However, it makes the interactive process redundant. To

addresses this problem, we propose a proactive confirmation method that enables the system to confirm with the user when the system is tentative about selecting a better image to match the user's editing requests. We defined an uncertainty score by using the entropy of the generated image to decide the system action to confirm. We demonstrate our method achieves a lower number of confirmations to the users with better image qualities through the dialogues.

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（論文審査結果の要旨）

Systems with natural language interfaces such as conversational interface are useful for human users in human-system collaboration tasks. Interactive image editing task is a task that uses natural language interfaces, which is a potential application for on-skilled users. If users want to create an imagined image, they can ask the system to create the image as we usually do with skilled sketch artists. This thesis presents an interactive image editing system based on neural network image generative models, which proactively communicates with users to create the desired image.

This thesis addresses the following two challenging problems for the interactive image editing task. The first problem is that the systems have to handle various editing requests from the users in natural language, which include requests for a slight change of images. Mr. Shinagawa proposed an interactive image editing framework based on machine learning systems, neural network-based image generative models. The model can directly estimate and generate new images from given previous (source) images and the users' natural language instructions (editing requests) to generate a fixed image as the user demanded. The second problem is that the systems have to handle the uncertainty of the generated images due to the diversity of editing requests. Mr. Shinagawa proposed a proactive confirrmation method that enables the system to confirm with the user when the system is tentative about selecting a better image to match the user's editing requests. He defined an uncertainty score by using the entropy of the generated image to decide the system action to confirm.

Conversational interactive image editing is a challenging task as it requires a image and natural language processing skills and insights. This thesis research proposed solutions to these problems, and a series of his research resulted in two high quality peer-reviewed journal papers, one peer-reviewed international conference paper, and some domestic conference papers. As a result, the thesis is sufficiently qualified as a Doctoral thesis of Engineering.