Proposal of Framework for GAN to Fit User's Favorite Distribution for "Kawaii"

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In recent years, the animation industry has been developing. In addition, creation and secondary creation related to animation and manga are increasing. Among these creation events, making a character is one of the most important parts. Due to changes in the times, not only "cool" but also "cute" is pursued for men. However, many people who want to create their own characters do not have the ability to draw pictures. For such people, research on the automatic generation of animation and cartoon characters has been studied recently.

At present, research on the automatic generation of cartoon characters is mainly divided into two types. One is to generate an animated cartoon style face based on the true face photo. The other type is to create facial images of animation and cartoon characters from nothing using deep learning approaches, such as Generative Adversarial Network (GAN).

However, there is few research about studying male characters or reflecting user's preferences in the generation results. Some methods use GAN to generate character face image with select "tag" (blonde hair, blue eyes, etc.) representing the appearance features of the character. Nevertheless, from the result of the preliminary experiment of this research, the face image of the character generated by this method does not necessarily reflect the taste of the user.

There are also some research about "kawaii" in the field of culture and Kansei engineering. The results of research in the field of culture show that "kawaii" has the feature of Japan and express a positive meaning. The results of research in the field of Kansei engineering use a statistical way to evaluate the Kansei values of industrial products. These works studied on the user's preferences, but they have not investigated what is composed of various colors and shapes like characters. Besides, "Kawaii" preferences is changing depending on people, so research on the characteristics and influence of "kawaii" is worthwhile.

Therefore, in this research, we propose a "kawaii" image generation framework of male animation character face, which can adapt to GAN and fit user's preferences. The GAN, which uses this framework, has the ability to generate male characters' face image fitting to the user's preferences. Moreover, our framework can reach this goal with only a small amount (64 images in our experiment) of data that show the "kawaii" preferences of the user. Then, in order to prove that the framework proposed by this research can

estimate the distribution of user's favorite distribution and the image generated by our framework can get closer to the preferences of the user's "kawaii" type, we have done the evaluation experiments and showed the results in this paper.

In order to conduct this research, we first organized a dataset for the training of our framework. Images with male characters have been collected from the Internet for this dataset. And then, the images have been organized by pre-processing such as face extraction (to cut the characters' face), data selection (to pick out male characters' face) and resizing to 64*64 pixel (for the training of our framework). As a result, this dataset contains 21607 images of male characters' face image.

If we want to use GAN to estimate user's preferences of "kawaii", we need a great amount of image data which are all "kawaii" characters suiting for user's taste. However, it is not practical to let the user provide millions of images of their favorite "kawaii" characters. Since it is not possible to provide large quantities of images representing user preferences, this framework adds a new Discriminator (D for short) named Evaluator (E for short) to GAN. E uses the feature of the middle layer (Low-level information and High-level semantics meanings) of D, which discriminates the face image of a general male character, to discriminate the face image of the "kawaii" male character by only a few image data satisfied user's "kawaii" preferences. The GAN applying this framework first learns the distribution of the face image of the male character from the dataset organized for this research. Then, learning is continued with 64 images representing a user's preferences, and the face image distribution of the obtained male character is fitted to the user's preference distribution. Finally, based on the preference distribution of this user, a face image of a male character that is more close to the preference of the user is generated.

In order to verify the effectiveness of this framework, our research has done an evaluation experiment. This evaluation experiment is carried out in two steps, one is image selection, and the other one scoring for images. The first step is to have subjects give 64 character face images that match the "kawaii" preference of the subject to fit the subject's preference distribution. The second step is to score a group of images generated by the model applying this framework and another group of the images generated by the model not applying this framework. Considering coincidence and the subject's feelings, each group has 64 images. The evaluation of this framework based on the scoring result.

The following conclusions were obtained from the results of the evaluation experiment.

1. This framework is effective, and the generation result of GAN applying this framework is being fitted to a user's preference.
2. This framework has no adverse effect on the stability of GAN generation.
3. Sixty-four images that represent a user's preferences and strongly affect the effect

of fitting. The higher level of "kawaii" for the character selected by the subject, the better the fitting effect can be carried out.

4. Males are less interested in "kawaii" male characters than females.

For the future work, we believe that better results can be obtained by the improvement of resolution, improvement of generation effect by a larger and cleaner dataset, and improvement of stability of GAN. In addition, since there is no specialization for "kawaii" of our framework besides data, it is considered that this framework can reach the same result of the perceptual words such as "cool" or "bad feeling".