Goshuin 2.0: Construction of the World's Largest Goshuin Dataset and Automatic Generation System of Goshuin with Neural Style Transfer

Shuma Shimizu
shumai@digitalnature.slis.tsukuba.ac.jp
Tokyo, Japan

Tatsuya Minagawa
mina.tatsu@digitalnature.slis.tsukuba.ac.jp
University of Tsukuba
Tsukuba, Japan

James Harry Morris
morris.harry.gu@u.tsukuba.ac.jp
University of Tsukuba
Tsukuba, Japan

Xanat Vargas Meza
meza@digitalnature.slis.tsukuba.ac.jp
University of Tsukuba
Tsukuba, Japan

Yoichi Ochiai
wizard@slis.tsukuba.ac.jp
University of Tsukuba
Tsukuba, Japan

Figure 1: (a) Some of the goshuin that we collected and compiled in the dataset, (b) Examples of goshuin generated by the Automatic Generation System, (c) The web viewer of the system we built, left: automatic generation system, right: dataset

CCS CONCEPTS

• **Human-centered computing** → *Systems and tools for interaction design*; • **Social and professional topics** → **Religious orientation**.

KEYWORDS

Goshuin, Dataset, Neural Style Transfer, Digital Humanities, Font

ACM Reference Format:
Shuma Shimizu, Tatsuya Minagawa, James Harry Morris, Xanat Vargas Meza, and Yoichi Ochiai. 2021. Goshuin 2.0: Construction of the World's Largest Goshuin Dataset and Automatic Generation System of Goshuin with Neural Style Transfer. In *Special Interest Group on Computer Graphics and Interactive Techniques Conference Posters (SIGGRAPH '21 Posters), August 09-13, 2021.* ACM, New York, NY, USA, 2 pages. https://doi.org/10.1145/3450618.3469160

SIGGRAPH '21 Posters, August 09-13, 2021, Virtual Event, USA

ACM ISBN 978-1-4503-8371-4/21/08.
https://doi.org/10.1145/3450618.3469160

1 INTRODUCTION

Goshuin (御朱印) are items that can be collected from shrines and temples in Japan as evidence of one's visit and worship. They consist of a red stamp, or seal, and calligraphy. They have been in circulation mainly in Japan since the Middle Ages, and in recent years, the artistic quality of the goshuin has appreciated and attracted considerable attention with the development of social networking sites.

Outside Japan, there are items similar to goshuin: Christianity issued stamps to pilgrimages at holy sites across the globe, with the most notable example being the Caminode Santiago de Compostela in Spain [de Navarra 2007]. Furthermore, from the 12th century, pilgrimage scrolls depicting maps and calligraphy were used to commemorate the Hajj, which is the Islamic peregrination to Mecca [of Islamic Art et al. 1997].

The aim of this study is to explore possibilities of utilizing goshuin data. We will clarify the current issues related to goshuin and propose solutions using goshuin data utilization. The following are some of the problems related to goshuin: 1) There are no datasets that include the available goshuin, and the relevant books and websites are difficult to use even for research purposes due to copyright issues: 2) As goshuin are an intangible culture, it may suddenly disappear: 3) Goshuin are not well known outside Japan, and there are no technical research examples related to goshuin: 4) Demand for goshuin is increasing owing to the current increase

in their popularity. Simultaneously, supply is decreasing due to Japan's aging workforce. As the number of people who can write goshuin is decreasing, shrines may stop providing goshuin.

We have proposed two approaches to solve these problems in this study. The first approach involves constructing the world's largest goshuin dataset. The second approach is to build an automatic goshuin generation system using neural style transfer. This system can freely create goshuin by applying an existing goshuin typeface to characters input by the user. In summary, we consider the possibilities of utilizing goshuin data to create a dataset and use it to generate more goshuin.

2 DATASET

We collected a total of 4000 goshuin to construct the world's largest goshuin dataset. Approximately 1000 of these were collected by actually visiting the temples and shrines, and the remaining 3000 were provided by DIAMOND, Inc., the largest publisher of goshuin-related books.

In the dataset, a user can search the name or narrow down the search according to the attributes of the goshuin. In doing so, a sequential list of results appears, and the user can download goshuin dataset. It is also possible to narrow down the search results according to six filters: type of institution (shrine and/or temple), type of shrine faith, type of Buddhist denomination, location, denominate numbers, and group. This dataset is available in web interface[1].

3 AUTOMATIC GENERATION SYSTEM

We created a system that allows users to generate goshuin with different characters and typefaces. We used neural style transfer to generate characters. This is a mechanism that inputs two images—a content image that determines the structure, and style images that determine the calligraphic style—and outputs an image that has both the structure of the former and the style of the latter. In particular, we used an empirical mode decomposition (EMD) network [Zhang et al. 2018] that allows fonts to be created with a small number of style images. This system uses a pre-trained model built by the EMD network used in DeepGlyph [Tamada 2019]. The structure of the network is shown in Figure 2 according to the paper which describes DeepGlyph.

This system can generate a goshuin by applying the typeface of the goshuin selected by the user to the characters entered by the user. To output one character, five style images and one content image for input need to be prepared. The style images enable the output of different characters of the same typeface by extracting five characters from the middle of goshuin that have the typeface the user desires to replicate. A representation of this system is shown in Figure 2. The characters generated by this system are shown in Figure 3. This automatic generation system is available in web interface[2].

4 DISCUSSION

The construction of the goshuin dataset is a significant contribution as it solves the current difficulties faced by people in order to obtain a goshuin that include not being able to physically go to a site and

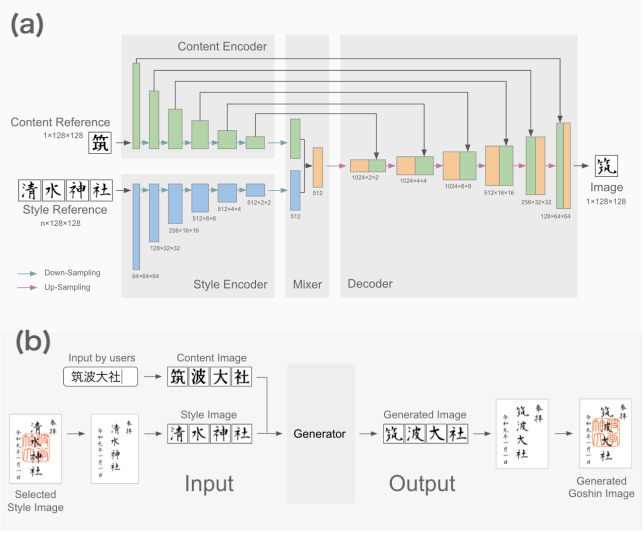

Figure 2: (a) EMD Network, (b) Automatic generation system

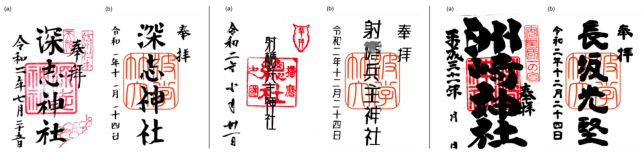

Figure 3: Three combinations of style image (left) and generated image with the left as input (right)

not receiving a receipt for goshuin due to religious reasons. We received feedback from temples and shrines nationwide regarding the automatic generation of goshuin by neural style transfer. The feedback was varied in that there were positive answers, indicating that it was very convenient, and negative answers, indicating that it was religiously problematic. However, by starting with collecting the data of the goshuin, constructing a dataset, and automatically generating goshuin using the dataset, a series of practical machine learning tasks can be executed, and there is a sufficient possibility of utilizing goshuin data. Finally, this study contributes to the promotion of technical research on goshuin, increases the variation of goshuin, and promotes the culture of writing goshuin.

ACKNOWLEDGMENTS

We are grateful to Mr. Akihiro Tamada who sent us his paper on DeepGlyph and the generated model he developed, and DIAMOND, Inc. who provided images of goshuin for the dataset.

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[1] https://seekgoshuin.herokuapp.com/
[2] https://deepgoshuin.tk/src/