（様式）

FY2019 Annual Report for International Joint Research with Research Fund
International Joint Digital Archiving Center for Japanese Art and Culture (ARC-iJAC), Art Research Center, Ritsumeikan University

Date (year/mm/dd): 2020-5-16

1. Title of the Research Project	
Multi-Label Classification of Stencil Images in the Katagami Database	
2. Research Leader	
Name	Organization and title
Tetsuji KUBOYAMA	Professor, Gakushuin University
3. Co-researcher (Total: 6 persons)	
Name	Organization and title
Eisaku MAEDA	Professor, Tokyo Denki University
Akihiro YAMAMOTO	Professor, Kyoto University
Keiko SUZUKI	Professor, Ritsumeikan University
Shinya SAITO	Associate Professor, Ritsumeikan University
Mizuho KAMO	Kyoto Institute of Technology, JSPS RPD
Hiroshi SAKAMOTO	Professor, Kyushu Institute of Technology

4. Overview of the Research Project (About 150 words) Note: If you have changed your project since the time of application submission, please write clearly where you made changes.

The katagami (textile printing stencils) database, created by the Art Research Center of Ritsumeikan University, classifies katagami images according to multiple labels such as "flower" and "geometric," and provides a search method based on these labels. One of the project members with sufficient knowledge of katagami has so far classified them, taking into account the consistency of the classification. This is one of the factors that hinder the speed of database construction. In this study, we aim to automate the classification with machine learning methods, using the katagami images manually labeled as training data. This is a continuation of the collaborative research of the past two years, which addresses this problem by improving the classification accuracy through deep learning, including consistency checking of the existing labels, in order to improve the accuracy of classification and improving efficiency of the database construction.

5. Overview of the Research Results Note: We may use this section for the Center's PR.

We attempted image preprocessing for labeled images in the katagami database, and those licensed by Kyotech to improve classification accuracy with deep learning. Since each katagami image contains multiple labels, the labeled data is insufficient for training. To address this problem, we developed an image segmentation algorithm to isolate the classification target. In addition, we investigated and implemented a deep learning model for compressed images to process high-resolution katagami images efficiently. Also, we developed a Web annotation tool that can label grid regions of an image to augment the training data.

6. Research Activities

(1) Books

(2) Articles

1.「狭い 16 ビットのスケッチを用いた高速最近傍検索」、共著、情報処理学会・誌数理モデル化と応用（TOM）、13 巻 1 号、樋口直哉, 今村安伸, 久保山哲二, 平田耕一, 篠原武、pp.13〜22、2020 年 3 月、査読有

"Fast Nearest Neighbor Search with Narrow 16-bit Sketch," IPJS・Transactions on Mathematical Modeling and its Applications (TOM),Vol.13, No.1, N. Higuchi, Y. Imamura, T. Kuboyama, K. Hirata, T. Shinohara, Mar. 2020, pp.13-22, peer-reviewed.

2. "Time Series Topic Transition Based on Micro-Clustering," IEEE・BigComp, DOI:10.1109/BIGCOMP.2019.8679255, T. Hashimoto, T. Uno, T. Kuboyama, K. Shin, D. Shepard, pp.1-8, Mar. 2019, peer-reviewed.

3. "A Fast Algorithm for Unsupervised Feature Value Selection," SCITEPRESS・ICAART (2), K. Shin, K. Okumoto, D. Shepard, T. Kuboyama, T. Hashimoto, H. Ohshima, Feb. 2020, pp.203-213, peer-reviewd.

4. "Fast Filtering for Nearest Neighbor Search by Sketch Enumeration Without Using Matching," AI2019, Springer・LNCS 11919, N. Higuchi, Y. Imamura, T. Kuboyama, K. Hirata, T. Shinohara, Dec. 2019, pp.240-252, peer-reviewed.

5. "Twitter Topic Progress Visualization using Micro-clustering," SCITEPRESS・ICPRAM, T. Hashimoto, A. Kusaba, D. Shepard, T. Kuboyama, K. Shin, T. Uno, Feb. 2020, pp.585-592, peer-reviewed.

6. "Using Label Information in a Genetic Programming Based Method for Acquiring Block Preserving Outerplanar Graph Patterns with Wildcards," IEEE・IWCIA, F. Tokuhara, S. Okinaga, T. Miyahara, Y. Suzuki, T. Kuboyama, T. Uchida, 2019, pp.95-100, peer-reviewed.

(3) Presentations

(4) Symposiums and/or research meeting you organized

(5) Other research activities (Lectures to the general public, and appearances in/contributions to mass media)

(6) Academic awards

(7) Grants-in-Aid for Scientific Research -KAKENHI

1. 近世後期から明治期京都における染織意匠の展開に関する研究、特別研究員奨励費、2017 年 4 月〜2020 年 3 月、代表 (加茂瑞穂)

1. 図と地でとらえる巨大二部グラフクラスタリングとその応用、基盤研究(C)、2019 年 4 月〜2023 年 3 月、代表（久保山哲二）

2. 構造抽出による自然言語ビッグデータへの高次高精度なデータマイニング技術の開発、基盤研究(A)、2019 年 4 月〜2024 年 3 月、分担 (久保山哲二)

3. 弱閉集合の代数的構造の解明と知識発見への応用、基盤研究(B)、2017 年 4 月〜2020 年 3 月、分担（久保山哲二）

4. 機械学習計算基盤の構築と複数領域における画期的成果の創出、基盤研究（A）、2017 年 4 月〜2021 年 3 月、分担（久保山哲二）

5. 高次元特徴空間の概念選択と基準創発に基づく知識統合基盤の構築、基盤研究（B）、2016 年 4 月〜2020 年 3 月、分担（久保山哲二）

6. 大規模自然災害後の数億件規模のツイートからの話題成長パターンの分析とモデル化、基盤研究（C）、2018 年 4 月〜2021 年 3 月、分担（久保山哲二）

(8) Competitive grants other than KAKENHI

(9) Other achievements