【Grant-in-Aid for Scientific Research (S)】

Construction and Implementation of a Deep Learning System for Estimating the Production Date and Region of Buddhist Statues

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Purpose and Background of the Research

● Outline of the Research

Buddhist statues are a legacy of Buddhist culture that spread throughout Asia and developed in deep connection with the history of dynasties, climates and customs of various regions. Therefore, we can expect to decipher the history and culture of Asia through Buddhist statues.

Until now, various studies have been conducted in the humanities, including art history, to determine when and where Buddhist statues were created. However, due to the subjectivity involved, it has been difficult to form a unified opinion on the style (characteristics of the form/typical form of expression), which has been the most important aspect of art history.

Therefore, this research aims to analyze the facial styles of Buddhist statues using AI, especially deep learning methods, and to objectively estimate the date and region in which the statues were created.
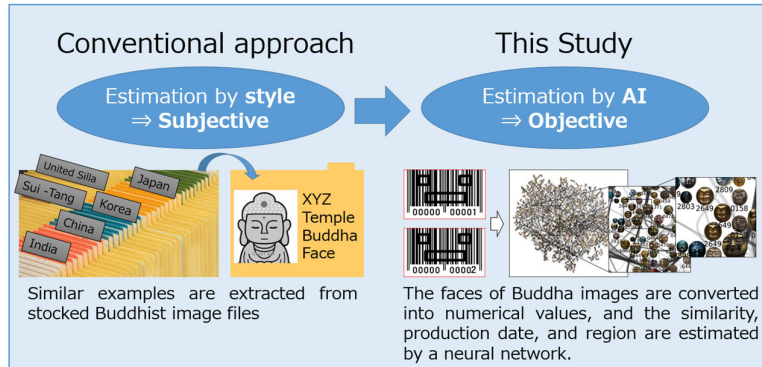

Figure 1. Features of this research

● Research Plan

This research is a fusion of the humanities and sciences in which members specializing in Buddhist sculpture research (Buddhist Sculpture History Section) and members specializing in AI and computer vision (Deep Learning Section) will collaborate, and will proceed as follows.
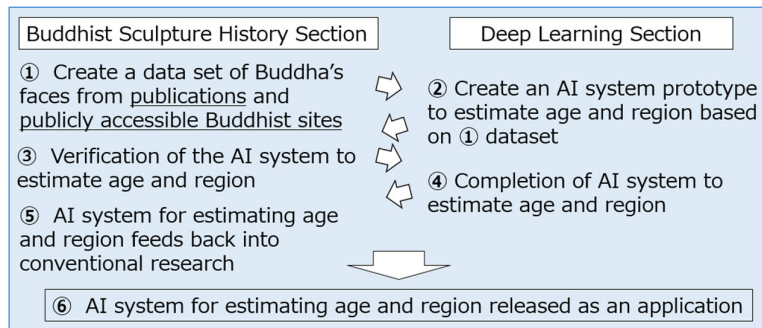

Figure 2. Research process

● Case Studies of AI-based Buddha's Face Analysis

This research aims to establish a system for estimating the date and production area of Buddhist images using Buddha's faces over a five-year research period. In addition to this, we will attempt the following four case studies.

① The Sanjusangendo Project

The Sanjusangendo Hall in Kyoto is home to 1,001 Kannon statues. They are categorized as being produced in the Heian and Kamakura periods, with some examples having identifiable authors. It is true that the faces of all Kannon statues are different, but they all look very similar. We will analyze them and attempt to create a phylogenetic tree based on the results.

② The Kaikei Project

We will conduct a cluster analysis of the facial expressions of works by Kaikei, a Buddhist master active in the Kamakura period, and examine the correspondence with the production year and changes of form observable in Kaikei's works.

③ The Yungang Grottoes Project

The Yungang Grottoes in China began construction in 460 AD during the Northern Wei dynasty. There are more than 50,000 Buddha statues, with a considerable number of intact Buddha faces remaining. We will analyze Buddha's faces based on the images of the recently published complete works and compare the results with archaeological research findings.

④ The Longmen Grottoes Project

Statues in the Longmen Grottoes in China form the basis for the research of Buddhist sculpture of the late Northern Wei and the early Tang dynasty. Although many heads were removed from the statues, we will attempt a chronological analysis based on the facial data.

● Additionally...

Although this study uses 2D images for analysis of Buddha's face, it would be ideal to use 3D images. With an eye toward the future, we are also working to collect 3D images of Buddha's face for this purpose, and even converting 2D images to 3D.

Expected Research Achievements

● Two Objectives

① Feedback on Buddhist sculpture studies

AI-based age and region estimation is probably not infallible. However, since AI estimates are not bound by researchers' preconceptions (accumulated knowledge), they have the potential to produce novel results. We would like to feed back the results not only to the estimation itself, but also to the Buddhist sculpture research to elucidate the propagation and history of Buddhist statues.

② Releasing an application for age/region estimation of Buddhist statues

In this study, the age/region estimation system will be made available online and freely available to registered account holders. And for this purpose, this study will use publicly available or photography-free images. By doing so, we hope to accelerate the globalization of stylistic studies of Buddhist statues, facilitate access to Buddhist statues for those interested, and lead to the rediscovery of buried Buddhist statues around the world.
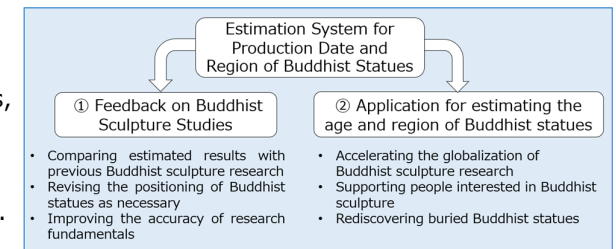

Figure 3. Aim of this research