Seals of Ancient Chinese Paintings: Recognition and Association Analysis Based on Deep Neural Networks

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Vermilion seals, as intricate symbols of identification in ancient Chinese paintings, offer a window into the lives of historical figures. To unveil these stories, this project leverages DNN technology to propose a recognition algorithm invented designed to identify the corresponding seals and generate association analysis depending on seals and inscriptions, enhancing appreciation and understanding of art's rich history. There are two network models developed to segment and identify seals initiated, which rely on databases released online. The cutting-edge YOLOX architecture was utilized for our first model, a choice driven by its exceptional accuracy and speed in detecting seals against the varied textures of paintings. The dataset consists of 4,000 paintings and 13,002 seals labeled, divided into 3 subsets in the ratio of 8:1:1. The second self-supervised model inherits from the momentum contrast method to match correct seals and visualize the results with the owners and dynasties, enhanced by data augmentation methods such as Image Thresholding to adapt different backgrounds. Achieving an impressive 96.9% Average Precision in seal extraction and 86.5% in matching, the models set a new benchmark for digital analysis in history, significantly outperforming existing methods. By associating figures and entities, paintings such as Autumn Colors on the Que and Hua Mountains can be analyzed through a new lens. The project lays the groundwork for future explorations into how technology can uncover the stories of historical artifacts. The process for experts' identification is streamlined by reducing the need for exhaustive searches, while the experience of connoisseurs is enriched, offering profound insights into the artwork with unprecedented ease and precision.

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