

## Deep Learning for Herbal Medicine Image Recognition: Case Study on Four-herb Product

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The consumption of herbal medicine and related products (herbal products) have increased in South Korea. At the same time the quality, safety, and efficacy of herbal products is being raised. Currently, the herbal products are standardized and controlled according to the requirements of the Korean Pharmacopoeia, the National Institute of Health and the Ministry of Public Health and Social Affairs. The validation of herbal products and their medicinal component is important, since many of these herbal products are composed of two or more medicinal plants. However, there are no tools to support the validation process. Interest in deep learning has exploded over the past decade, for herbal medicine using algorithms to achieve herb recognition, symptom related target prediction, and drug repositioning have been reported. In this study, individual images of four herbs (*Panax ginseng* C.A. Meyer, *Atractylodes macrocephala* Koidz, *Poria cocos* Wolf, *Glycyrrhiza uralensis* Fischer), actually sold in the market, were achieved. Certain image preprocessing steps such as noise reduction and resize were formatted. After the features are optimized, we applied GoogLeNet\_Inception v4 model for herb image recognition. Experimental results show that our method achieved test accuracy of 95%. However, there are two limitations in the current study. Firstly, due to the relatively small data collection (100 images), the training loss is much lower than validation loss which possess overfitting problem. Secondly, herbal products are mostly in a mixture, the applied method cannot be reliable to detect a single herb from a mixture. Thus, further large data collection and improved object detection is needed for better classification.

**Key words:** Deep learning, GoogLeNet\_Inception v4, Herb recognition, Herbal medicine

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