

# 1. Differential learning: A powerful tool for interactive content-based image retrieval

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**Authors:** Zheng, Qinghe (1); Tian, Xinyu (2); Yang, Mingqiang (1); Wang, Hongjun (3)

**Author affiliation:** (1) School of Information Science and Engineering, Shandong University, Jimo; Qingdao; 266237, China; (2) College of Mechanical and Electrical Engineering, Shandong Management University, Changqing, Jinan; Shandong; 250357, China; (3) School of Information Science and Engineering, Shandong University, Qingdao; 266237, China

**Corresponding author:** Yang, Mingqiang(yangmq@sdu.edu.cn)

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**Abstract:** Faced with the huge image data in the context of big data era, how to effectively manage, describe, and retrieve them has become a hotspot issue in academia and industry. In this paper, we propose an end-to-end image retrieval system based on deep convolutional neural network and differential learning method. Compared with the traditional method of using the deep convolutional activation features as the feature vector to match the image, we simplify the retrieval process of the method and decrease the problem of "semantic gap" in the content-based image retrieval system. We first build an image matching dataset based on the gravitational field model, that is to add the similarity score label for each image in the dataset manufacturing stage. Then we train the improved deep learning model and verify the effectiveness of the algorithm on three common image matching datasets (i.e., Caltech-101, Holidays, and Oxford Paris). Finally, the experimental results show that our improved deep learning model with differential learning method that used for image retrieval system has state-of-the-art image matching performance. The overall retrieval accuracy in Caltech-101, Holidays, and Oxford Paris datasets are 88.5%, 94.1%, and 96.2%, respectively. As the number of returned image increases, the retrieval accuracy of the system decreases slightly and eventually becomes stable at a high value. And the differential learning based retrieval method is superior to many traditional algorithms in terms of image matching accuracy and single image processing speed. © 2019, International Association of Engineers. All rights reserved.

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