Computational Vision Systems and Applications of Pattern Recognition

Special Session along with PATTERNS 2018, February 18-22, 2018 - Barcelona, Spain
https://www.iaria.org/conferences2018/PATTERNS18.html

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***Abstract*—Computational vision systems and applications of pattern recognition have infiltrated into various fields as an important technology. All processing systems by computers are designed as efficient as possible for the intelligent performances. Computational vision often seeks to actualize human vision system for the intelligent performances. Nowadays, these technologies enable to recognize two-dimensional patterns, inspect failure and quality of substrate, detect and track human motion, recover the 3D shape from input images, etc. Then, applications of pattern recognition bear an essential part of these technologies. This session includes intelligent processing, artificial neural networks, an intelligent operation for application, computational vision processing with learning approach and cognitive processing including actual applications of pattern recognition. A special session on Computational Vision Systems and Applications of Pattern Recognition is included in Pervasive Patterns and Applications (PATTERNS) 2018 conference, held in Barcelona, Spain. Four papers address the challenges on the topics of computational vision systems and applications of pattern recognition that are important subjects to solve at present.**

***Index Terms*—Image Data Set; Query Expansion; Web Image Mining; Image Processing; Web Intelligence; Colon Blood Vessel Detection; CNN; U-net; Biomedical Image Processing.**

I. Introduction

Three papers [1] [2] [3] are presented in this session COVAPR. Each paper treats the reent research topic in Image Data Set and Query Expansion, Web Image Mining, Image Processing and Web Intelligence, Colon Blood Vessel Detection, CNN, U-net, and Biomedical Image Processing.

A. Automatic Construction of Image Data Set Using Query Expansion Based on Tag Information [1]

In the research of general object recognition, the computer recognizes images without constraints, and researches have focused on feature extraction and machine learning methods. A huge image data set with various unbiased objects is required for the learning. A manual collection of huge image data set causes biased collection and a lot of human costs.

Recent researches for image data set try to automatically or semi-automatically generate image data set from Web image sharing services, such as Flickr, i.e., Web image mining [4]. Web image mining enables makes it possible to obtain a large amount of images including daily scenes with low cost [5]. One of the problems in Web image mining is that the image data set generated with Web image mining naturally includes noise images. The method for noise removal using image features has been reported [6].

However, in collecting images from the web by most previous methods, tag search is used with the target label as a query, and the collection range is limited to images in which target words are included in meta data given to images, such as tags, titles, and descriptions.

Therefore, this paper proposes extending the data set by selecting appropriate queries and collecting images that can not be collected by the previous method.

In Section 2, proposed method is given. In Section 3, peformance is evaluated in the experiments. In Section 4, conclusion and future work are discussed.

B. Automatic Construction of Large Scale Image Data Set fromWeb Using Ontology and Deep Learning Model

General object recognition is the recognition of unconstrained image existing in the real world using computer system and this is one of the representative tasks in the computer vision. Since Convolutional Neural Network (CNN) [7] was proposed in 2012, the recognition ratio was improved dramatically. However, recognition requires a large scale image data set and the recognition accuracy depends on the image data set. Construction of large scale image data set by human requires a lot of time and human costs. Automatic or semi-automati construction of image data set using Web image mining searching images on the Web has been reported recently [8] [9] to avoid the construction by human manually. Web image mining makes it possible to obtain large scale images taken under usual conditions by various humans with low cost since searching operation is available via posting service of a large scale images such as Flicker, Bing Image Search or Google Image Search and so on.

Only the Meta information added to the image, such as title, explanation sentence or tag is stil difficult to collect the target image data set. Image data collected automatically from the Web includes non-target images (noise images) and it is stil difficult to apply these approach directly to the general object

recognition. This paper uses the low level concept of ontology and expands to increase the number of image data set and to exclude the noise images simultaneously, then how to perform the automatic construction of a large scale image data set is proposed.

C. Colon Blood Vessel Detection Based on U-net

Detection and analysis of colon blood vessels play a significant role in medical diagnosis in a large number of areas like retinopathy, endoscopy, etc. Colon blood vessel lesions are frequently derived from malignant polyps. While some algorithms [10]-[**?**] are proposed for retina blood vessel extraction, they can not be used in an endoscope environment as well. The algorithms based on convolutional neural network (CNN) [12] [**?**] perform high precision in retina blood vessel. However, common CNN needs massive datasets. It is difficult to prepare massive datasets with mask images in biomedical image processing. The typical use of convolutional networks is for the classification tasks, where the output of an image is a single class label. However, in many visual tasks, especially in biomedical image processing, the desired output should include localization, i.e., a class label is supposed to be assigned to each pixel. This paper proposes a method based on the U- net architecture [14] for colon blood vessel detection with a few training images. Section II explains the proposed method, Section III mentions experiments and Section IV concludes the paper.

II. Conclusion

Paper [1] proposed an image data set expansion method that selecting appropriate queries and collecting images that can not be collected in previous methods. In the experiment, it is possible to select a useful query for data set extension by query expansion from the image tag of the data set constructed by the previous method.

Paper [2] proposed an automatic construction of Web image dataset by removing noise images using ontology and CNN features. Low level concept of ontorogy made it possible to recorrecting images and expand the range of correcting images. Removing noise images was also applied using the image features obtained by CNN for the corrected images.

Paper [3] proposed the colon blood vessel detection method based on the U-net architecture with a few training images. It was confirmed that the proposed method performs better colon blood vessel detection with a few training im- ages from experiment results.

Future works of papers [1] and [2] includes to select more useful queries and evaluation using this generated dataset for the general object recognition as future task, while that of paper [3] includes applying the method to Narrow Band Imaging (NBI) and detecting malignant polyp based on results.

Acknowledgment

Iwahori's research is supported by Japan Society for the Promotion of Science (JSPS) Grant-in-Aid Scientific Research(C)(#17K00252) and Chubu University Grant.

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