

Accepted Manuscript

Split-Net: Improving Face Recognition In One Forwarding Operation

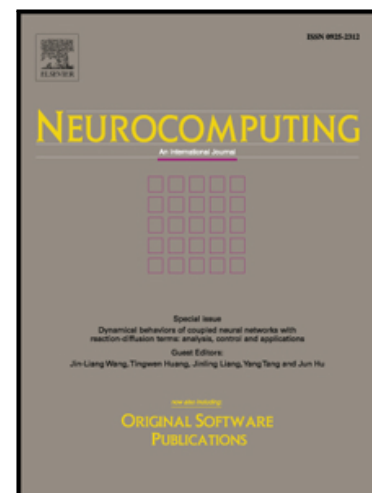
Ge Wen, Yi Mao, Deng Cai, Xiaofei He

PII: S0925-2312(18)30766-5
DOI: [10.1016/j.neucom.2018.06.030](https://doi.org/10.1016/j.neucom.2018.06.030)
Reference: NEUCOM 19708

To appear in: *Neurocomputing*

Received date: 22 January 2018
Revised date: 2 June 2018
Accepted date: 7 June 2018

Please cite this article as: Ge Wen, Yi Mao, Deng Cai, Xiaofei He, Split-Net: Improving Face Recognition In One Forwarding Operation, *Neurocomputing* (2018), doi: [10.1016/j.neucom.2018.06.030](https://doi.org/10.1016/j.neucom.2018.06.030)



This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Split-Net: Improving Face Recognition In One Forwarding Operation

Ge Wen, Yi Mao, Deng Cai, Xiaofei He

The State Key Lab of CAD&CG, Zhejiang University, No.388 Yu Hang Tang Road, Hangzhou 310058, China

Abstract

The performance of face recognition has been improved a lot owing to deep Convolutional Neural Network (CNN) recently. Because of the semantic structure of face images, local part as well as global shape is informative for learning robust deep face feature representation. In order to simultaneously exploit global and local information, existing deep learning methods for face recognition tend to train multiple CNN models and combine different features based on various local image patches, which requires multiple forwarding operations for each testing image and introduces much more computation as well as running time. In this paper, we aim at improving face recognition in only one forwarding operation by simultaneously exploiting global and local information in one model. To address this problem, we propose a unified end-to-end framework, named as Split-Net, which splits selective intermediate feature maps into several branches instead of cropping on original images. Experimental results demonstrate that our approach can effectively improve the accuracy of face recognition with less computation increased. Specifically, we increase the accuracy by one percent on LFW under standard protocol and reduce the error by 50% under BLUFR protocol. The performance of Split-Net matches state-of-the-arts with smaller training set and less computation finally.

Keywords: Deep face representation, region based models, feature fusion

Introduction

Face recognition has attracted lots of attention in the domain of computer vision since decades ago because of its various applications in the area of biometrics, access control, surveillance, etc. There are also many works focused on face sketch recognition [16, 26], which have wide applications ranging from digital entertainments to law enforcements. And more and more works of face sketch synthesis have been proposed [24, 25, 27]. Based on the definitions, face recognition can be divided into two specific subtopics, face identification and face verification. Face identification is to assign a label or a name from a candidate set to a face image, and face verification is to tell whether two face images belong to the same person or not. For face identification, it should be ensured that the identities in training set and testing set are identical while face verification is much more flexible. Moreover, given a gallery set, face identification problem can also be solved with face verification by repeated one-vs-one comparison.

Since the huge success was achieved by convolutional neural network [12] in ImageNet [3] object classification competition in 2012 with a large margin advanced to traditional methods, convolutional neural networks have been adopted to more and more computer vision problems, including face recognition [22]. In the past years, more and more face recognition algorithms based on CNN [14, 21, 15, 19] have been proposed whose accuracies are superior to that of human or even higher

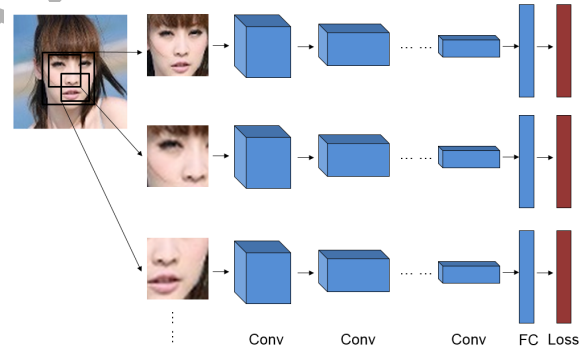


Figure 1: Overview of deep CNN model using multi-patch.

than 99% on LFW [10], a widely used face verification benchmark. Almost all of them train several models of the same architecture or extract multiple features based on various face patches for ensemble so as to improve the performance further by simultaneously taking advantage of global and local facial information as illustrated in Figure 1. However, there exist many limits in such an ensemble way. Multiple forwarding operations either on several models [21, 14] or one model [15] are required for each image to extract features during testing, which will introduce linearly increased computation or running time and slow down the recognition process. In addition, the improvement is usually not linearly with the number of models used and may get saturated. Take DeepID2 [21] as an example. It trains 200 CNN models based on different face patches and the corresponding horizontally flipped counterparts. At testing time, up to 25 highly selective features are picked out of the

Email addresses: zjuwenge@gmail.com (Ge Wen), yimao.zju@gmail.com (Yi Mao), dengcai@cad.zju.edu.cn (Deng Cai), xiaofeihe@cad.zju.edu.cn (Xiaofei He)

Download English Version:

<https://daneshyari.com/en/article/8960120>

Download Persian Version:

<https://daneshyari.com/article/8960120>

[Daneshyari.com](https://daneshyari.com)