Robust face identification by means of optical correlation and deep learning

Matthieu Saumard[1]

[1]ISEN YNCREA OUEST

2 rue de la Châtaigneraie, 35510 Cesson-Sévigné

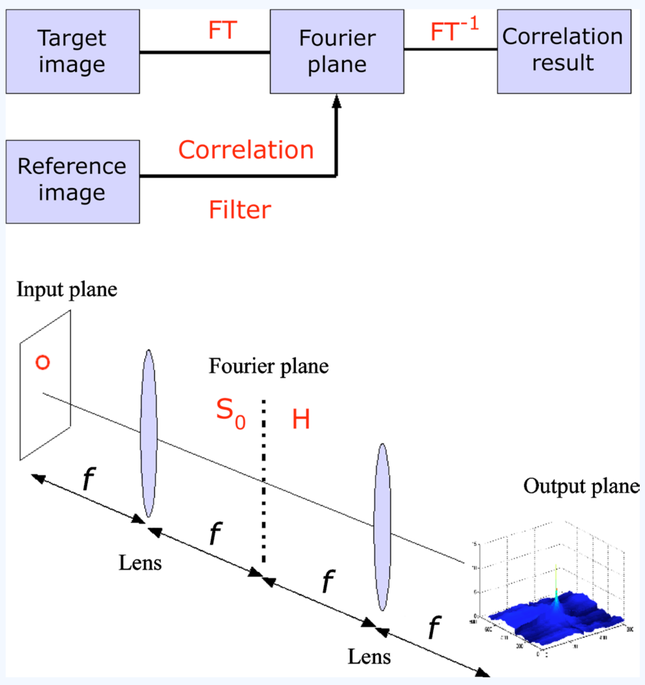
E-mail: matthieu.saumard@isen-ouest.yncrea.fr

Abstract

Optical correlation is a pattern recognition method which is very famous to recognize an image from a database. It is simple to implement, to use and allows to obtain good performances. However, it suffers from a global decision based on the location, height and shape of the correlation peak within the correlation plane. It entails a considerable reduction of its robustness. In this paper, to overcome these problems, we propose and validate a new method based on the correlation plane by means of deep learning via a CNN. The idea is to enhance the decision by taking into consideration the shape and the distribution of energy in the correlation plane. This relies on learning the correlation plane via a convolutional network. The advantages of the new method are the robustness and the directly transferable problem to other identification problem.

1 Optical correlation plane

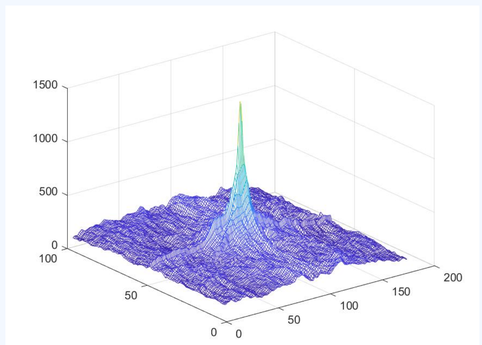
The method of correlation is described on the picture below, see [4] and [1].



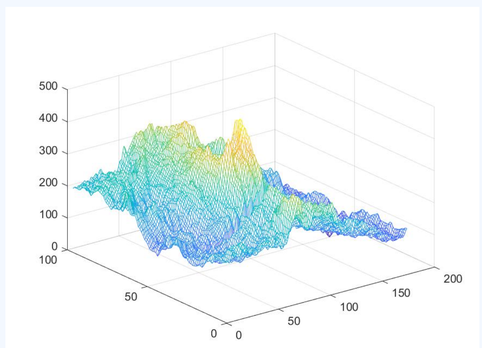
Illustrating the VLC principle.

There is two possibilities :

- we observe a peak when the images are similar:



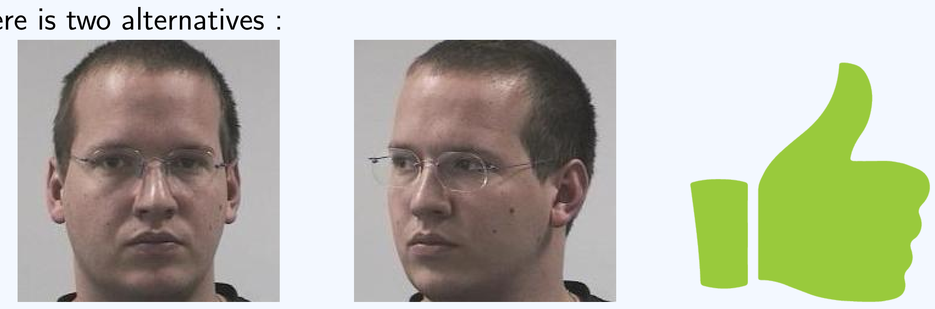
- there is no peak:

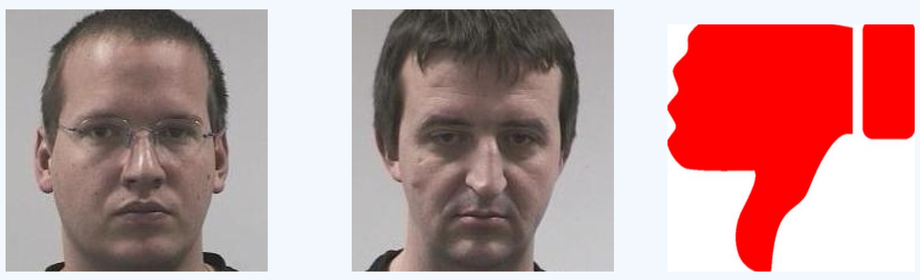


2 Face verification

The problem of face verification is to decide wether two images represent the same person or no.

There is two alternatives :

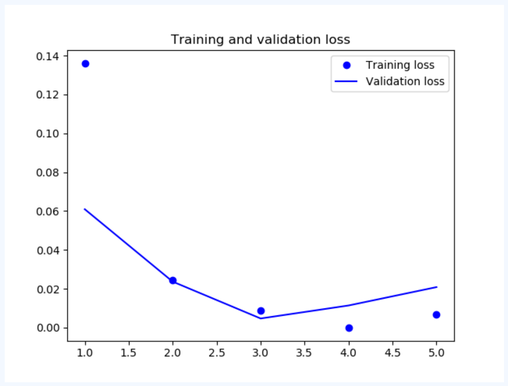
- 

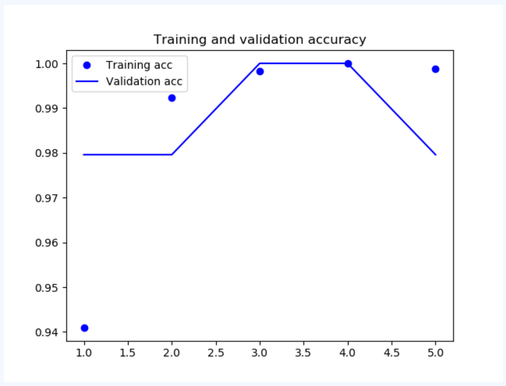
- 

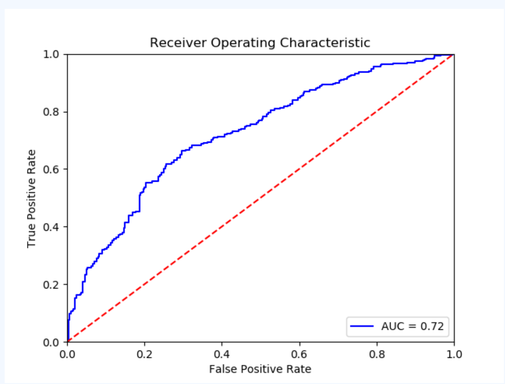
3 LFW Database

We use the popular Labeled Faces in the Wild (LFW) database [2]. It contains 13,233 images of 5749 different persons represented as 256 $\times$ 256 pixels JPEG images. For our experiments, we use two different datasets known as LFW-a. The former is the aligned version of LFW by Wolf et al. [3]. The LFW dataset is considered as uncontrolled due to the acquisition protocol: all of the images are the result of detections by the ViolaJones face detector [5] involving variations in age, ethnic, gender, lighting, expression, background, pose, etc.
The two used LFW datasets are already aligned and cropped and do not require preprocessing. In order to evaluate our new method in the context of face verification, we have used the standard LFW protocol for "Image-Restricted, No Outside Data" as describe by Huang et al. [2]. Particularly, we have used "View 1" for training and validation while "View 2" was used for final benchmarking. For our evaluation, we have considered the 10 random splits (train and test) of this second set.

4 First results







Roc curve.

References

[1] A. Alfalou and C. Brosseau. *Understanding correlation techniques for face recognition: From basics to applications.* In-Tech, 2010.

[2] G. B. Huang and E. Learned-Miller. Labeled faces in the wild: updates and new reporting procedures. Technical report, University of Massachusetts, 2014.

[3] T. Hassner L. Wolf and Y. Taigman. Effective face recognition by combining multiple descriptors and learned background statistics. *IEEE Trans. Pattern Anal. Mach. Intell.*, 2011.

[4] A. VanderLugt. Signal detection by complex spatial filtering. *IEEE Trans. Info. Theory*, 1964.

[5] P. Viola and M. Jones. Robust real-time face detection. *International Journal of Computer Vision*, 2004.