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# Face validation using skin, eyes and mouth detection

In unconstrained facial images, large visual variations such as those due to pose, scale, presence of occlusions, expressions and lighting cause difficulties in discriminating faces from the background accurately, so as a result, there are non-face regions that are recognized as faces (false positive), whereas the effectiveness of face detection algorithms is characterized by low false positive (FP) rate, high detection rate and high speed of processing. So, to reduce these non-face regions, instead of developing accurate face detection algorithm that needs much time for processing, face validation step will be added after the detection. In this paper, new fast face validation method is proposed. It consists of two steps, the first one is skin detection using YCbCr color method. The second step is eyes and mouth detection using Cascading approach; In this step, region of candidate face is divided into two overlapping regions, one for the eye detection model and the other for mouth detection model. For evaluation our method, SVM face detection algorithm is used as a baseline validation algorithm. The experimental results on FDDB dataset showed a better performance of our proposed method (2 ms validation time compared to 500 ms in the SVM algorithm) and a similar number of rejected FP.

**Keywords:** face detection, validation, false positive, cascading approach.

## Introduction

Face detection is one of the mostly studied problems in vision, it has been actively researched for over two decades [1]. Face detection is considered as a problem of single-class object detection, and it is an important field of research in computer vision, because it forms a necessary first step for many face processing systems such as face recognition, face tracking, face verification and identification or facial expression analysis. The purpose of the face detection step is to determine whether there are any faces in an image (or video sequence) or not, it is a classification between faces and non-faces. So, if there are faces, the detection system will return their positions and scales or in other words «face localization», but what are the algorithms which allow computers to detect faces in images.

Actually, the field of Machine Learning is filled with many algorithms for learning complex representations and models from training data and distinguishing between different categories (faces vs non-faces). This distinguishing requires different algorithms than distinguishing between similar object categories (motorcycles vs bicycles), because the distribution of non-faces or background is very widespread in contrast of face distribution that is small.

There are a wide range of face detection algorithms, most famous of them have been based on cascading approach [2–5] and Deformable Parts Models (DPMs) [6–9]. More recently, following the success of deep learning for computer vision, e. g. [10–14], methods based on Convolutional Neural Networks (CNNs) have been applied to object detection tasks, e. g. [10].

Many face detection systems contain one step that verifies the ROIs classified as faces. These ROIs may contain many non-face regions or false positives that must be rejected. The validation step filters false positives, using criteria that do not overlap with the classifier.