A Study of Face Detection Using CNN and Cascade Based on Symmetry-LGP & Uniform-LGP and the Skin Color

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Abstract. This paper offers toughness to external factors such as lighting, background, angle and improved algorithm on detecting speed. This paper uses the S-LGP(Symmetry Uniform Local Gradient Pattern) and U-LGP(Uniform Local Gradient Pattern) methods that improve the symmetry and uniform using the LGP(Local Gradient Pattern) that are stronger against external factors such as changes of lighting, facial expression, background etc. than the LBP(Local Binary Pattern) through preprocessing the input image and the skin color extracting method at the YCbCr space using the Cascade Classifier Training extractor that forms XML files which is made from gathering and studying the positive face sample and negative face sample at a 1:2 rate and uses the CNN(Convolution Neural Network) of deep learning algorithm to study it. Suggested algorithm is applicable for applications, as well as improve the accuracy of detection.

Keywords: LBP, LGP, S-LGP, U-LGP, Symmetry, Uniform, YCbCr, Cascade Classifier, XML, CNN

1 Introduction

In this paper, reduce affected by external factors it had conducted a study for the sophisticated face detection algorithm. Tend to receive much influenced by external factors such as changes in the nature of LBP [1] lighting, facial expressions, and backgrounds used the LGP to compensate[2]. Using the CNN algorithm is the method using the S-LGP and U-LGP improved with a Symmetry Uniform and using Cascade Classifier Training [3] method for detecting skin color in the YCbCr space [4][5] studied an algorithm that can improve the accuracy more[6][7]. Using this study was an algorithm that can improve the accuracy.

2 Proposed Method

The most important process to the face recognition is to accurately detect a face from
Fig. 1. The Proposed Method

the image. Face detection minimizes the effects of lighting, background and increase the detection rate to process in real-time. Figure 1 used a strong LGP to changes in lighting, facial expressions, and background areas after Gray-Level Transformation. In this paper, we use a modified S-LGP and U-LGP by Symmetry and Uniform. It proposes a method for learning a method of detecting a skin color in the YCbCr space by Cascade Classifier Training detector. It offers a way to learn this method on CNN algorithm. CNN algorithm lessens the size of feature map by using several feature maps alternating convolutions layer and sampling layer. At the last stage, a single data is produced from each feature map and is used to connect neurons of a general nerve network. Therefore it is called a fully connected layer and the values acquired at the convolution layer and sampling layer goes through this fully connected layer to be the final result. It takes a relatively long term of learning because weights of different layers has to be adjusted but results are more accurate.

3 Experimental Results

To verify reliability of the proposed method, used test images provided by Yale Face database. Figure 2 is a test result of test image: 57 faces were detected with 2 mis-detection and 2 faces were undetected out of total 42 people. I used a variety of
images that color images, black-and-white images, group pictures, individual pictures, dark images, bright images, slightly tilted images, etc. Most of them are front pictures and I conducted a test comparing performances of different algorithms including Haar-like, LBP+Adaboost, LGP+Adaboost, S&U LGP+Skin color+Adaboost and S&U LGP+Skin color+CNN by using them. Table 1 shows the result of the test.

![Test Image](image)

**Fig. 2.** Test Image

**Table 1.** Comparison of Efficiency(%)  

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>True detection (%)</th>
<th>False detection (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haar-like</td>
<td>89</td>
<td>80</td>
</tr>
<tr>
<td>LBP, Adaboost</td>
<td>90</td>
<td>61</td>
</tr>
<tr>
<td>LGP, Adaboost</td>
<td>92</td>
<td>49</td>
</tr>
<tr>
<td>S&amp;U LGP, Skin Color, Adaboost</td>
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<td>30</td>
</tr>
<tr>
<td>S&amp;U LGP, Skin Color, CNN</td>
<td>96</td>
<td>14</td>
</tr>
</tbody>
</table>
4 Conclusions

This paper has developed a face detection system that are not affected much by the surrounding environment. It was proved that the proposed S&U LGP algorithm has a better performance than Haar, LBP, and LGP algorithms that are among the most frequently utilized face detection algorithms by conducting a test comparing their performances with test images provided by Yale face database along with additional test images of various environments.

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References