Influence Analysis of Each Facial Region on Facial Expressions Recognition

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Abstract. Many researchers are conducting research to detect human emotions based on facial expressions. In this study, we tried to classify facial landmarks by face area and find out which area has the most influence on emotion recognition. To this end, we extracted 68 landmarks by receiving human face images. After that, the input image was divided into eyebrow region, eye region, nose region, and mouth region along the landmark. Seven universal emotions were evaluated for the divided images. As a result of the experiment, we confirmed that the mouth area has the most influence on emotions.

Keywords: Facial Region, Facial Expression, Facial Landmark

1 Introduction

A lot of systems are being developed that recognize emotion through existing facial information and apply them to various fields. In universal emotion is to recognize seven emotions (happy, angry, disgust, fear, neutral, sad, surprise) from the extracted data. By using this emotion information, it can be used in the fields of human behavioral psychology, security industry, and marketing. Facial recognition systems are systems that analyze and recognize changes in facial joints and muscles, and are operated by geometric information based recognition methods. However, in this paper, we analysis of influence of facial region on facial expression recognition.

2 Proposed System

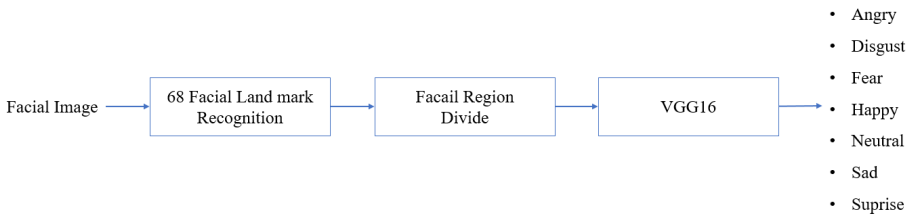

Fig. 1. A Flow char of the proposed system.

Proposed system is composed of 3 steps as shown in Fig. 1. Firstly, we recognize the 68 facial landmark from input facial image by Adrian Rosebrock's facial landmarks[1,2] as shown in Fig. 2. Secondly, we divide the facial region to eyebrow region, eye region, nose region, and mouth region along the landmark as shown in Fig. 3. Thirdly, we recognize facial expression by VGG16 as shown in Fig. 4.

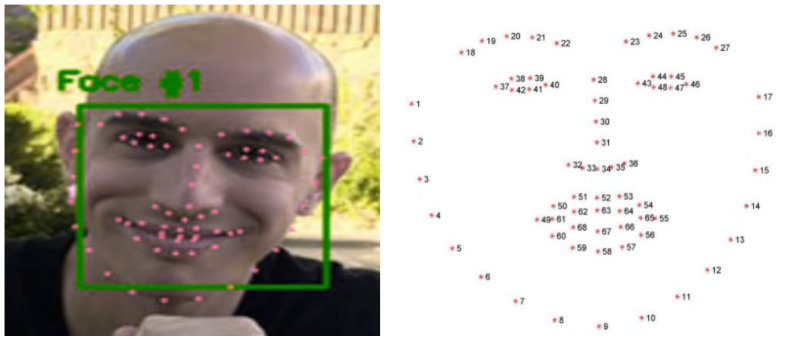

Fig. 2. Example of 68 facial landmark[1]

Fig. 3. Example of facial regions

Layer	Filter Size	filters	Output Size	
input			64x64x3	
Conv2D	3x3	32	64x64x32	
reLu				Activation
Pool	2x2		21x21x32	
Dropout				0.25

Conv2D	3x3	64	21x21x64	
reLu				Activation
Conv2D	3x3	64	21x21x64	
reLu				Activation
Pool	2x2		10x10x64	
Dropout				0.25

Conv2D	3x3	128	10x10x128	
reLu				Activation
Conv2D	3x3	128	10x10x128	
reLu				Activation
Pool	2x2		5x5x128	
Dropout				0.25
Flatten			3200	
Dense			1024	
reLu				Activation
Dropout				0.5
Dense			7	
Sigmoid				Activation

Fig. 4. Structure of VGG16

3 Experiments & Results

We use a large dataset of facial expression named FER2013 [3] as shown in Fig. 5. This dataset consist of 48x48 gray-scale images: 28711 for training, 7176 for validation and testing. In our experimentation, 7176 image used for testing.

Fig. 5. Samples of FER2013 from training dataset

In the case of the collected data, it is a dataset that is configured to understand human emotions in consideration of facial expressions. After recognizing the face part using dlib's shape_predictor_68_face_landmark, it was prepared by proceeding with normalization to (64,64,3) by proceeding with crop. We conduct the 300 epoch, 1e-3 loss rate, 64 batch size, Adam's optimizer and binary cross-entropy loss function. Figure 6 shows that the results of facial expression with FER 2013 on facial region. Frist row, image is only use the VGG16. Second row, all_landmark is use the 68 facial landmark with VGG16. Third, mouth is use the mouth region with VGG16.

	loss	accuracy	val_loss	val_accuracy
image	0.1635	0.7624	0.2204	0.6939
all_landmark	0.0791	0.7746	0.1199	0.6879
mouth	0.2136	0.6711	0.2892	0.5484
eye	0.2569	0.597	0.3607	0.4277
eyebrow	0.2859	0.5313	0.3329	0.4479
nose	0.2754	0.5619	0.3177	0.496

Fig. 6. Results of facial expression with FER 2013 on facial region

4 Conclusions

As a result of the experiment, we were able to confirm that the order of influence on facial expression recognition among facial regions was in the order of mouth, eyes, nose, and eyebrows.

References

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