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A FACIAL EXPRESSION ANALYSIS FOR EMPLOYEES STRESS DETECTION

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In private sector and public sectors success rate is fully depends on the productivity of employees. Productivity of employees is truly depends on their mental balance. To meet the project deadlines and targets maintaining mental balance makes essential factor. But to achieve the same employees are carrying work pressure and stress. A high level of stress is the cause for losing the mental balance and same may be the cause for decrease in work productivity. In collaborative work environments stress is transferred from one to other easily because here one to one dependency is more. Companies are spending more money to make employees effective with their refreshment programs in regular intervals. In this method employers are failing to identify when exactly refreshment is required to their employees. This paper explains one of the solutions for this problem by deploying facial expression detection in work environment for identifying the stress levels. Here Haar filter, convolution neural networks and deep machine learning techniques are used for emotion detection. This is facilities less time for employees stress detection with more accuracy. Productivity, Mental balance, Collaborative work environment, high level of stress, refreshment programs, facial expression detection, Haar filter, convolution neural networks and deep learning.

1 Introduction

According to the [6], work is stress as the harmful physical and emotional responses that occur when job requirements do not match the workers capabilities.

1.1 Types of stress

There are three types of stress namely

• Eustress: From Shamshul (2014), his view on eustress is the stress that results from a positive view of an event or situation, which is why it is also called "good stress.

• Distress/dysfunctional: type of stress on the other hand, is being overwhelmed with stressors in certain situation which negatively leads to distress, unpleasant feeling and as a result affect one's attitude towards a stimuli hence low performance.

• Hyper-Stress: If the person pushed beyond what one can handle, which turns in to Hyper-stress. More times it occurs due to workload. This type of stress occurs when

constant heavy financial difficulties, work both at home and office, Continuous tension.

1.2 Symptoms of stress

Prakash B. (2015), in his research work stress of employees, he suggested that, following are the some early symptoms of stress.

1. Head ache
2. Fatigue
3. Increased absenteeism
4. Altered performance
5. Changes in attitude, behavior or mood
6. Aggressive
7. Conflict with others
8. Diminished work relationships
9. tiredness

1.3 stressors

the following are considered as stressors

1. Workload
2. Longer working hours
3. Lack of staff recognition effort
4. Role conflict
5. Poor work-life balance
6. Poor working conditions

1.4 Effects of stress

the following are effects of stress

1. Ill health
2. Absenteeism
3. Accident
4. Staff turnover
5. Disengagement
6. Low performance

1.5 strategies to reduce the stress levels

The below mentioned strategies may help to reduce the stress level of employees in an organization.

1. Know individualâ€™s personality type
2. Design job to meet employeesâ€™ strength, Weakness and pressure point

3. Provide effective social support to employees
4. Ensuring employee work-life integration.

Even though by following above mentioned key actions some how organizations are failing to reduce the work pressure in collaborative work environment. Employeeâ€™s emotion detection with automated face detection helps to measure their stress levels. This reduces the employer manual task to mentor the stress level of their employees, their emotions of are categorized as

1. Angry
2. Disgust
3. Fear
4. Happy
5. Sad
6. Surprise
7. Neutral

2 LITERATURE STUDY

2.1 Steps in face emotion detection

As per various literature surveys it is found that for implementing this project four basic steps are required to be performed.

1. Preprocessing
2. Face registration
3. Facial feature extraction
4. Emotion classification

Here deep learning neural network is going to use for employees emotion detection with machines. Below mentioned Fig.1 represents the formation of problem solving steps.
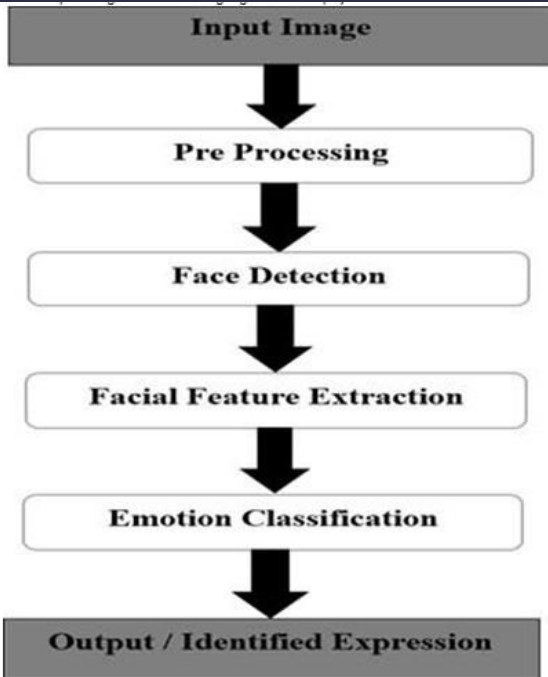
Figure 1: Formation of problem solving steps in face emotion detection

2.2 Preprocessing

Preprocessing is a common name for operations with images at the lowest level of abstraction both input and output are intensity images. Most preprocessing steps that are implemented are

• Reduce the noise
• Convert the image to binary/gray scale
• Pixel brightness transformation
• Geometric transformation

2.3 Face Registration

Face registration is the process of extraction a face from the image. This is done by using a technique called face localization or face detection with some set of landmark points. These detected faces are used for normalized to match some template image in process called face registration. That is represented in below mentioned Fig.2 in squares.
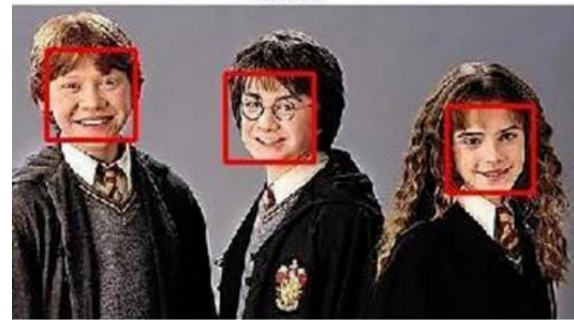

Figure 2: Face registration

2.4 Facial feature extraction

It is defined as the process of locating specific regions, points, landmarks, or curves/contours in a given 2-D or 3-D image. Registered image is taken as input to this process and it generates resulting numerical feature vector. Fig.3 is the representation of facial feature extraction. The following common features extracted are
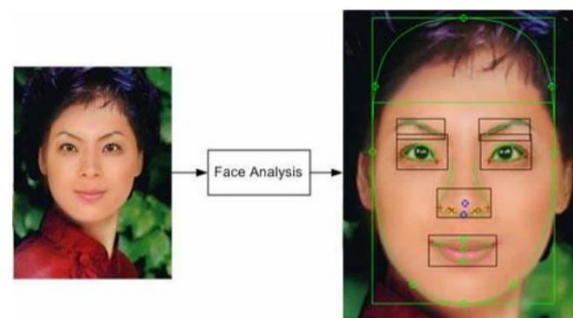
1. Lips
2. Eyes
3. Eyebrows
4. Nose tip

Figure 3: Representation of facial feature extraction

2.5 Facial emotion classification

It is a algorithm that try to classify the given face in a image to one of the seven basic emotions. Below Fig.4 represents the basic emotions classification.

Figure 4: Representation of facial emotion classification

Face classification is possible to achieve by following different approaches. They are listed below

• Neural network approach

• Principal of component analysis

• Gabor filter

In current project neural network approach is chosen by considering the factor like

training the machines and its data set availability.

3 Design

Design of employees facial expression detection system is represented in data below model and it is categorized into 4 levels.

• Level 1: To show the overview of whole model, which is shown in Fig.5

• Level 2: Break down the whole system in to context based representation, which is shown in Fig.6

• Level 3: Face detection with Haar cascade filter and Adaboost algorithm, which is shown in Fig.7

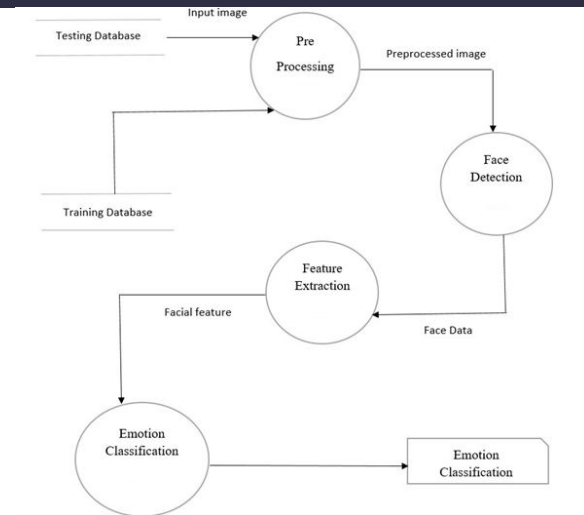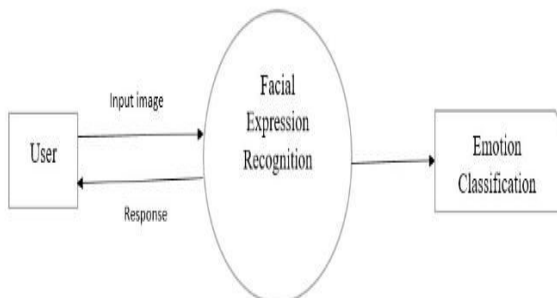• Level 4: Emotion detection, which is shown in Fig.8
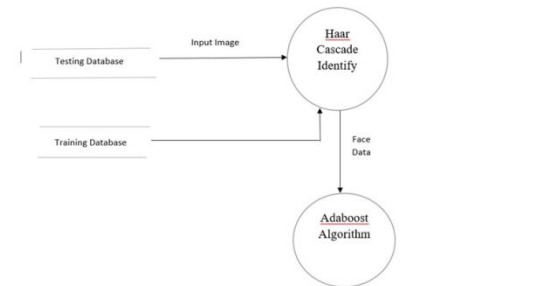

Figure 6: Context based representation

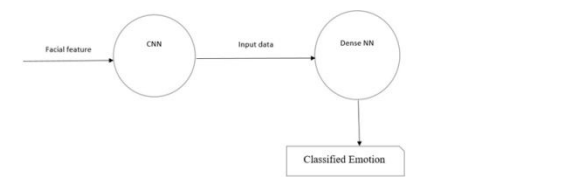
Figure 7: Representation of face detection

Figure 8: Representation of emotion detection

4 Implementation

4.1 Data set

Kaggle facial expression recognition challenge FER2013 data set is taken for deep learning training set by considering below factors.

• The data consists of 48x48 pixel grayscale images of faces.

• The faces have been automatically registered so that the face is more or less centered and occupies about the same amount of space in each image.

• The training set consists of 28,709 examples. The public test set used for the leaderboard consists of 3,589 examples. The final test set, which was used to determine

the winner of the competition, consists of another 3,589 examples.

1. 0: -4593 images- Angry
2. 1: -547 images- Disgust
3. 2: -5121 images- Fear
4. 3: -8989 images- Happy
5. 4: -6077 images- Sad
6. 5: -4002 images- Surprise
7. 6: -6198 images- Neutral

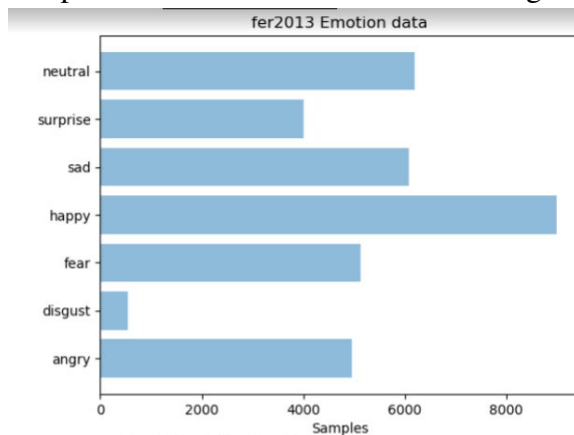Samples of data set is shown in below Fig.9

Figure 9: Kaggle data set samples representation

4.2 Library and packages

• OpenCv
• Python Numpy package
• Python SciPy package
• Keras
• TensorFlow

4.3 Model

Deep learning is a one of the technique for computer vision. Convolution neural network layers taken for creating the model architecture. In general convolution neural network contains below mentioned layers

1. Input layer
2. Some convolution layers
3. Some dense layers
4. Output layer.

These layers are ordered in sequence as shown below as shown in below Fig.10.
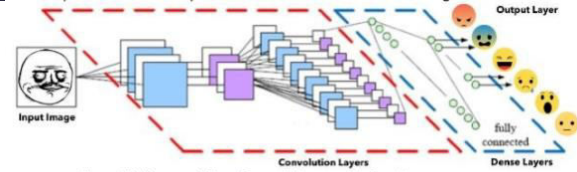

Figure 10: Representation of convolution neural network

• Input layer: Input image need to processed before fed to the input layer with OpenCv and a computer vision library called Haar cascade filter xml for face detection and crop the the face from the input image.

• Convolution layers: The numpy array gets passed into the convolution 2D layer where we specify the number of filters as one of the hyper parameters. Pooling is a dimension reduction technique usually applied after one or several convolution layers.

• Dense layers: It work like the way neurons transmit signals through the brain. It

takes a large number of input features and transform features through layers connected with trainable weights.

• Output layer: The out put presents the probability for each emotion class.

5 Result

Figure 11: Representation of happy emotion

6 Advantages

1. With the implementation of above mentioned method, it is easy to identify the employees stress levels in the organization.
2. Refreshment programs effectiveness shall be increased.

3. Organization productivity and customer relation will increase.

4. Employees will feel comfort and they contribute completely for organization growth.

5. Cost of refreshment programs shall decrease.

6. By implementing this method along with CCTV monitoring, cost of project and number of PC required for security monitoring also decrease.

7 Disadvantages

1. Accuracy of the system is less it train it self completely

2. Face detection accuracy also effects the performance of the system

3. This system fails to identify emotion of multiple employees at same time

8 Conclusion

In the above mentioned way employees emotion may be identified by the computer. It maintains the this data for employer reference. With this method employer able to identify the employees stress levels based on the accuracy of face emotion detection. Based on analyzed results organization need to plan for employee refreshment programs.

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