convolutional neural network (CNN) architecture to classify images of facial emotions.

we are using the FER 2013 dataset

The dataset consists of 48x48 pixel grayscale images of faces. The faces have been automatically registered so that the face is more or less centred and occupies about the same amount of space in each image.

There are seven categories (0=Angry, 1=Disgust, 2=Fear, 3=Happy, 4=Sad, 5=Surprise, 6=Neutral).

The training set consists of 28,709 examples and the public test set consists of 3,589 examples.

MODEL ARCHITECTURE

The CNN has the following layers:

1. Input layer: Takes 48x48 grayscale images as input.

2. Convolutional layer: Uses a 3x3 kernel with 32 filters and ReLU activation function.

3. Convolutional layer: Uses a 3x3 kernel with 64 filters and ReLU activation function.

4. Max pooling layer: Uses a 2x2 window to reduce the spatial dimensionality of the output.

5. Dropout layer: Randomly drops 25% of the connections to prevent overfitting.

6. Convolutional layer: Uses a 3x3 kernel with 128 filters and ReLU activation function.

7. Max pooling layer: Uses a 2x2 window to reduce the spatial dimensionality of the output.

8. Convolutional layer: Uses a 3x3 kernel with 128 filters and ReLU activation function.

9. Max pooling layer: Uses a 2x2 window to reduce the spatial dimensionality of the output.

10. Dropout layer: Randomly drops 25% of the connections to prevent overfitting.

11. Flatten layer: Flattens the output from the convolutional layers.

12. Dense layer: Uses 1024 neurons with ReLU activation function.

13. Dropout layer: Randomly drops 50% of the connections to prevent overfitting.

14. Output layer: Uses 7 neurons with softmax activation function to output the probability distribution over the 7 facial emotion classes.

The model is compiled with a categorical cross-entropy loss function, Adam optimizer with a learning rate of 0.0001 and decay of 1e-6, and accuracy metric. The model is then trained using the fit generator method from Keras with a batch size of 64 and for 50 epochs on the training data, and evaluated on the validation data(test).

Model accuracy analysis

- **Confusion Matrix**
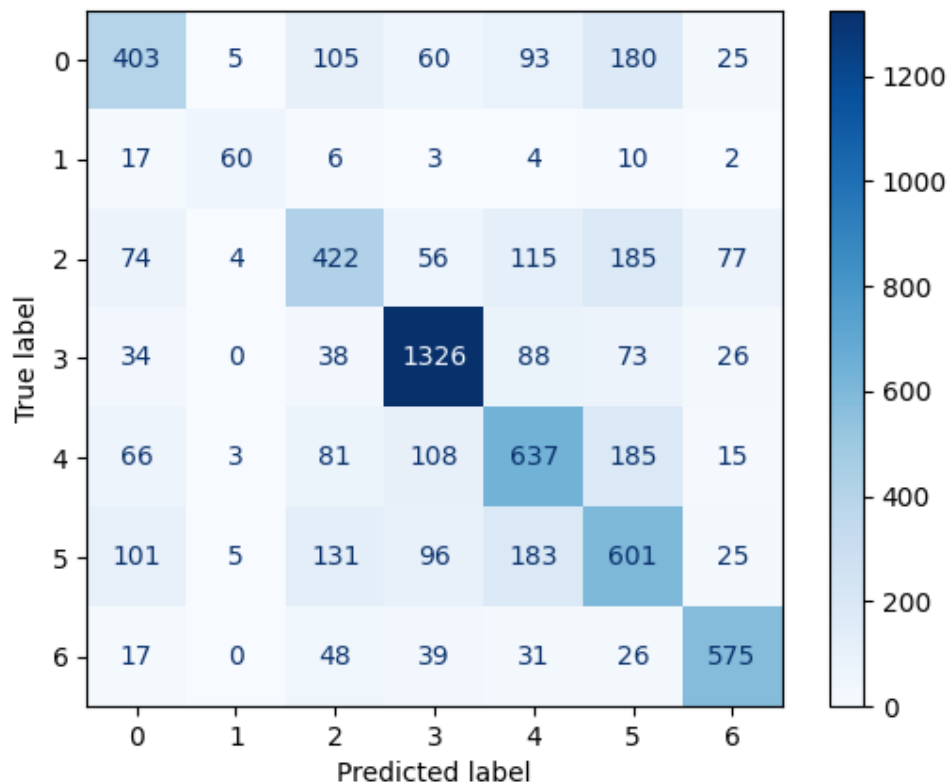
The accuracy of the model on the testing FER 2013 dataset is approximately 62%.

```
              precision    recall  f1-score   support

         0.0       0.56      0.46      0.51       854
         1.0       0.78      0.62      0.69        95
         2.0       0.51      0.46      0.48       922
         3.0       0.79      0.84      0.81      1617
         4.0       0.56      0.59      0.57      1118
         5.0       0.47      0.52      0.49      1126
         6.0       0.77      0.79      0.78       732

    accuracy                           0.62      6464
   macro avg       0.63      0.61      0.62      6464
weighted avg       0.62      0.62      0.62      6464
```