Facial Expression Recognition

Decoding Emotions Using ML

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Introduction

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This course project focuses on Facial Expression Recognition (FER) using CNNs to classify emotions from images. We preprocess data, used augmentation for better generalization. Our goal is to build a simple yet effective system for recognizing emotions with many potential future improvements.

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Methodology

Data Understanding:

- We reviewed the dataset, This step identified potential problem related to the dataset along with EDA.

Data Preparation:

- The provided dataset was split into training and testing dataset. Since the size of dataset was uneven, we used augmentation techniques and merged the augmented images with the training datasets.

Modeling:

- Implemented a CNN model for Facial Expression Recognition and applied data augmentation, batch normalization and dropout to improve generalization.

Evaluation:

- We evaluated the model using accuracy, precision, recall, and F1-score, along with confusion matrices to analyze classification performance. While the training accuracy exceeded 99%, the significantly lower test accuracy indicates overfitting.

Results & Performance Metrics

Classification Report Metrics
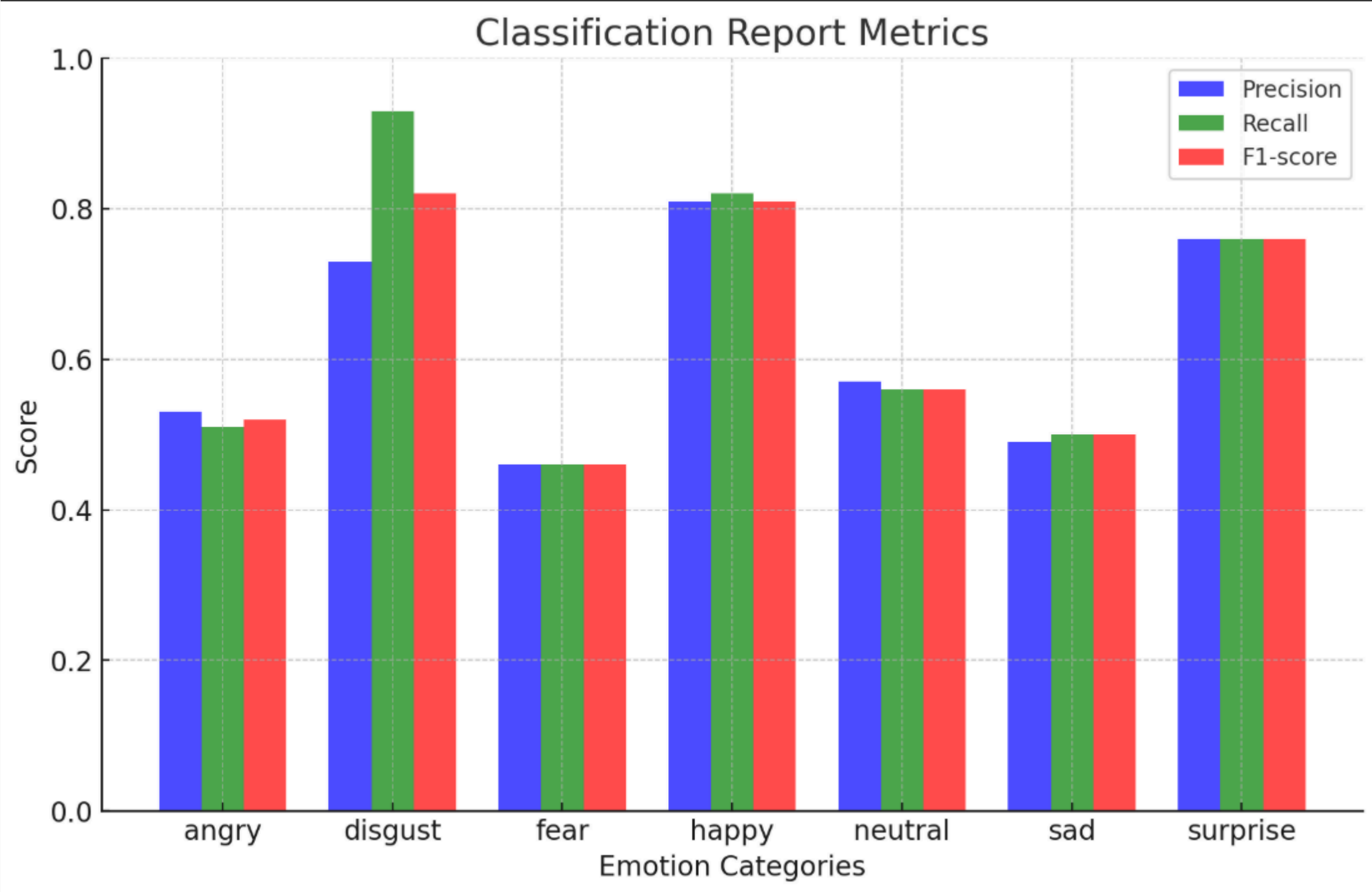
Model Evaluation Metrics:
Accuracy: 0.6208
Precision: 0.6190
Recall: 0.6208
F1 Score: 0.6197

Classification Report:

	precision	recall	f1-score	support
angry	0.53	0.51	0.52	799
disgust	0.73	0.93	0.82	88
fear	0.46	0.46	0.46	822
happy	0.81	0.82	0.81	1457
neutral	0.57	0.56	0.56	993
sad	0.49	0.50	0.50	966
surprise	0.76	0.76	0.76	635
accuracy			0.62	5760
macro avg	0.62	0.65	0.63	5760
weighted avg	0.62	0.62	0.62	5760

Confusion Report Metrics

Confusion Matrix
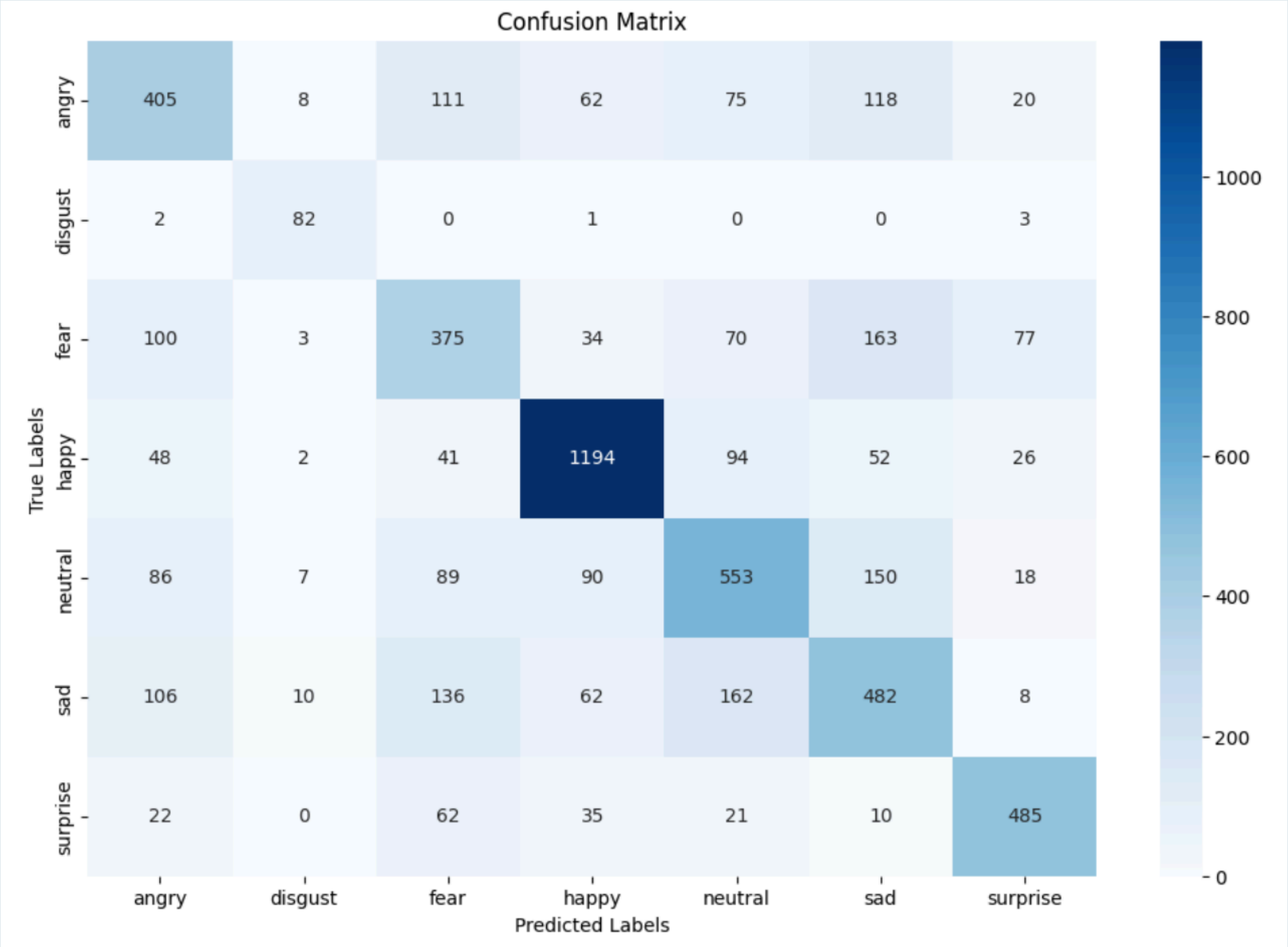
- **The model detects "happy" well but confuses "fear" and "sad."**

- **High misclassification between "angry" and "fear".**

- **Low value of "disgust" because of fewer training sample compared to other emotion.**

Conclusion and Future plan

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We have successfully achieved accuracy of 0.6208 with f1 score of 0.619 after optimizing our CNN model

Future Plan :

- We can use deeper CNN to capture more complex features.
- Address Overfitting: using advanced regularization methods to improve generalization.
- Deploy the model for real-world use such as in HCI, mental health monitoring, smart surveillance etc.
- Explore multi-modal emotion detection by integrating audio cues.

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Thank you