Facial Emotion Detection Using CNN

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Motivation

The ability to read emotions from faces is a very important skill. Despite different cultural backgrounds, humans express emotions similarly. Even then, reading emotions from faces is a tricky task. Thus, training a neural network to detect emotions from faces is an interesting and challenging problem.

Problem Statement

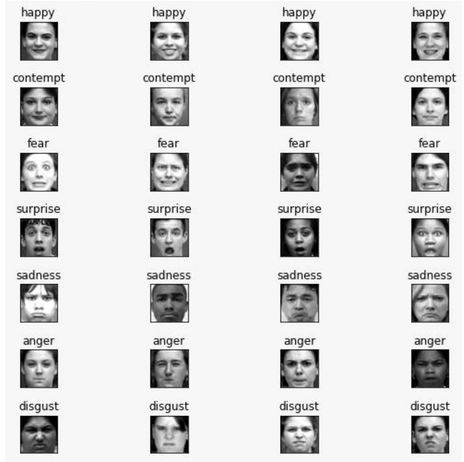
Main goal: Classify the type of emotion from images of faces

There are 7 emotions: Anger, Contempt, Disgust, Fear, Happy, Sadness, Surprise

Evaluation is based on prediction accuracy

Dataset

- **981** images in the original **CKPLUS** dataset (https://www.kaggle.com/shawon10/ckplus).
- **250** images chosen randomly for modelling.
- **Class Distribution**: Anger (45), Contempt (18), Disgust (44), Fear (25), Happy (45), Sadness (28), Surprise (45)
- Split into train (80%)



Methods

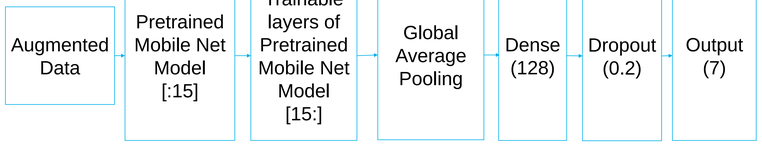
Models built and Evaluated

- Simple CNN Model
- CNN using Transfer Learning
  - Using ResNet architecture and Data Augmentation
  - Using MobileNet without regularization and Data Augmentation
  - Using MobileNet with regularization and Data Augmentation
- Dataset Enhancement using Conditional GAN

Experiments

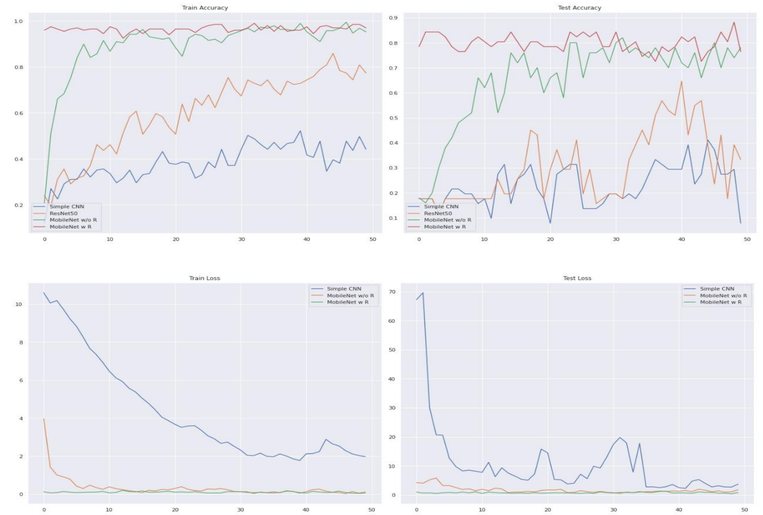
- Setting benchmark accuracy with custom architecture
- Transfer learning with ResNet, MobileNet, VGG16, VGG19, VGG Face
- Creation and training of customized conditional Generative Adversarial Networks to overcome small dataset size
- Augmenting data using Image Data Generator
- Validation with optimum weights from best model

Best Model Architecture



- Augmentation done to increase the training data and overcome dataset size
- ImageNet weights used for face detection in the initial layers
- Training done on current dataset for the subsequent layers
- Flattening using Global Average Pooling
- One Dense layer with ReLU activation function
- Dropout layer to reduce overfitting
- Output layer with seven nodes and Softmax activation.

Experimental Evaluation



The graphs above show the trends of accuracies and loss of train and test sets. Evidently, Model 4 (MobileNet model with Regularization) has the least loss with highest validation accuracy. Overfitting has been decreased here.

Conclusion

- Retraining few layers provides the best result in training and validation accuracy
- Most of the training is set at epoch 50
- Results of 84% on test set by MobileNet with regularization model.

Future Work

- Retrain with larger datasets
- Build CGAN on different dataset and train on current one
- Use an ensemble of models