



Emotional Face Classifier

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Background

- Faces are rich sources of emotional information
- Emotions can be organized categorically (e.g., happy, sad)
- Many people are quite good at rapidly and dynamically monitoring such information
- However, sometimes additional means of quantifying emotional expressions may be helpful

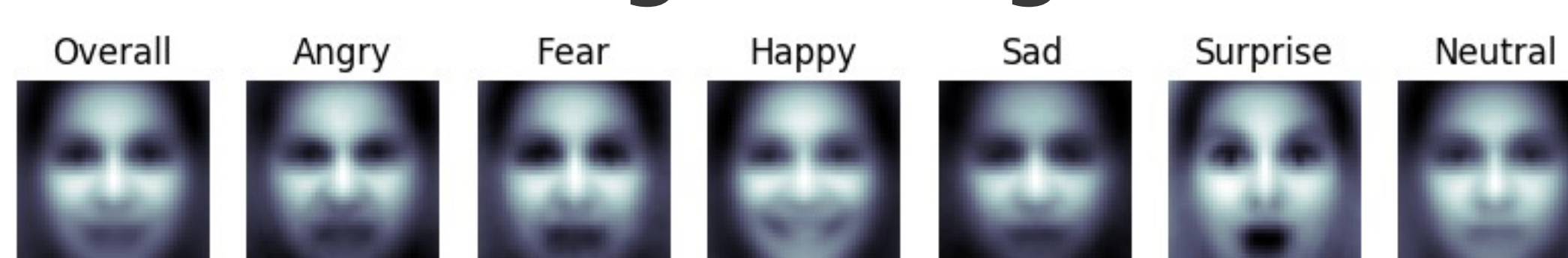
Data

- Data obtained from Kaggle FER2013 dataset ([www.kaggle.com / c /challenges-in-representation-learning-facial-expression-recognition-challenge/data](https://www.kaggle.com/c/challenges-in-representation-learning-facial-expression-recognition-challenge/data))
- Expressions: Angry, Fear, Happy, Sad, Surprise, Neutral and Disgust
- Disgust was dropped due to a low number of images (XXX)
- Images were 48x48, gray scale

Example Images



Averaged Images



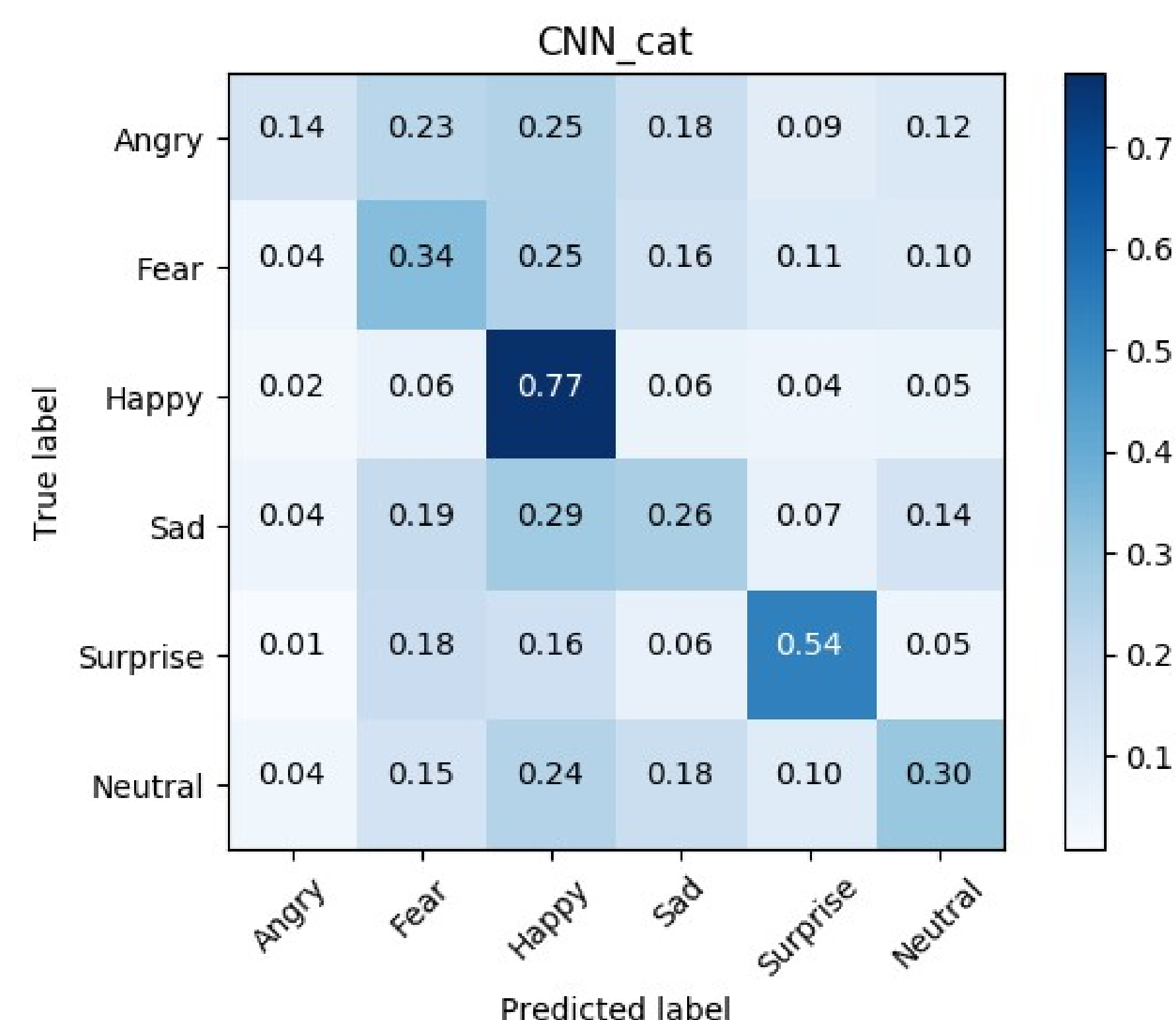
Label	Train #	Balanced Train #	Validation #	Test #
Angry	3995	3171	528	491
Fear	4097	3171	879	528
Happy	7215	3171	895	879
Sad	4830	3171	653	594
Surprise	3171	3171	415	416
Neutral	4965	3171	607	626
TOTAL	28273	19026	3977	3534

Models

- Multinomial Naive Bayes (MNB), Random Forest (RF), Convolutional Neural Network (CNN)
- Trained on balanced and unbalanced datasets

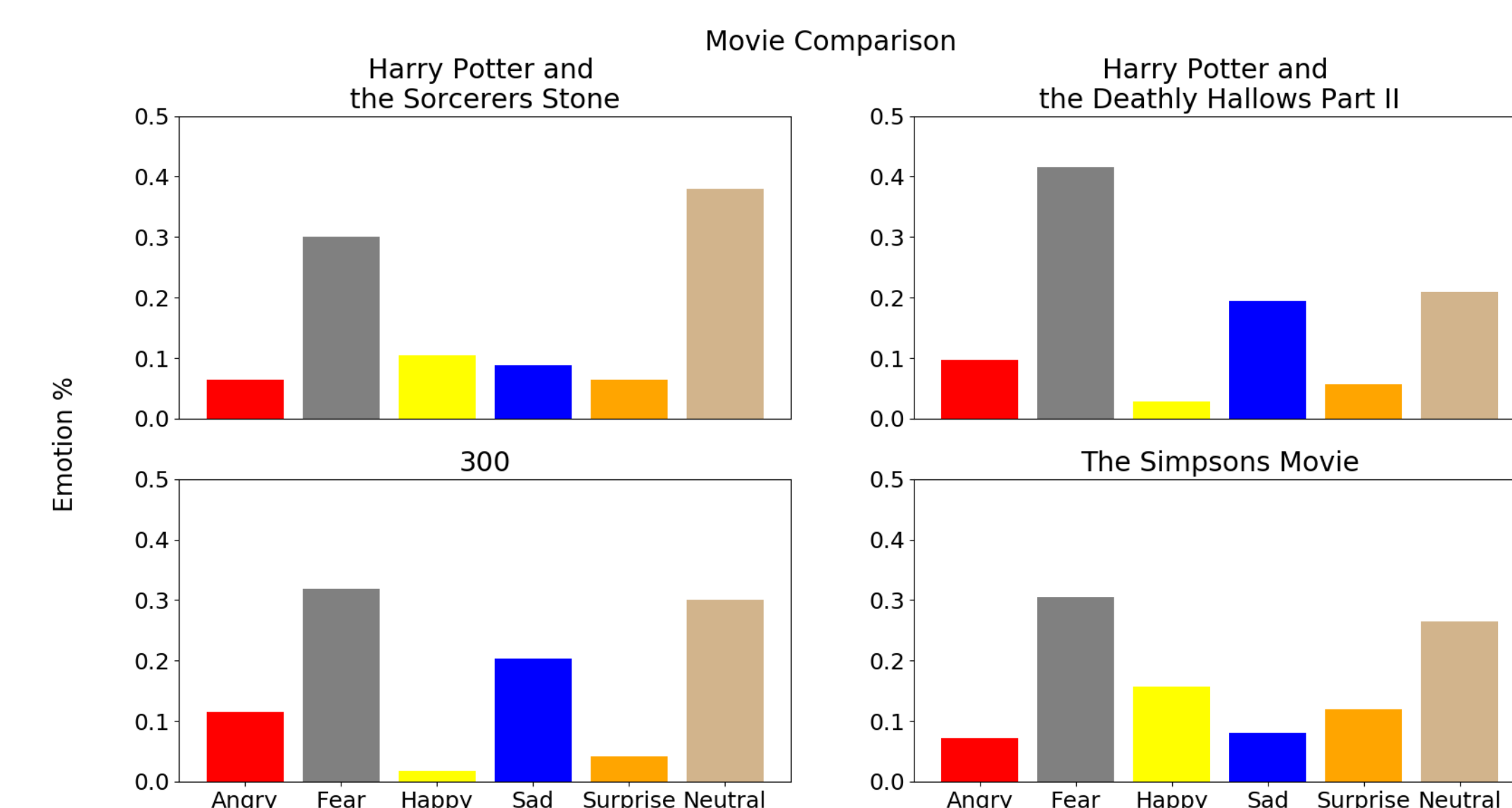
Model	Balanced	Train Log Loss	Test Log Loss	Train Accuracy	Test Accuracy
MNB	No	25.549	25.661	25.4	25.2
MNB	Yes	25.684	25.730	24.9	25.0
RF	No	0.331	4.733	99.1	37.4
RF	Yes	0.337	5.225	99.1	32.7
CNN	No	13.109	19.494	60.4	42.3
CNN	Yes	14.909	20.532	55.5	39.5

Results

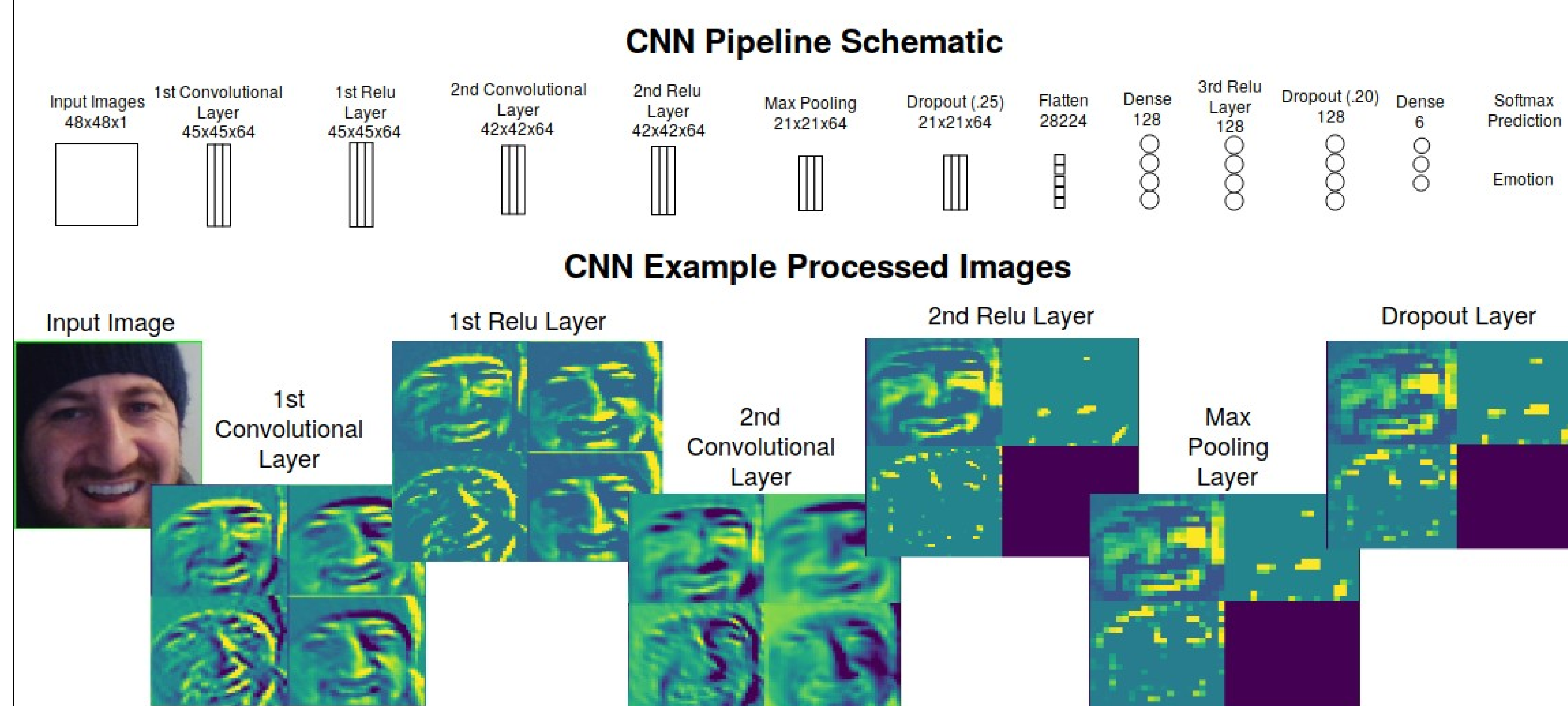


Test Case: Movies

- Classified all facial expressions in 4 movies

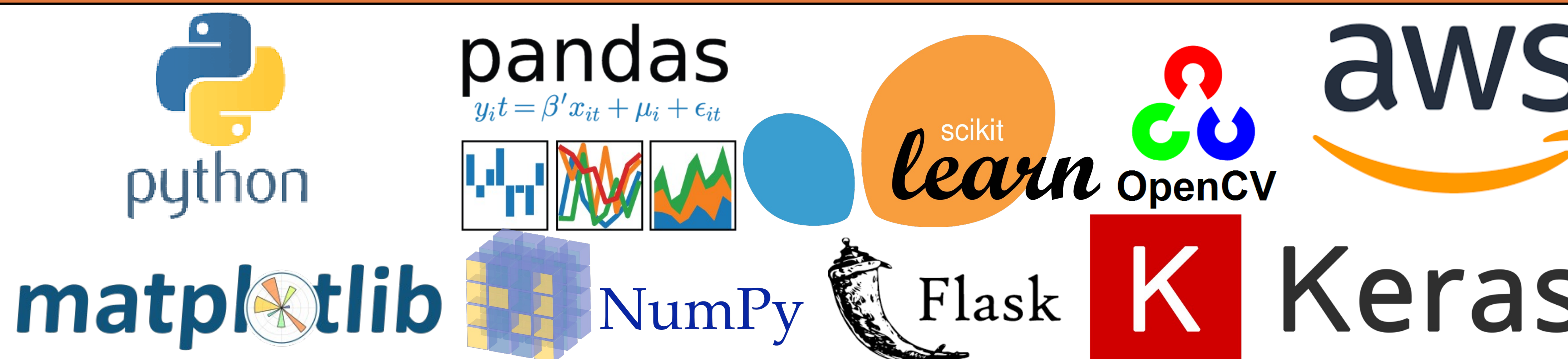


Convolutional Neural Network



- Convolutional Layers: 2
- Filters: 64
- Batch Size: 256
- Activation Layers: 4
- Pool Size: (2, 2)
- Epochs: 100
- Max Pooling Layers: 1
- Kernel Size: (4, 4)
- Total Classes: 6

Tech Stack



Conclusions

- Several machine learning models were able to classify emotion better than chance (i.e., 17% with 6 classes)
- The CNN model outperformed both Multinomial Naive Bayes and Random Forest models
- The CNN model trained on the full dataset performed best with an accuracy of over 40%
- Some emotions (e.g., happy and fear) appear easier to classify than others
- The model was successfully applied to static images, recorded video (motion pictures) and live stream video capture (webcam)

Future Directions

- Utilize model with real-time feedback to facilitate social interactions for individuals with emotion processing impairments
- Develop an app with user input and feedback to expand training dataset