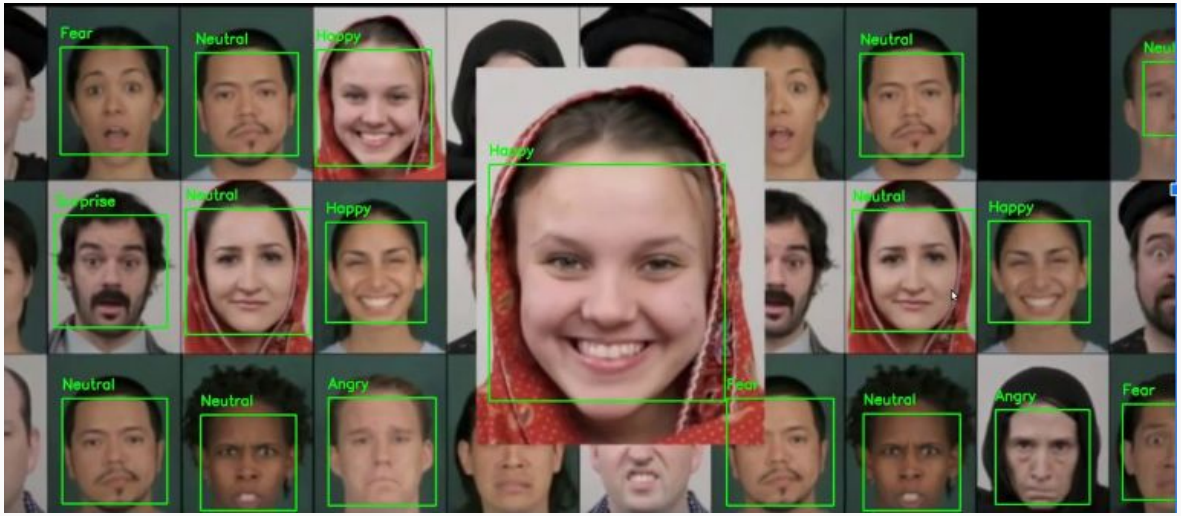
Facial Expression Recognition

By Rita Samir and Sohayla Mohammed

Overview

Problem

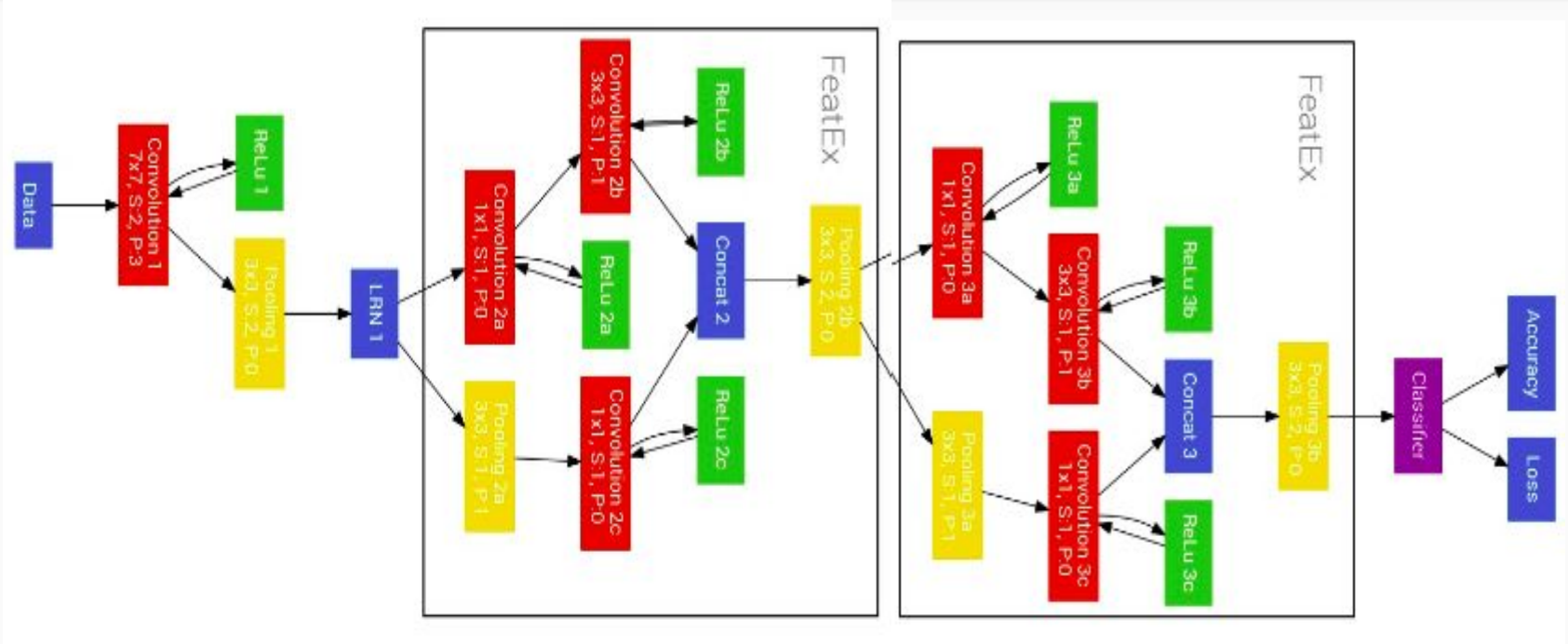
- **Facial expression recognition** software is a sentiment analysis tool and is able to automatically detect the six basic or universal expressions: happiness, sadness, anger, surprise, fear, and disgust.
- **Evaluation Metric :** Accuracy derived from confusion matrix



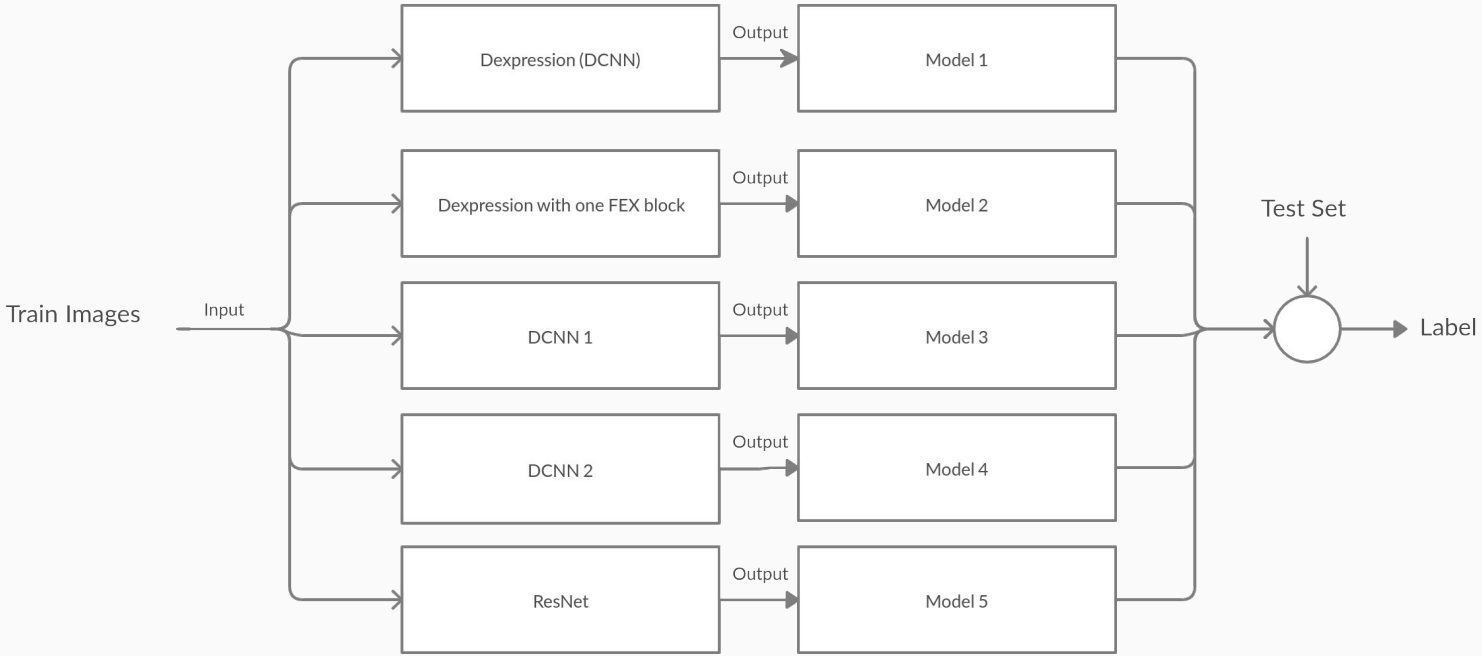
Datasets used

- Ck
  - 48x48 resolution.
  - Unique
  - Posed
  - 6 BEs & 1 Neutral.
- FER2013
  - 48x48 resolution.
  - Wild
  - Posed and spontaneous.
  - 6 BEs & 1 Neutral.

Dexpression model



Proposed Model : Ensemble



Proposed Model : Observations

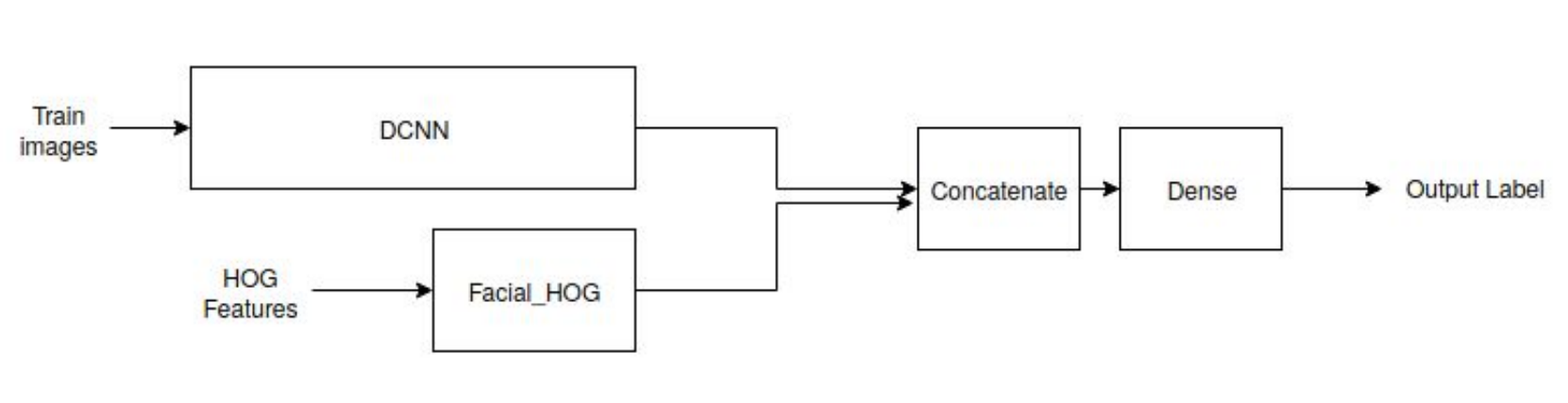
- Overfitting to data in some models.
  - ResNet model achieved training ~99%.
    - Tried implementing it from scratch.

- Simple DCNN models showed great performance, so we wanted to exploit that.

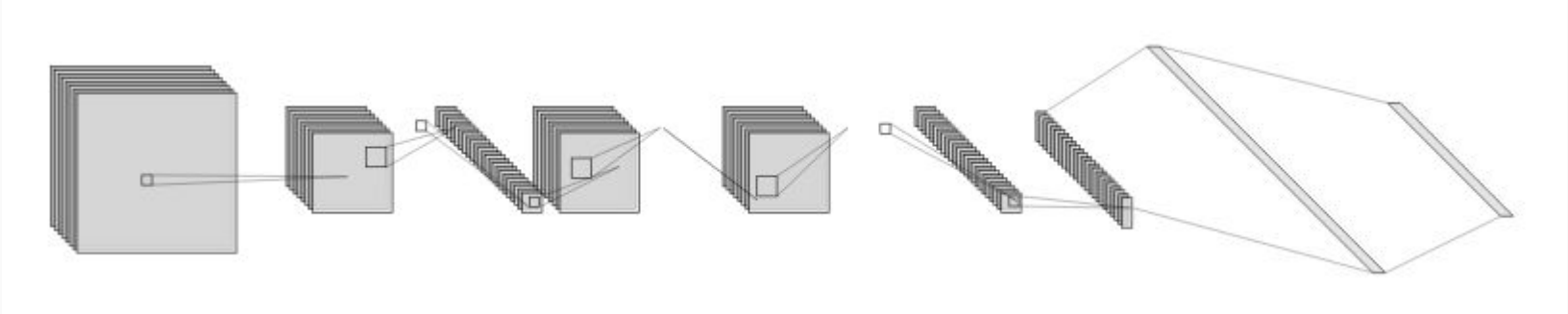
Histogram of Oriented Gradients : HoG

- Conventional Feature Descriptors.
- HOG descriptor is computed by calculating image gradients that capture contour and silhouette information of grayscale images
  - FER2013 are gray scale images.
- Showed great individual performance.

Merging of HoG with DCNN



Simple DCNN



Final Model Architecture

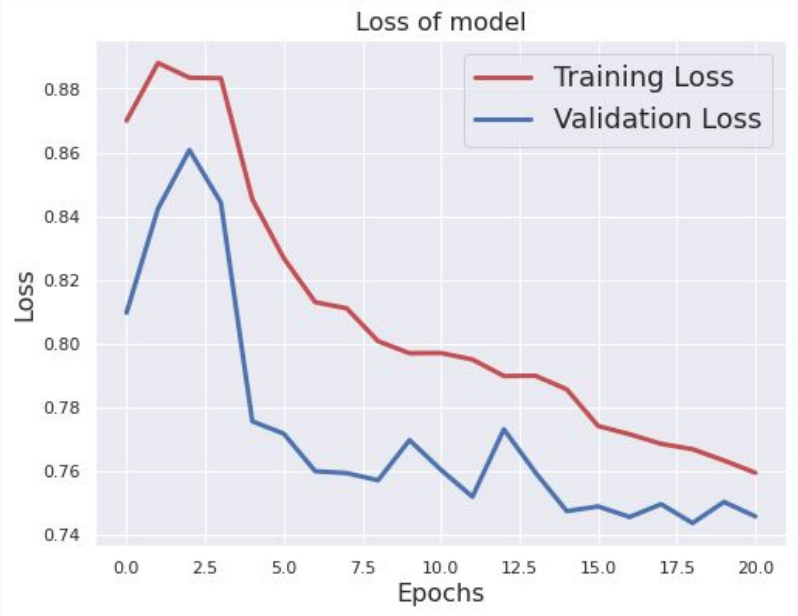
- After ensembling different models together, we found two models that achieve great performance together :
  - DCNN with HoG
  - Simple Built DCNN
- Ensemble using : Voting, Average, Weighted Average.

Results

DCNN_HOG

total wrong validation predictions: 1239

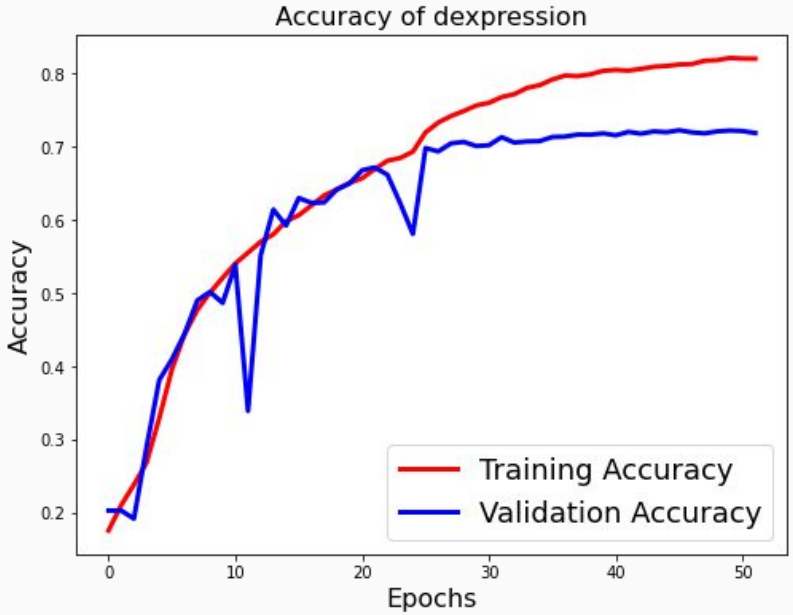
	precision	recall	f1-score
0	0.63	0.66	0.64
1	0.89	0.99	0.94
2	0.65	0.33	0.44
3	0.88	0.91	0.89
4	0.57	0.54	0.56
5	0.78	0.82	0.80
6	0.60	0.76	0.67
accuracy			0.73

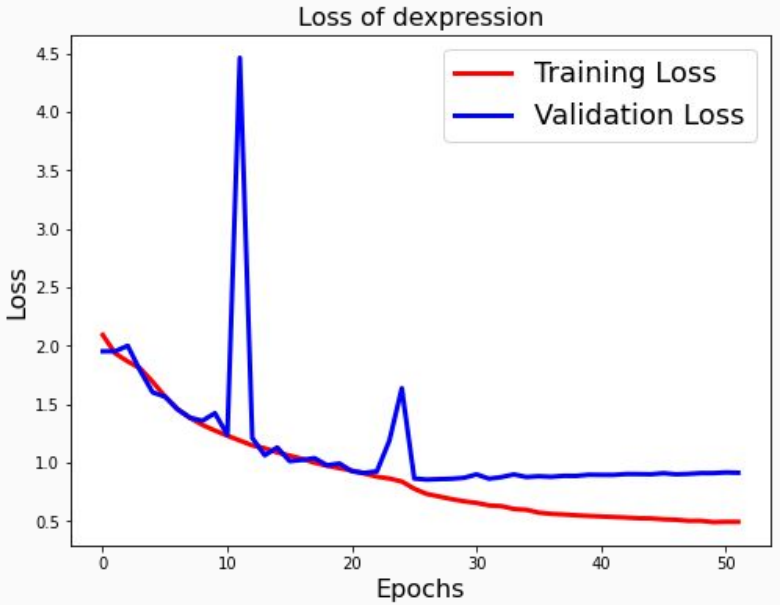


Simple Built DCNN

total wrong validation predictions: 1235

	precision	recall	f1-score
0	0.69	0.57	0.63
1	0.95	0.97	0.96
2	0.60	0.50	0.55
3	0.82	0.87	0.84
4	0.53	0.60	0.56
5	0.83	0.79	0.81
6	0.62	0.69	0.65
accuracy			0.72





Ensemble

```
[135] from sklearn.metrics import accuracy_score
      test_accuracy_score = accuracy_score(rounded_labels, labels_w_average)
      print(test_accuracy_score)
```

```
0.8499437570303712
```

```
[136] from sklearn.metrics import accuracy_score
      test_accuracy_score = accuracy_score(rounded_labels, labels_average)
      print(test_accuracy_score)
```

```
0.8434195725534308
```

```
[137] from sklearn.metrics import accuracy_score
      test_accuracy_score = accuracy_score(rounded_labels, labels)
      print(test_accuracy_score)
```

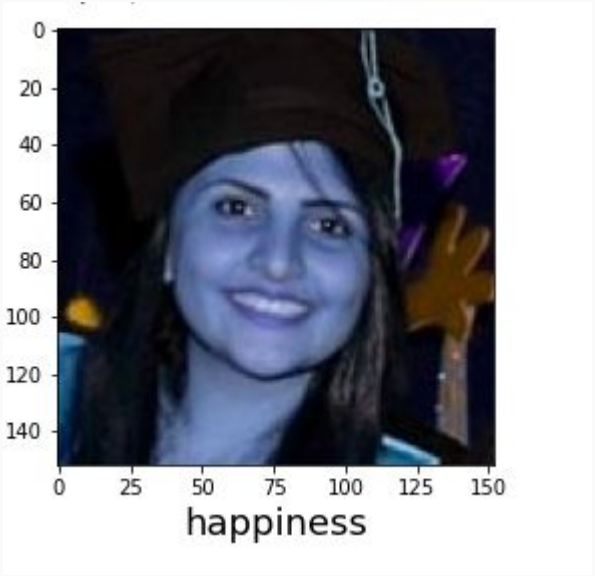
```
0.8137232845894263
```

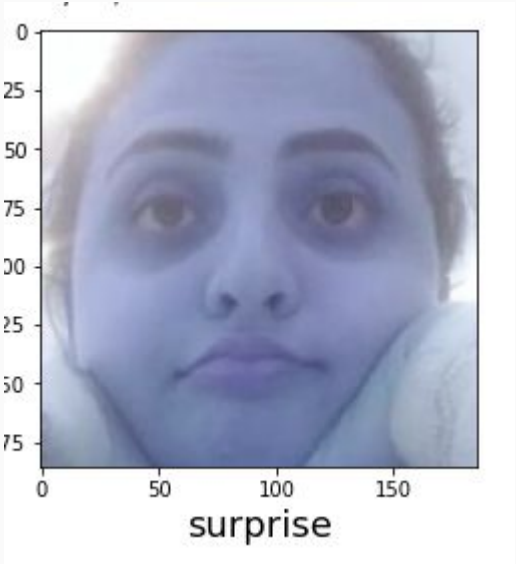
Results Summary

Model	DCNN_Hog	Cnn_2	Ensemble
Accuracy	73%	72%	**85%**

Demo

Demo





Link of the demo

Future Work

Future Work

- Consider pose Invariant image by creating a model, which jointly learns face frontalization and discriminative representation end-to-end that mutually boost each other to achieve pose-invariant face recognition.

- Consider other problems that may face facial expression recognition like illumination, pose, aging, and occlusion.

Team Contribution

	Sohayla	Rita
Research	yes	yes
Deployment of original model	yes	---
Deployment of proposed model	yes	yes
Deployment of final model	---	yes
Documentations	yes	yes

This Link shows our work from scratch till we reach to the current results

Thank you ^ ^.