ANALYSIS of using Hog vs CNN

The primary objective in this analysis is to generate optimal encodings for facial features, crucial for unique image classification.

To achieve this, we leverage dlib's face_recognition module, which allows us to choose the encoding algorithm. Different algorithms yield varying results in terms of quality and processing time.

In this investigation, a comparison is made between two algorithms: Convolutional Neural Network (CNN) and Histogram of Oriented Gradients (HOG).

1. CNN: A deep learning-based approach employing multiple layers to automatically learn and extract features. It produces high-quality encodings but requires more processing time due to its complex architecture.

2. HOG: A traditional computer vision-based approach analyzing gradient orientations distribution. It is computationally less intensive than CNN but may yield lower-quality encodings.

The use of both CNN and HOG enables us to evaluate their individual strengths and weaknesses regarding processing time and encoding quality. The appropriate algorithm choice depends on specific application requirements and available resources.

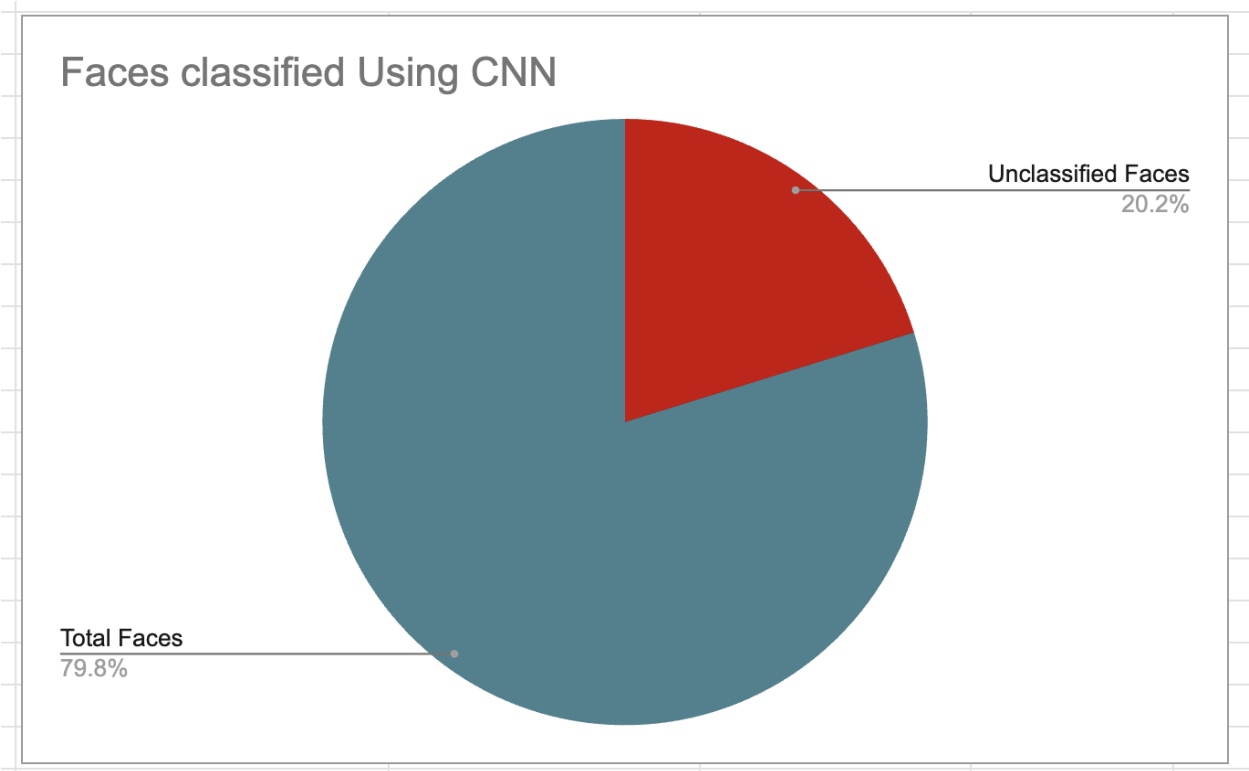
Detailed comparison of both the Algorithms on same Sample sets

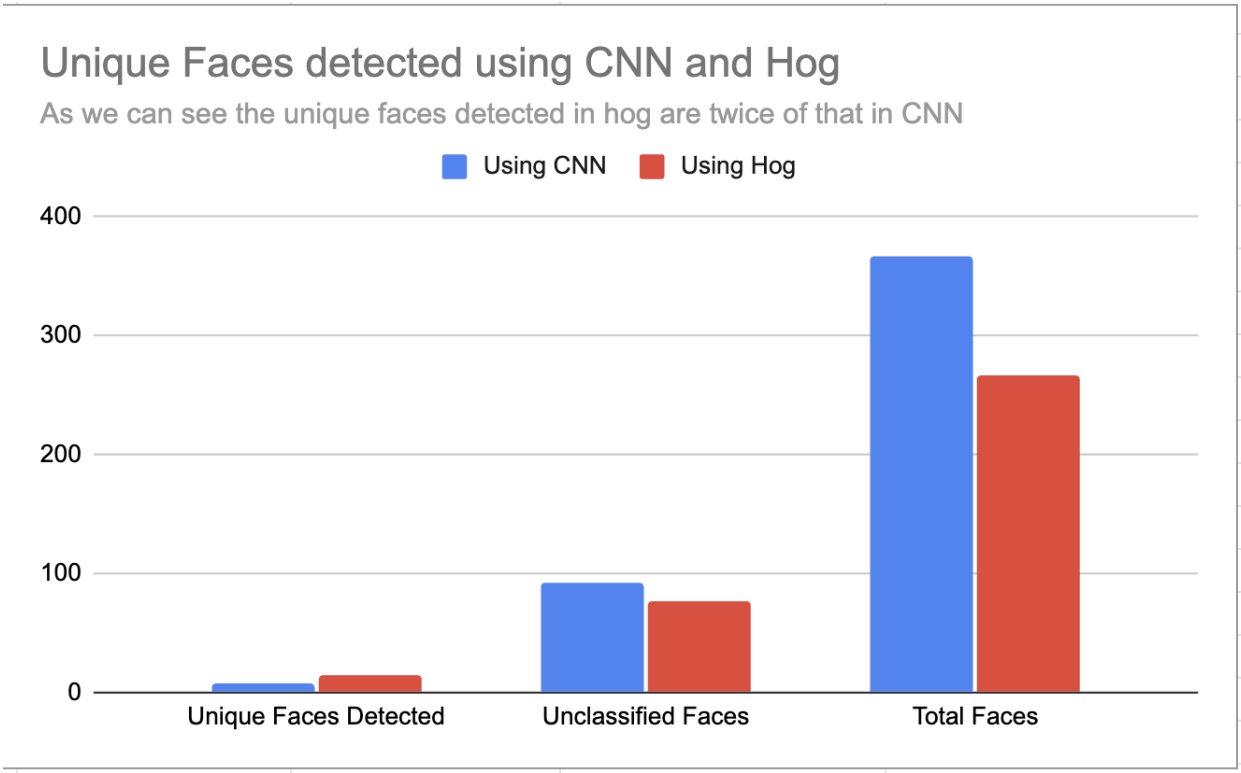
	A	B	C	D	E
1	Face Detection and Encoding generation				
2	Sample Length:	30 sec. + 163 sec.		283 Images	
3	Algorithm:	CNN	HOG	CNN	HOG
4	Time taken:	26.92 sec	102 sec	21.9 sec	37.9 sec
5	Accuracy:	74%	71%	83%	87%
6	Unique Faces Detected	7	14	14	14
7	Unclassified Faces	93	77	52	35
8	Total Faces	367	266	313	289
9	Clustering Time Using DBSCAN	0.0100 sec.	0.004 sec.	0.0450 sec.	0.004 sec.
10					

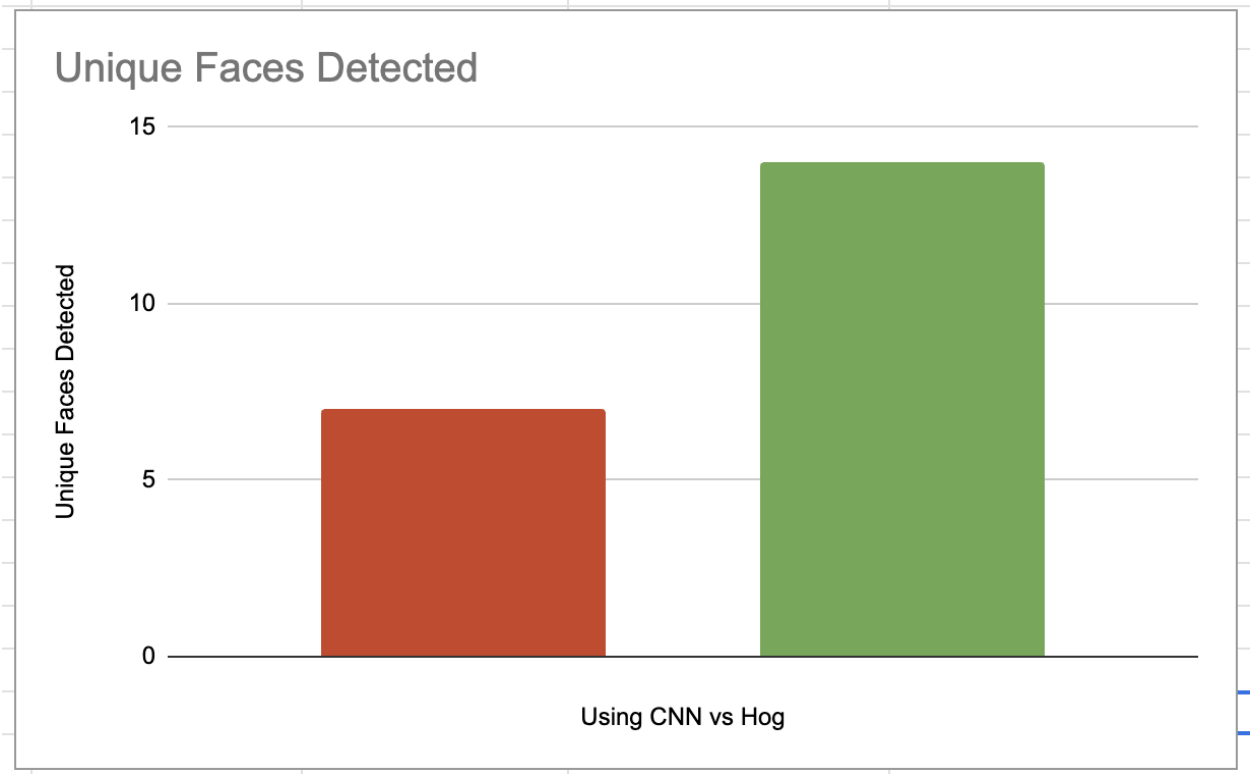
The comparison between CNN and Hog reveals distinct characteristics in terms of processing time and encoding accuracy.

CNN outperforms Hog in terms of processing speed, requiring only 29 seconds compared to Hog's 102 seconds for the same sample set. However, the trade-off is evident in the encoding quality. While CNN takes slightly more time to cluster the encodings, it produces more false positive results, leading to the detection of more faces than Hog.

Despite its faster processing time, CNN's accuracy is compromised, resulting in unclassified faces. In this scenario, there are 93 unclassified faces using CNN, compared to 77 with Hog. Furthermore, Hog demonstrates better performance in accurately classifying unique faces, correctly identifying 14 different individuals, whereas CNN manages to classify only 7 different faces with slight inaccuracies. These findings indicate that for clustering purposes, Hog's encodings perform notably better than CNN.


Faces classified Using CNN
Unclassified Faces
20.2%
Total Faces
79.8%


Unique Faces detected using CNN and Hog
As we can see the unique faces detected in hog are twice of that in CNN
Using CNN
Using Hog
400
300
200
100
0
Unique Faces Detected
Unclassified Faces
Total Faces

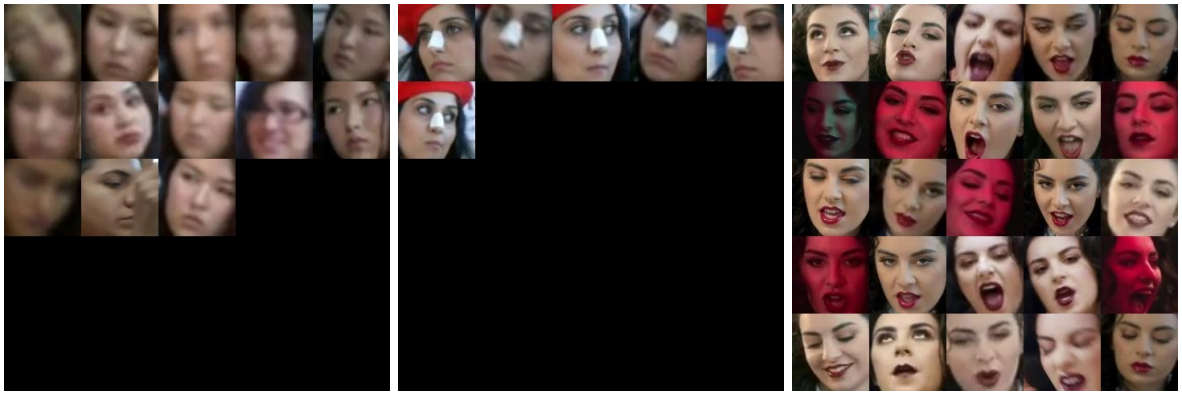

Unique Faces Detected
15
10
5
0
Unique Faces Detected
Using CNN vs Hog

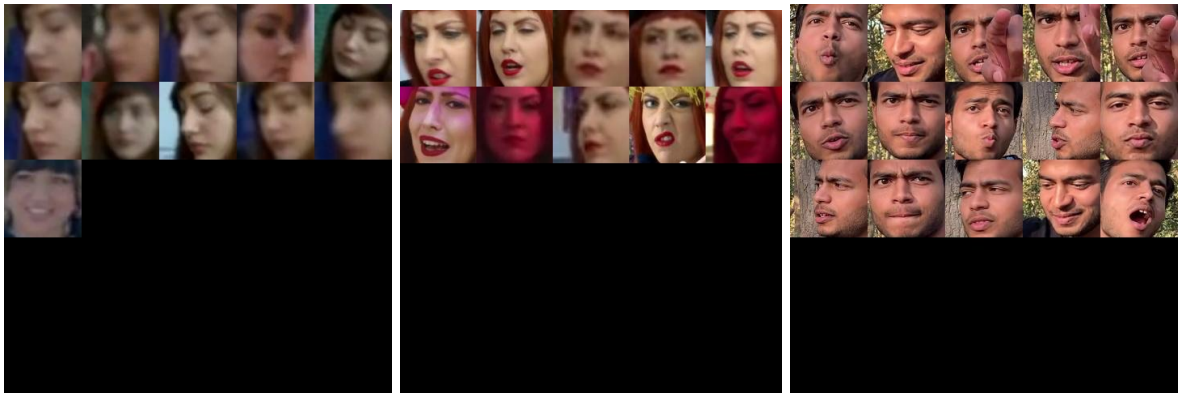
Correct Classification Using CNN

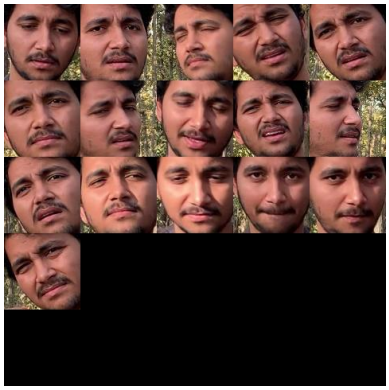
Incorrect Classification

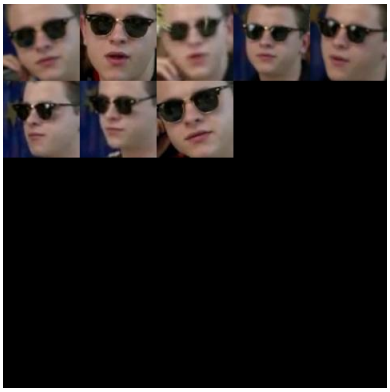
Unclassified Faces In CNN:

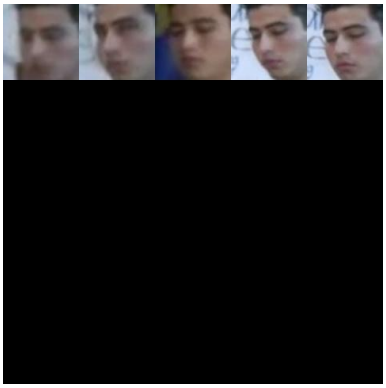
Classification Using Hog:

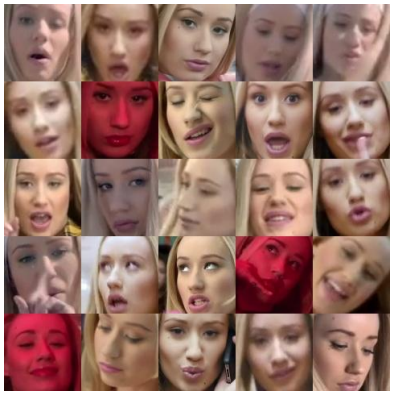


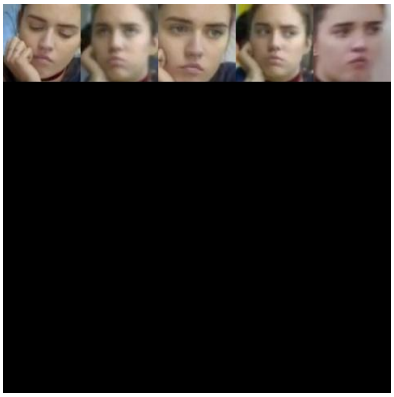


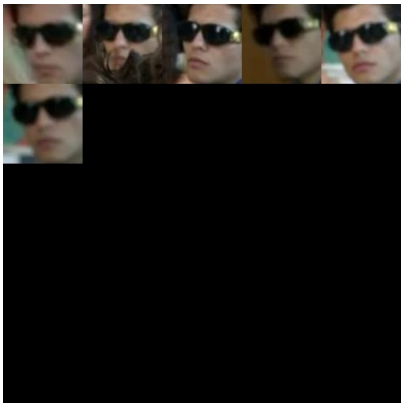


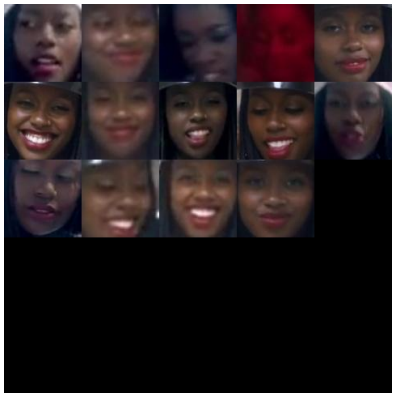












Unclassified Faces:

- There Is no Incorrect classification in this case

Conclusion:

The results clearly demonstrate that Hog generates superior quality encodings compared to CNN. Despite taking more processing time, Hog's accuracy and ability to correctly classify unique faces outweigh the faster processing time of CNN.

Given these findings, Hog can be considered as the preferred choice over CNN for tasks where encoding quality and accurate classification of faces are crucial factors. The marginal increase in processing time with Hog is justified by the significantly improved results it offers, making it a more suitable option for applications where precision and reliability are of utmost importance.