# Mask and No mask detection Project Report

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**Abstract**

The abstract goes here.

**Index Terms**

IEEE, IEEEtran, journal, LATEX, paper, template.

## I. Introduction

THIS file is to serve as the report of the machine learning project mask and no mask detection produced under LATEX using IEEEtran.cls version 1.8b and later. I hope you get the complete gist of the project while reading it.

Team
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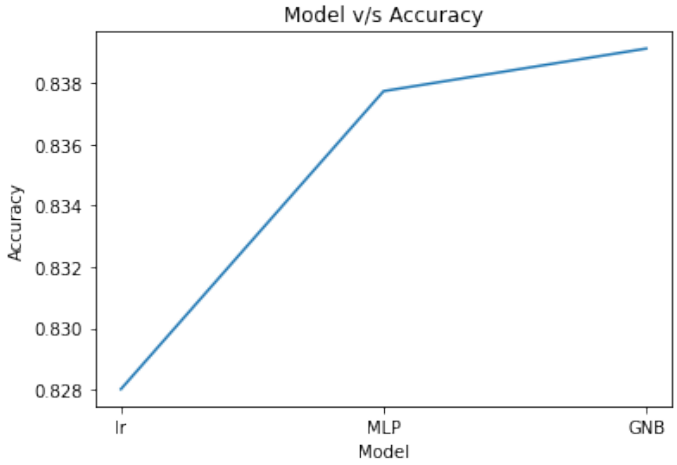
### A. About the Data set

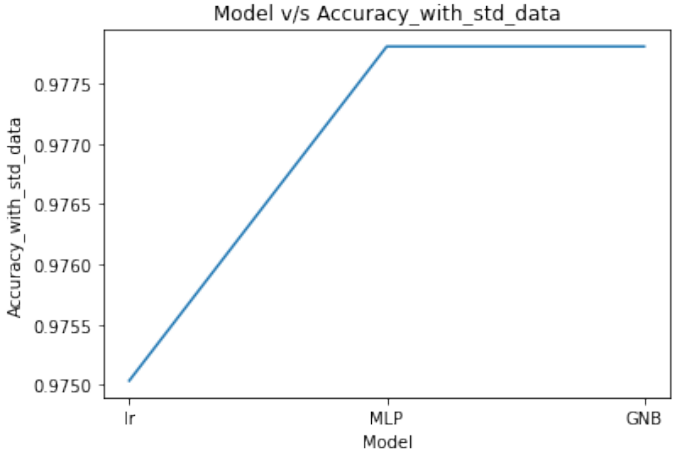
The dataset comprises of images of faces wearing mask or not wearing mask.

*1) Our Approach:* First data was standardized inorder to bring the data into same format.
Then dimensionality reduction technique linear discriminant analysis was used to reduce the number of features to a more manageable number before the process of classification.
After shuffling the data , it was splitted into train and test.
We trained our models on both non standardized data wher LDA was not used and standardized data where LDA was also used.
The models used for training were Logistic Regression as it is less inclined to overfitting , multi layer perceptron as neural networks are very famous in image processing and recognition because of their ability to take in a lot of inputs and infer complex and non linear relationship and gaussian naive bayes because it is not sensitive for irrerelevant feature and in face mask detction you need to focus on pixels for mouth nose area only.
Along with accuracy score , crosss validation score was calculated as well inorder to determine if data is senstive to train test split.
F1 score was calculated for every model as its the harmonic mean of precision and recall which are related to true positive , true negative , false positive and false negative .So to get correct analysis of exactly where the model is good or fails F1 score was calculated.

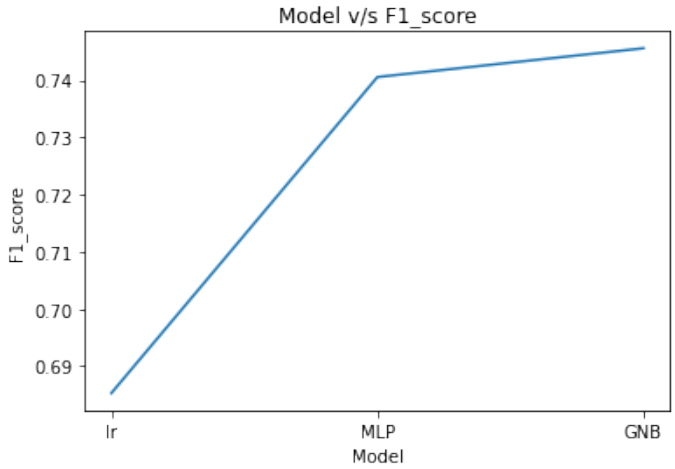
*2) Our Findings:* For normal (not standardized ,no LDA ) the accuracy was around 83 percent.

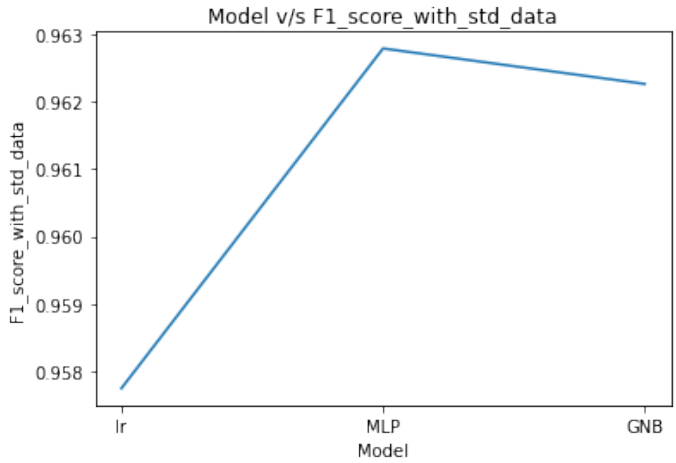


The acuracy for Gaussian naive bayes was highest.This happend because it does not show any sensitivity towards irrerelevant feature and in face mask detction you need to focus on pixels for mouth nose area only.

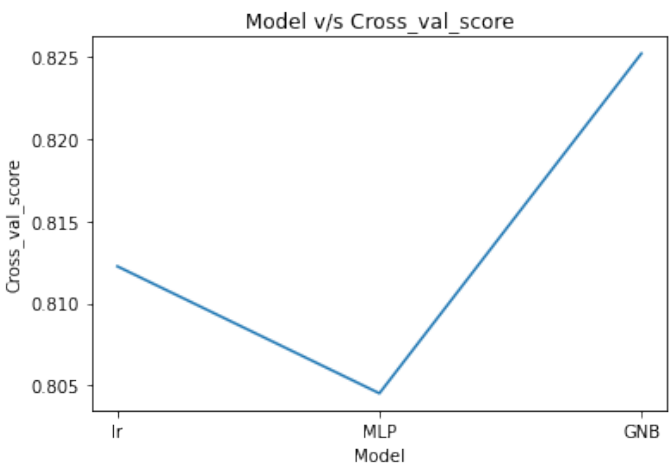


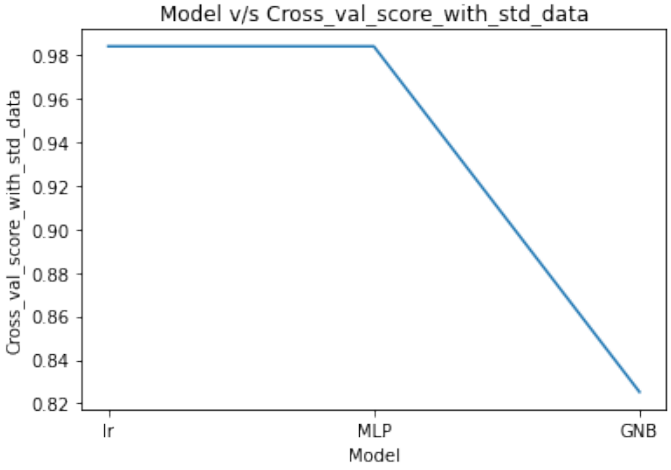

The accuracy shooted up from around 83 percent to around 97 percent for all the three classifiers for standardized , dimensionally reduced (using LDA) data set.This happened because an image is represented by its pixel value. The number of pixel values are very high , hence the number of features for the image data set is very high . Here in this problem we are only concerned about the face and nose area.What lda does is takes linear combination of features which are acutally responsible for classification hence reducing the dimension and making the data more managebale for classification.




The F1 score for both standardized and non standardized data is lesser than their accuracy implies one of precision or recall value is less.Precision is the measure of Fraction of retrieved instances that are relevant and recall is the measure of Fraction of relevant instances that are retrieved.Accuracy only talks about how many true positives are obtained.
Accuracy is used when true positives and true negative are important and precision is used when false positive and false negative are more important
Here we are concerned about true positive and true negative hence accuracy is a better parameter.




Cross Validation score is same for both standardized and non standardized data in case of gaussian naive bayes this shows that initailly its accuracy was higher for only specific data set and its senstive to train test split proving it to be not a good classifier in this case.It happens because its basic theory assumes all the features to be independent.Here features are pixels and their value being almost same at mouth, nose area is going to determine whether a person is wearing mask.So features are not independent.
However for non standardized data GNB is still has high cross validation score among all , another reason for GNB not being able to perform better standardization is that it already only uses relevant feature in prediction and applying LDA does the same so this the best score it can acgieve no matter you apllied LDA or not.
For logistic regrssion and MLP after cross validation also LDA used data gave way better result(reason explained above).
MLP performed better because of its ability to take higher number of inputs and analyze their complex and non linear relationship.
Logistic regression performed better because of its less incline to overfitting.

*3) Experiment result:* The results obtained are as follows:

F1 score for non-standardize data from logistic regression : 0.68
Accuracy for non-standardize data from logistic regression model: 0.82
CVS for non-standardize data from logistic regression model: 0.81

F1 score for standardize data from logistic regression : 0.95
Accuracy for standardize data from logistic regression model: 0.97
CVS for standardize data from logistic regression model: 0.98

F1 score for non-standardize data from MLP : 0.74
Accuracy for non-standardize data from MLP model: 0.83
CVS for non-standardize data from MLP model: 0.80

F1 score for standardize data from MLP : 0.96
Accuracy for standardize data from MLP model: 0.97
CVS for standardize data from MLP model: 0.98

F1 score for non-standardize data from GNB : 0.74
Accuracy for non-standardize data from GNB model: 0.83
CVS for non-standardize data from GNB model: 0.82

F1 score for standardize data from GNB : 0.96
Accuracy for standardize data from GNB model: 0.97
CVS for standardize data from MLP model: 0.82

*4) Contribution:* Preprocessing and Dataset selection : Sandip
Choosing to use which model and applying it: Pragati , Sandip (done through meet)
Grpah plotting : Pragati
Final report : Pragati and Sandip

## II. Conclusion

Gaussian naive bayes is not a good classifier for image classification problem like mask and no mask detection.
Using Linear discriminant analysis for reducing dimension increases accuracy
Logistic regression and MLP (with dimension reduction though LDA ) gave best cross validation score of 98 percentage
F1 score is lesser than CVS however CVS is more releavant in this problem.

## Acknowledgment

We would like to express our special thanks to our Professors Dr. Richa Singh, Dr. Romi Banerjee and Dr. Yashashwi Verma for their efforts to teach such a knowledgeable course of Pattern Recognition and Machine Learning which helped us a lot in research fields. In this course we came to know about so many new things which we did not know earlier. We are really very grateful to them. We would also like to show our gratitude towards our TAs who helped us a lot during the entire course within the limited time period.

## References

https://www.kaggle.com/dhruvmak/face-mask-detection https://www.youtube.com/watch?v=Ax6P93r32KU https://www.youtube.com/wat