Mini Project -2
Report

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Introduction -

In this project we were asked to expected to perform classification task on CIFAR-10 dataset and report the f1 - score as well as the accuracy on the test dataset. We were asked to use dimensionality reduction techniques such as PCA and LDA, and at least four classifiers such as Decision Tree, Soft-margin Linear SVM, Kernel SVM with RBF Kernel, MLP and Logistic Regression. Analysis of hyperparameters. We have used following python libraries :- numpy, sklearn, matplotlib and warnings. The hyperparameters were calculated using GridSearchCV from model_selection and final result was calculated using most appropriate hyperparameter.

Observation -

- Raw Data gives high accuracy and better f1 score than PCA and LDA (dimensionality reduction techniques) but it also takes a lot more time.
- Accuracy and f1 score of MLP classifier decreases with increase in learning rate.
- By reducing the number of components and keeping whiten=False in PCA there is unfavourable effects on accuracy and f1 scores but it also the reduces computing time.
- By setting loss as hinged in Soft Margin Linear SVM accuracy and f1 score reduces as compared to squared_hinge.
- “lbfgs” solver provides maximum accuracy and f1 score in MLP.
- By reducing the tolerance in Logistic Regression, reduces the computing time and have adverse effects on the accuracy and f1 score.

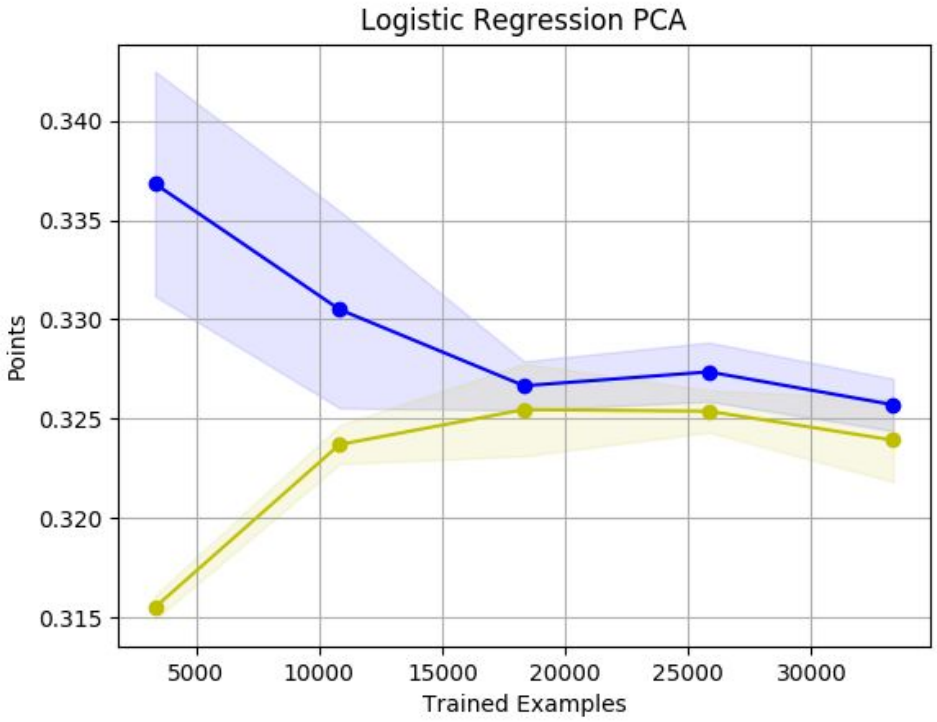
- Activation function such as RELU in MLP gives similar accuracies and f1 scores for all the computed representations.
- To quantify training set overfitting we have to measure the difference between training and the test accuracy for a given estimator.

Results

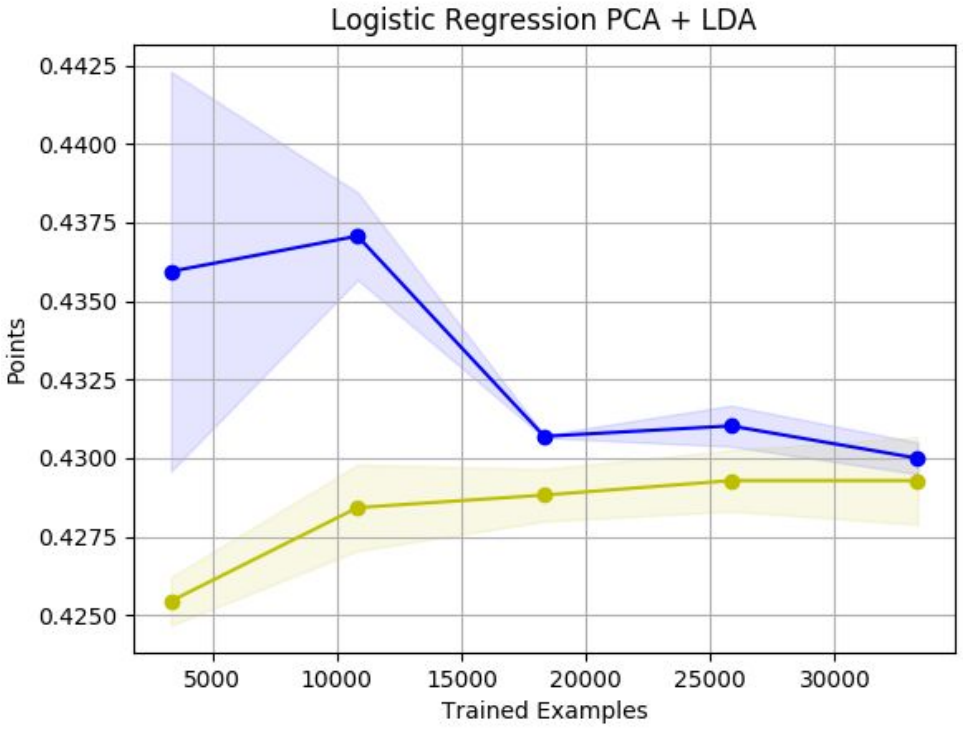
Classifier	Dimensionality Reduction	Accuracy	F1 Score
LOGISTIC REGRESSION	PCA	0.2967	0.2985
LOGISTIC REGRESSION	LDA	0.3669	0.3673
LOGISTIC REGRESSION	PCA + LDA	0.2289	0.2285
SOFT MARGIN WITH LINEAR SVM	PCA	0.3037	0.3048
SOFT MARGIN WITH LINEAR SVM	LDA	0.3727	0.3715

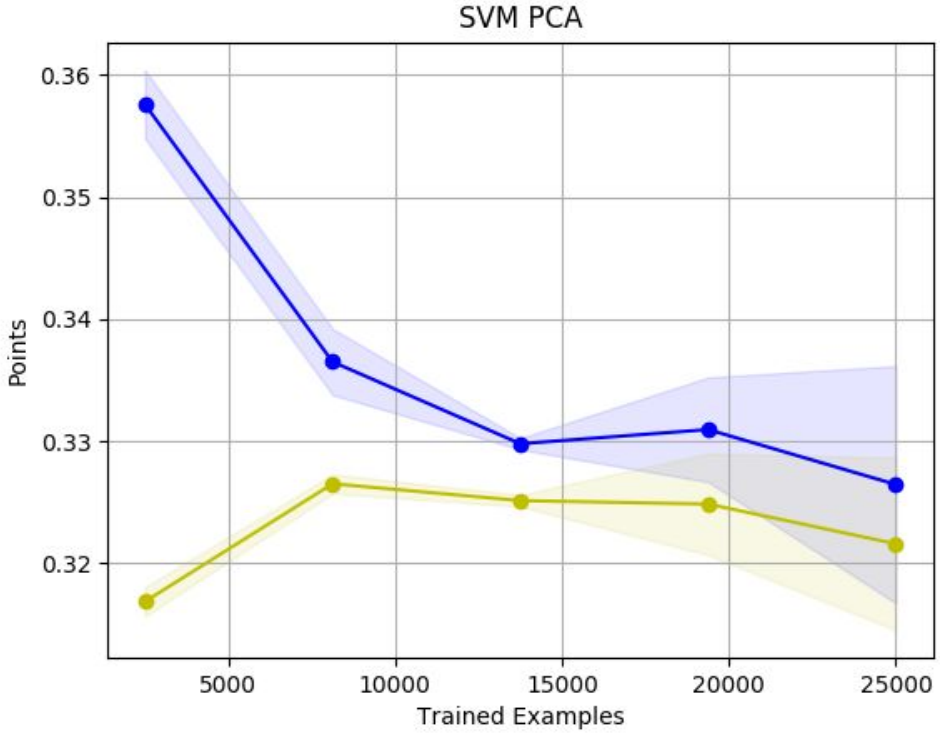
SOFT MARGIN WITH LINEAR SVM	PCA + LDA	0.2314	0.2336
DECISION TREE	PCA	0.2677	0.2641
DECISION TREE	LDA	0.3235	0.3268
DECISION TREE	PCA + LDA	0.2016	0.2028
MLP	PCA	0.4089	0.4053
MLP	LDA	0.3743	0.3732
MLP	PCA + LDA	0.4320	0.4356

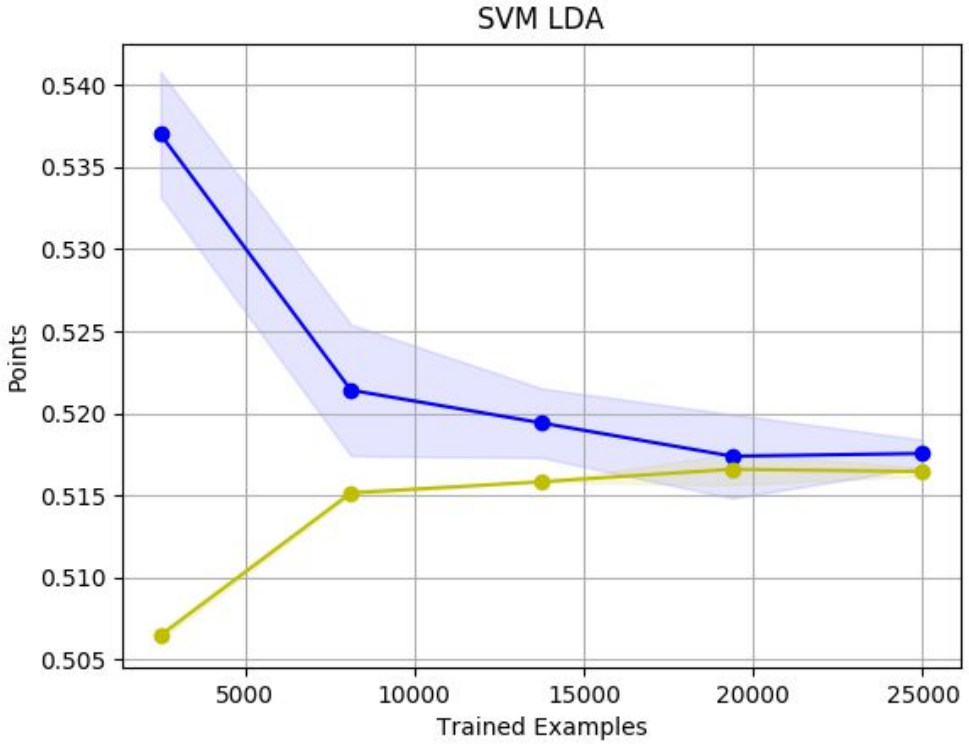
Graphs

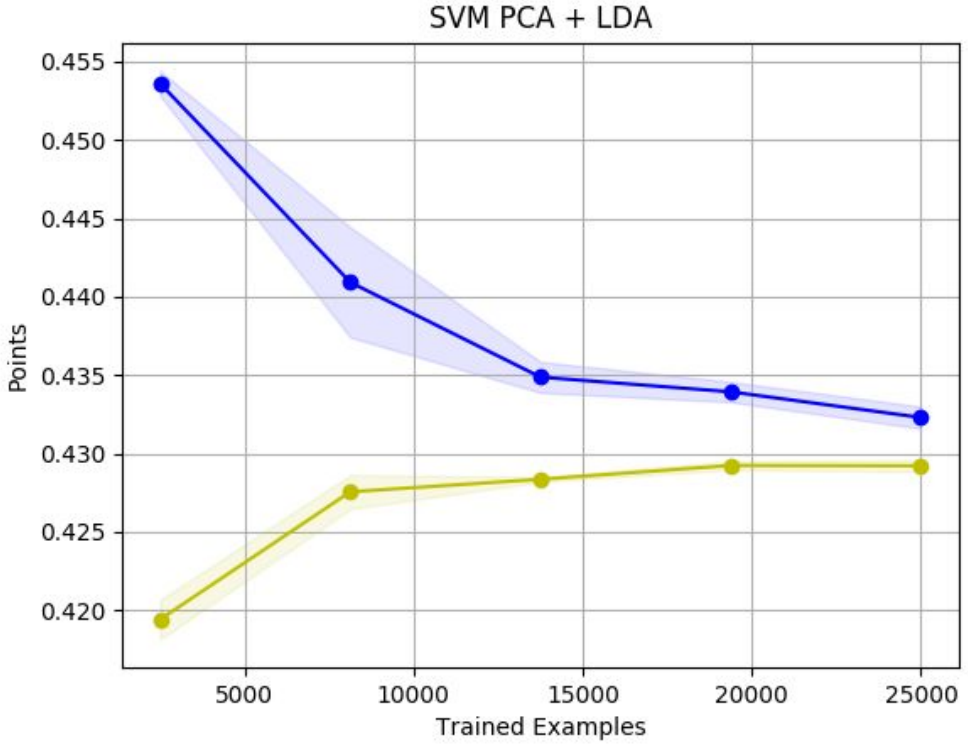

Logistic Regression PCA
Points
0.340
0.335
0.330
0.325
0.320
0.315
5000
10000
15000
20000
25000
30000
Trained Examples

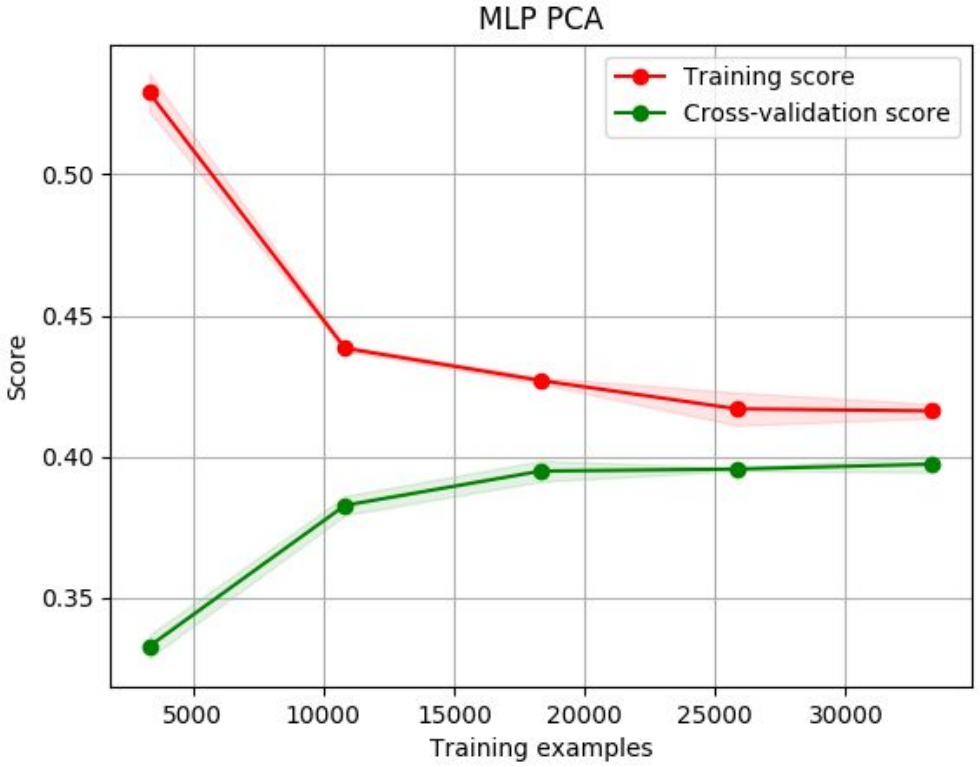

Logistic Regression LDA
Points
0.5250
0.5225
0.5200
0.5175
0.5150
0.5125
0.5100
0.5075
0.5050
5000
10000
15000
20000
25000
30000
Trained Examples

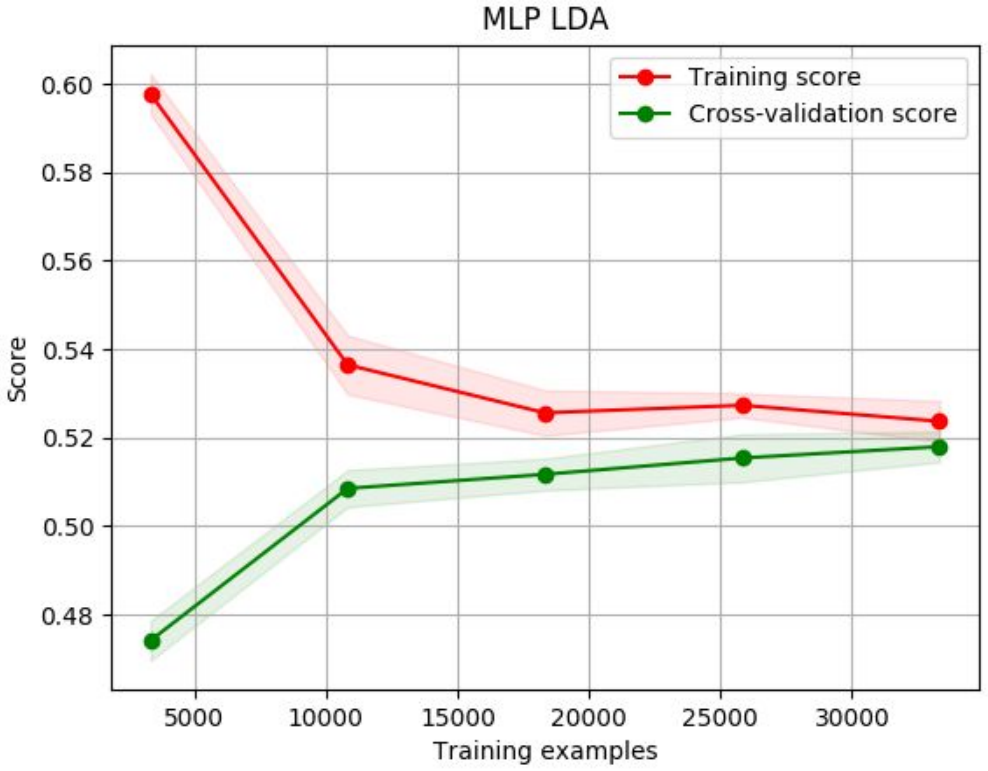

Logistic Regression PCA + LDA
0.4425
0.4400
0.4375
0.4350
0.4325
0.4300
0.4275
0.4250
Points
5000
10000
15000
20000
25000
30000
Trained Examples

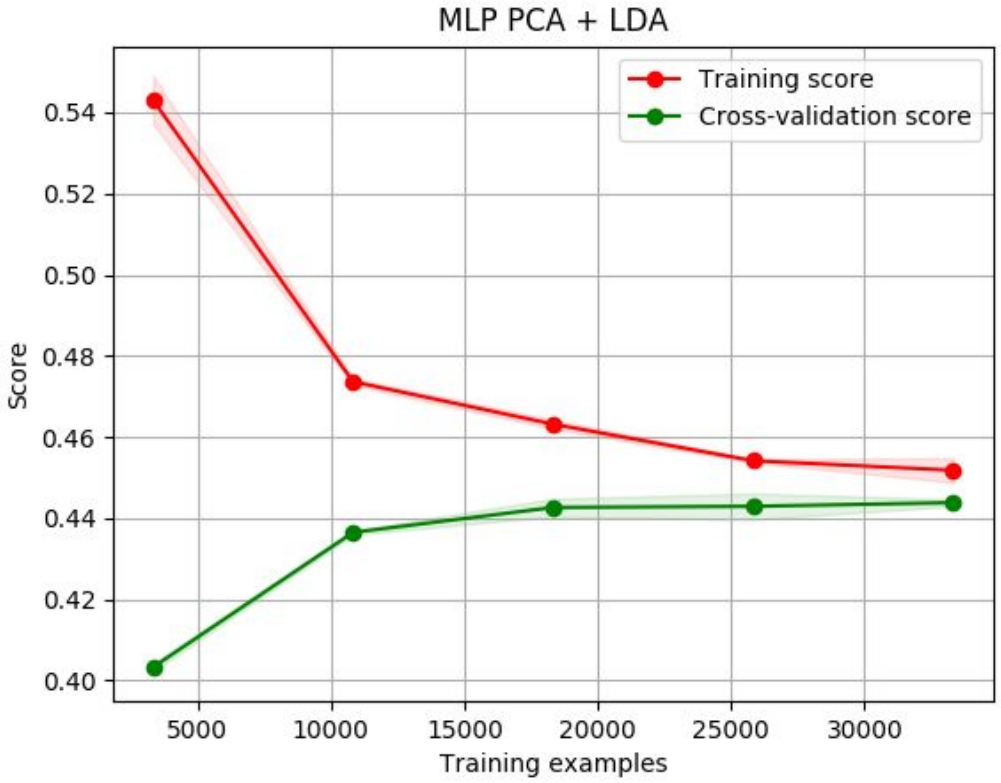

SVM PCA
0.36
0.35
0.34
0.33
0.32
Points
5000
10000
15000
20000
25000
Trained Examples


SVM LDA
0.540
0.535
0.530
0.525
0.520
0.515
0.510
0.505
Points
5000
10000
15000
20000
25000
Trained Examples


SVM PCA + LDA
0.455
0.450
0.445
0.440
0.435
0.430
0.425
0.420
Points
5000
10000
15000
20000
25000
Trained Examples


MLP PCA
Training score
Cross-validation score
0.50
0.45
0.40
0.35
Score
5000
10000
15000
20000
25000
30000
Training examples


MLP LDA
Training score
Cross-validation score
0.60
0.58
0.56
0.54
0.52
0.50
0.48
Score
5000
10000
15000
20000
25000
30000
Training examples


MLP PCA + LDA
Training score
Cross-validation score
Score
0.54
0.52
0.50
0.48
0.46
0.44
0.42
0.40
5000
10000
15000
20000
25000
30000
Training examples