Cover page for answers.pdf

CSE512 Fall 2019 - Machine Learning - Homework 6

Your Name: Abhay Goyal

Solar ID:112551276

NetID email address: a9goyal@cs.stonybrook.edu

abhay.goyal@stonybrook.edu

Names of people whom you discussed the homework with:

Q1. As given in the qs,

$$C = \frac{1}{n} X X^T.$$

We can see that the new covariance is found after the removal of the first principal eigenvector., we take

We know that the first principle vector v_1 satisfies the condition

$$Cv_1 = \lambda_1 v_1$$

or

$$C = \lambda_1 v_1 v_1^T.$$

Hence,

$$\tilde{C} = \frac{1}{n} XX^T - \lambda_1 v_1 v_1^T.$$

Q2. We can see that the if we remove any eigen value from the matrix, we would not have any change in the other eigen values as the new diagonal matrix has all the information except the removed value.

$$C = \frac{1}{n} XX^T.$$

$$C = E \Lambda E'$$

E → eigen vectors

Λ → eigen values.

We can say that removing correlation is the goal of PCA and hence the eigen vectors can be called the PCA principal components. As the correlation has been removed, we can say that v_j will remain a principal eigen vector of $\tilde{C}$ with same eigen value λ_j.

Q.3 Now, we got $\tilde{C}$ by removing the principal component v_1 which is the first principal eigen vector. As proved in Q2, we can say that v_2 of C will have the same value in $\tilde{C}$. But, now as v_1 has been removed, v_2 is the principal component for $\tilde{\Sigma}$. Hence, (assuming v to be a unit vector) We can say that $v = v_2$.

Q4. Pseudo code for eigenvectors and eigen values.

```
def first-k-vectors(C, k, f):
    eigenvalist, eigenvallist = [], []
    for x in range(k):
        [vec, val] = f(c)
        eigenvec list.append(vec)
        eigen vallist.append(val)
        c = c - [1 *(val @ val.T)]
return eigenveclist, eigenvallist.
```

CSE512 Fall 2019 Machine Learning
Homework 6

Abhay Goyal

December 11, 2019

Question 3

Network Architecture:
3x3 Conv2d Layer with 300 filters and stride 1
MaxPool2d layer
LeakyReLU layer with slope 0.3
BatchNorm2d layer
Inception layer
2x2 Conv2d layer with 100 filters and stride 1
MaxPool2d layer
LeakyReLU layer of slope 0.3
BatchNorm2d Layer
Inception Layer
Flatten Layer
Linear layer
LSTM layer
Linear layer to convert to the 10 classes
Optimizer
AdaDelta optimizer with learning rate of 0.01
CrossEntropy
50 epochs
Accuracy on validation:- 73.50