

ME 532 Project Update-2

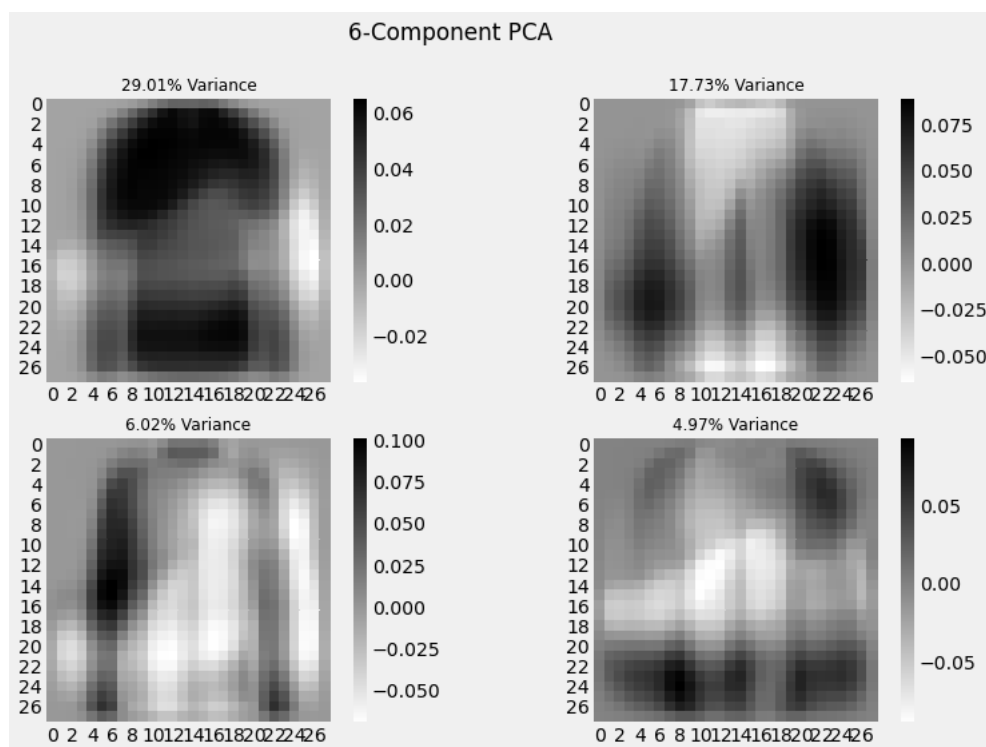
Dataset

The dataset used for this project is the **Fashion-MNIST** data from Zalando's article images. The data consists of image examples each of which is a 28x28 pixels greyscale image. Thus, there are total 784 pixels in an image. Each pixel holds a value from 0 to 255 denoting the brightness of the pixel. The location of each pixel in the image is defined by the equation $x=28i+j$, where the x^{th} pixel lies in the i^{th} row and j^{th} column of a 28x28 matrix. Each article can be associated to one of the 10 labels mentioned later. There are 60,000 examples in the training data and another 10,000 in the test data. The goal of this project is to develop a machine learning classification algorithm that can accurately classify a given article to its corresponding label by understanding the pixel composition of the image.

1) Dimensional reduction and PCA

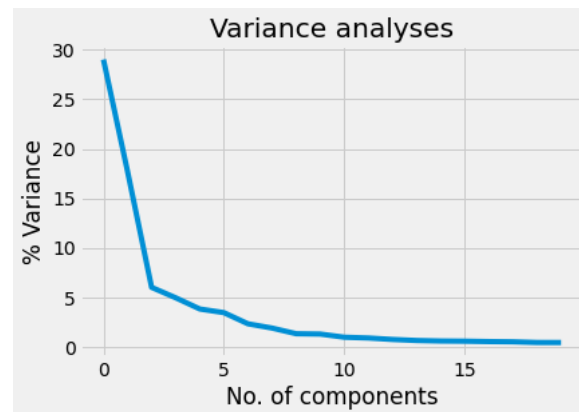
The dataset is a 28x28 pixel image, PCA has been used to visualize if dimension reduction can be applied and the complexity of the dataset can be reduced. The preliminary results have been shown here.

For instance, with a 6 component PCA analyses on 4 random objects is as follows, the variance from original images has also been calculated and mentioned.



It can be seen that a shoe can be identified in these images and thus the classification can be made to a certain assurity.

To find out a good cut-off for number of components for PCA analyses the variance was plotted vs components.



As can be seen through this plot a 2-component PCA analyses can be used as a cut-off since the variance flattens beyond that.

Following this a k means clustering algorithm is being worked on to classify the labels by integrating the PCA analyses.

An attempt has also been made to reconstruct the images by reducing the number of pixels that define the image. These results will be shown in the final report.

- 2) Logistic regression in dataset: The aim of the analyses was to reduce the cost function which represents the missclassification.

Steps being applied to the algorithm are as follows:

- The regression is applied by first converting the data into categorical values.
- Weights to individual pixels are initialized and a bias is also initialized.
- To the weighted sum of pixels, a sigmoid function is applied that classifies the label as 0 or 1 (category).
- The cost is calculated, and the loss is representative of the missclassifications.
- The weights are updated based on recalculated gradients from the loss functions and the steps are repeated till a high accuracy is reached.

The algorithm is under construction and the results will be presented in the final report.

- 3) The final analyses will be based on a neural network application, this section hasn't been started yet. However, algorithm and results will be presented in the final report.

Github link: <https://github.com/agiwal/ME532-Project.git>