# Implementation of Autoencoder Assignment 3

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## 1 Objective

The objective of this assignment is to implement an autoencoder with encoder and decoder neural network and reconstruct an image and compare it with PCA.

## 2 Dataset

The dataset given contains total 530 images of George bush having a dimensions of (250X250X3) , which is splitted into 70:20:10 ratio of train, validation and test images respectively. After splitting 371 images for training image , 106 validation images and 53 images for testing images .

## 3 Approach

From the dataset given containing 530 images which are first split into train validation and test in 70:20:10 ratio, In that case 371 images for training images, 106 images for validation and 53 images for testing. After splitting in the ratio, the images are resized (64X64) in order to reduce the computations required and converted into Gray scale images, with this our data is pre-processed and ready for implementation. I have prepared the model by using the keras library which uses TensorFlow as backend and matplotlib for visualization.The model contains two dense layers one for encoder and another is for decoder.Since the image has a dimension(64X64) which contains 4096 pixels so it is compressed by using encoding dimensions of 550 (compressed by factor of 7.5). The purpose of the encoder model is to preserve the important features of images which in turn reduces dimensionality and the purpose of decoder is to reconstruct the images with this latent feature. I have trained the model with adamax optimizer with mean square error loss for 100 epochs with the batch size of 16.

# 4 Analysis and Results

By training the model on 100 epochs with batch size of 16 I got training loss of 0.0059 and validation loss of 0.0198 , from this it is observed that model is capable of reconstructing the faces well but it fails to reconstruct the background of the images .

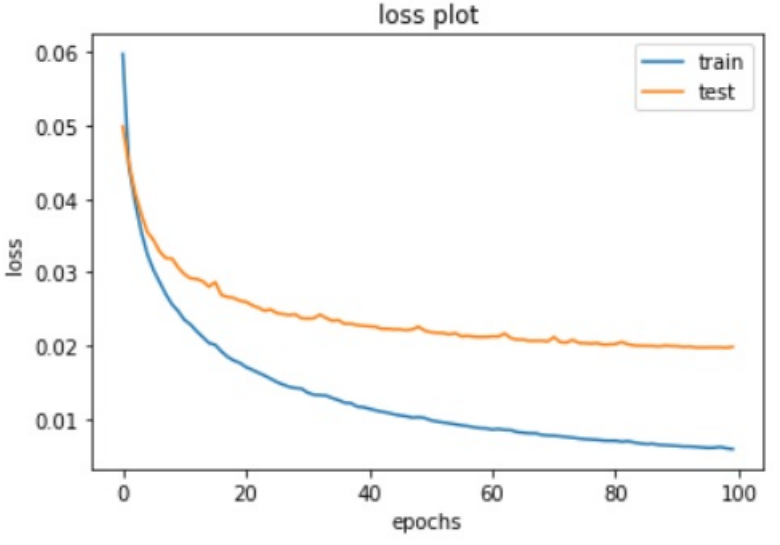


Figure 1: Training epochs vs loss

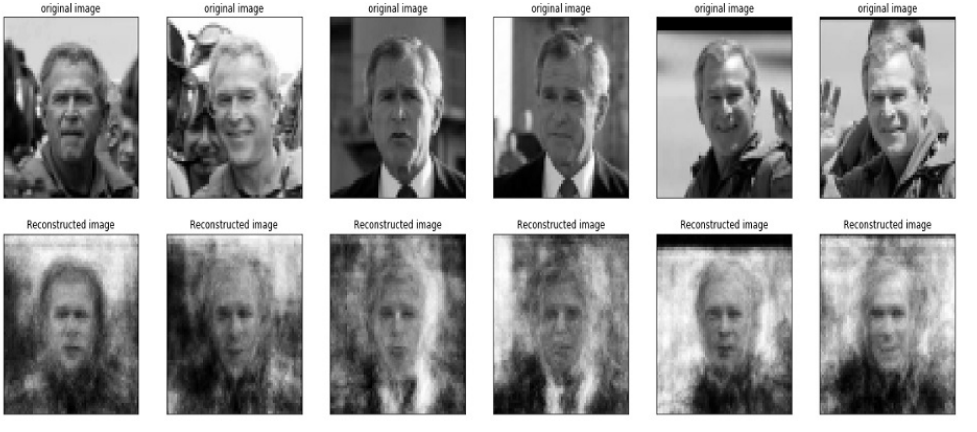


Figure 2: Output of decoder network

The above are some sample images predicted by model and from this it is clear that model is reconstructing faces well but fails to reconstruct the background.

The below images are the output of PCA with 10 principal components ,the principal component analysis can only perform only linear transformation while autoencoder performs non linear transformation and is efficient in learning model parameters. I have also implement this (Figure 4) by using simple(single hidden layer) neural network model trained for

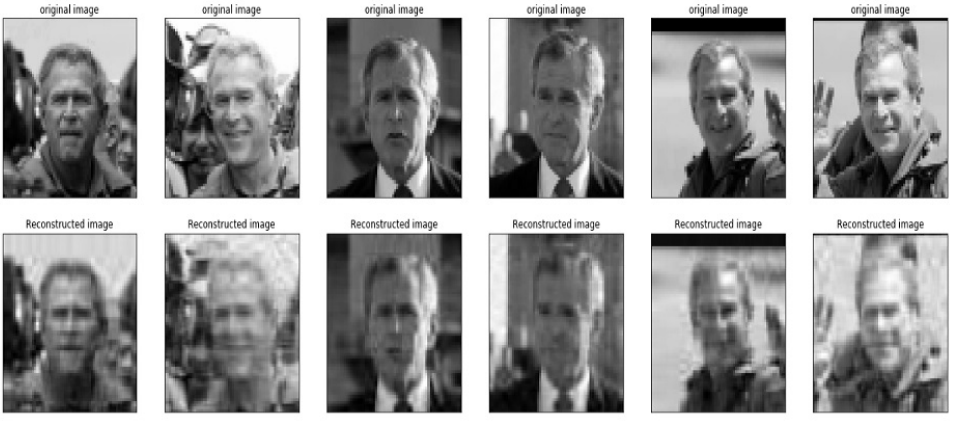


Figure 3: Output of PCA

100 epochs and batch size of 16 with Adam optimizer but with this decoded images contains noise from which it is difficult to exact some information .

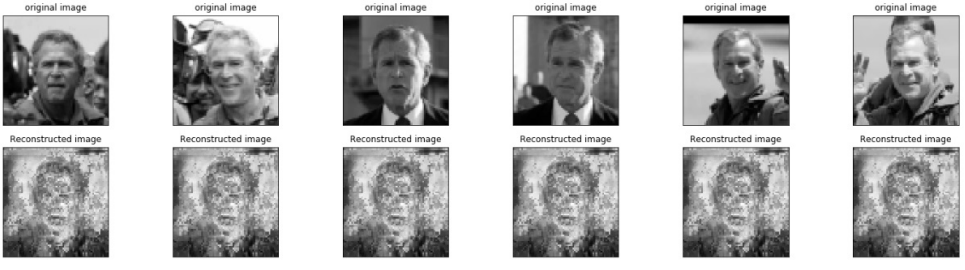


Figure 4: Output of Simple Neural Network model