In this assignment, The Olivetti dataset, which was reduced using PCA, was utilized to train an autoencoder. The autoencoder's design consists of three hidden layers, and we found the optimal hyperparameters using k-fold cross validation. After that, we displayed some of the photographs that we had rebuilt using the best model.

**Images and/or Discussion**

**Step 3b:**

I applied the linear activation function to each and every hidden layer and output layer. This is due to the fact that the dataset is no longer standardized between 0 and 1 following PCA. It went from about -11 to 10. I used linear to avoid losing information or patterns as a result. For instance, using "tanh" will cause my data to be overly compressed, while using "relu" will cause me to lose the negative values.

My choice for the loss function was Mean Squared Error, or MSE. Because our inputs and outputs have the same dimensions, we can use MSE to determine how dissimilar they are from one another. Furthermore, the model is penalized more for significant mistakes since the errors are squared, which is advantageous because even minor adjustments might affect the quality of the reconstructed picture.

**Step 4:**

A collage of a person's face

Description automatically generated

The rebuilt photos appear to be in good condition. We can somewhat recognize the face's form because of the good reconstruction of the pixel intensities. Yet it isn't flawless. The subject in image 1 has closed eyelids, for instance, yet the reconstructed image shows an open eye. However, it's essentially a hybrid of the closed and opened eyes.

**Learning point from question 1:**

* Through scikeras, I discovered that I could apply GridSearchCV to my tensorflow model using KerasRegressor.
* I discovered that higher scores do not necessarily correspond to more neurons. For instance, the best model after GridSearchCV employs 75 neurons, even though I tested 75 and 100 for the center layer neurons.
* I gained additional knowledge about how MSE fits into this particular activity.
* I gained greater knowledge about how the activation functions differ from one another.