**What we did**

In this assignment, we used the Olivetti dataset that has been reduced using PCA to train an autoencoder. The autoencoder has an architecture of 3 hidden layers, and we used k-fold cross validation to determine the best hyperparameters. We then used the best model to reconstruct some images and display them.

**Images and/or Discussion**

Step 3b:

For all the hidden layers and output layer, I used the linear activation function for all of them. This is because after applying PCA, the dataset is no longer normalized between 0 and 1. It became around -11 to 10. Because of this, I used linear to not lose information/pattern. For example, if I were to use "relu", I will lose the negative values, and if I use "tanh", my values will be squished too much.

As for the loss function, I used MSE (Mean Squared Error). This is because both our inputs and outputs are the same dimensions, which means that we can calculate how different they are from each other using MSE. In addition, since the errors are squared, it penalizes the model more when making large errors, which is good because even small changes can impact the quality of the reconstructed image.

Step 4:

A collage of a person's face

Description automatically generated

As we can see, the reconstructed images are not too bad. The pixel intensities are reconstructed quite well, which allows us to kind of see the shape of the face. However, it isn’t perfect. For example, we can see that in image 1, the person has closed eyes, but the reconstructed image has an open eye. It’s actually kind of a mix of the closed and opened eyes though.

**What I learned**

* I learned that I could use KerasRegressor from scikeras to use GridSearchCV on my tensorflow model.
* I learned that more neurons don’t equate to better scores. For example, I tried 75 and 100 for the neurons in the central layer, but after GridSearchCV, the best model uses 75 neurons.
* I learned more about how MSE is appropriate for this exercise.
* I learned more about the differences between the activation functions.