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COMP257 - Assignment 5 – Analysis Report

1. The Olivetti dataset loaded and split like the previous assignment, but with adding a scaler.
2. PCA was applied on the training data like the previous assignment.
3. An autoencoder was defined with the specified architecture, consisting of an input layer, three hidden layers, a central bottleneck layer, and an output layer.

a) k-fold cross-validation was used to fine-tune the autoencoder, three values for the learning rate and regularization strength were tested: 0.0001, 0.001, and 0.01. The number of hidden units in each layer was initially set to 256, 128, and 64 to form a bottleneck structure. Other combinations (128, 64, and 32, and 512, 256, and 128) were also tested, but the results did not differ significantly. When fitting the model, the number of epochs was increased, but the results were the same. Additionally, the batch size is 16, 32 was also tried, with not much difference. Dropout was tested, but it did not yield better results and increased training time.

b) The activation function used for the encoder and decoder layers was ReLU, which is a commonly used function because it helps avoid the vanishing gradient problem. Leaky ReLU was tested, but it was time-consuming and did not provide significant improvements. The sigmoid activation function in the output layer is used as it is commonly used for image reconstruction.

1. After training the final model with the best hyperparameters, reconstructed images for the test set were generated and displayed alongside the original and noisy images. The reconstructed images retain basic facial features but appear similar to each other, lacking the distinct characteristics that differentiate individual faces.