This assignment is about feature extraction via dimensionality reduction using variants of autoencoders.  Use the CIFAR10 dataset provided in Keras, after conversion to gray-level images!

Task 1: Perform standard PCA and identify the eigenvectors associated with top eigenvalues with 95% total energy (i,e.,  >=95 percent). Using these, train a logistic regression classifier to classify the images into 10 classes. Draw the ROC curve for the test dataset. Repeat the same with randomized PCA and compare.

Task 2: Train a single layer autoencoder with linear activation function and appropriate normalization of the input. Compare the eigenvectors obtained in step 1 with those obtained using the autoencoders. Explain your observations.

Task 3: Train an appropriate deep convolutional autoencoder with same dimension of latent space. Calculate the reconstruction error and compare that with a single hidden layer autoencoder (with sigmoid activation at the autoencoder and linear at the decoder) for the test dataset. What will be the reconstruction error if the hidden nodes are distributed equally (approximately) among 3 hidden layers in a new 3 hidden layer autoencoder with sigmoid activation at the autoencoder and linear at the decoder final layer.