import pandas as pd

import numpy as np

import json

import sys

import warnings

from sklearn.datasets import make\_regression

from sklearn.feature\_selection import RFECV

from sklearn import datasets, linear\_model

from sklearn.preprocessing import StandardScaler

from sklearn.decomposition import PCA

from sklearn.decomposition import NMF

from sklearn import datasets

from sklearn.model\_selection import train\_test\_split

**#9.1 reducing features using Principal Components**

digits = datasets.load\_digits()

features= StandardScaler().fit\_transform(digits.data)

pca=PCA(n\_components=0.99, whiten=True)

features\_pca = pca.fit\_transform(features)

print("original number of features:", features.shape[1])

print("reduced number of features:", features\_pca.shape[1])

print("output from 9.1 done!")

#**9.4 Reducing Features Using Matrix Factorization**

features = digits.data

nmf=NMF(n\_components=10, random\_state=1)

features\_nmf=nmf.fit\_transform(features)

print("Original number of features:", features.shape[1])

print("reduced number of features:", features\_nmf.shape[1])

print("output from 9.4 done!")