Please write a program to perform one of the following tasks on the IRIS data.

1. k-means clustering algorithm

In IRIS data every sample was labeled with a class of flower among three. Please perform clustering with three clusters, and compare the clustering result with the class labels and have a few discussions.

1. t-SNE for reducing every samples as 2D points

The 4D samples of IRIS dataset could be converted into 2D points through t-SNE algorithm, which may be further visualized on a plane. Please perform t-SNE to produce 2D points, and use three colors corresponding to the class labels to display the 2D points.t-SNE 用於將每個樣品減少為 2D 點

IRIS數據集的4D樣本可以通過t-SNE演算法轉換為2D點，並在平面上進一步可視化。請執行 t-SNE 生成 2D 點，並使用類標籤對應的三種顏色顯示 2D 點。

I choose question2 to switch the 4Dpoints to 2Dpoints through t-SNE algorithm.

there is my visiualized png result below :

chinese :

Dimension 1 和 Dimension 2 是 t-SNE 降維後的 2D 坐標，分別代表 x 和 y 坐標。

result\_df 是包含原始 4D 特徵和降維後 2D 坐標的新 DataFrame。

plt.scatter 函數使用 Dimension 1 和 Dimension 2 來繪製 2D 散點圖，這些點的顏色根據其對應的標籤（setosa, versicolor, virginica）設置。

English :

Dimension 1 and Dimension 2 are the 2D coordinates after dimensionality reduction by t-SNE, representing the x and y coordinates respectively.

result\_df is a new DataFrame containing the original 4D features and the reduced 2D coordinates.

The plt.scatter function uses Dimension 1 and Dimension 2 to draw a 2D scatter plot, with the colors of the points set according to their corresponding labels (setosa, versicolor, virginica).

一張含有 文字, 螢幕擷取畫面, 圖表, 行 的圖片

自動產生的描述

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sepal.Length | Sepal.Width | | Petal.Length | | Petal.Width | | Species | | Dimension 1 = X | | Dimension 2 = Y | |
| 5.1 | | 3.5 | | 1.4 | | 0.2 | | setosa | | -23.5809 | | -0.52206 | |
| 4.9 | | 3 | | 1.4 | | 0.2 | | setosa | | -26.2917 | | -1.0937 | |
| 4.7 | | 3.2 | | 1.3 | | 0.2 | | setosa | | -26.1933 | | 0.053057 | |
| 4.6 | | 3.1 | | 1.5 | | 0.2 | | setosa | | -26.6383 | | -0.3217 | |
| 5 | | 3.6 | | 1.4 | | 0.2 | | setosa | | -23.545 | | -0.94138 | |
| 5.4 | | 3.9 | | 1.7 | | 0.4 | | setosa | | -21.6083 | | -0.81096 | |
| 4.6 | | 3.4 | | 1.4 | | 0.3 | | setosa | | -25.9608 | | 0.458465 | |
| 5 | | 3.4 | | 1.5 | | 0.2 | | setosa | | -24.3471 | | -0.49608 | |
| 4.4 | | 2.9 | | 1.4 | | 0.2 | | setosa | | -27.3913 | | -0.30168 | |
| 4.9 | | 3.1 | | 1.5 | | 0.1 | | setosa | | -25.7688 | | -0.94529 | |
| 5.4 | | 3.7 | | 1.5 | | 0.2 | | setosa | | -22.0654 | | -0.18251 | |
| 4.8 | | 3.4 | | 1.6 | | 0.2 | | setosa | | -24.9495 | | -0.87336 | |
| 4.8 | | 3 | | 1.4 | | 0.1 | | setosa | | -26.5746 | | -0.88739 | |
| 4.3 | | 3 | | 1.1 | | 0.1 | | setosa | | -27.5171 | | 0.322736 | |
| 5.8 | | 4 | | 1.2 | | 0.2 | | setosa | | -20.775 | | -0.09778 | |
| 5.7 | | 4.4 | | 1.5 | | 0.4 | | setosa | | -20.5931 | | -0.65258 | |
| 5.4 | | 3.9 | | 1.3 | | 0.4 | | setosa | | -21.4729 | | -0.41266 | |
| 5.1 | | 3.5 | | 1.4 | | 0.3 | | setosa | | -23.5402 | | -0.34056 | |
| 5.7 | | 3.8 | | 1.7 | | 0.3 | | setosa | | -21.2914 | | 0.098973 | |
| 5.1 | | 3.8 | | 1.5 | | 0.3 | | setosa | | -22.5218 | | -0.9963 | |
| 5.4 | | 3.4 | | 1.7 | | 0.2 | | setosa | | -22.6839 | | 0.570334 | |
| 5.1 | | 3.7 | | 1.5 | | 0.4 | | setosa | | -22.8101 | | -0.80469 | |
| 4.6 | | 3.6 | | 1 | | 0.2 | | setosa | | -25.9319 | | 1.247823 | |
| 5.1 | | 3.3 | | 1.7 | | 0.5 | | setosa | | -24.0347 | | 0.745505 | |
| 4.8 | | 3.4 | | 1.9 | | 0.2 | | setosa | | -24.8908 | | -1.71914 | |
| 5 | | 3 | | 1.6 | | 0.2 | | setosa | | -25.8892 | | -1.44036 | |
| 5 | | 3.4 | | 1.6 | | 0.4 | | setosa | | -24.1926 | | 0.22382 | |
| 5.2 | | 3.5 | | 1.5 | | 0.2 | | setosa | | -23.1404 | | -0.18138 | |
| 5.2 | | 3.4 | | 1.4 | | 0.2 | | setosa | | -23.4946 | | -0.04124 | |
| 4.7 | | 3.2 | | 1.6 | | 0.2 | | setosa | | -25.9228 | | -0.43075 | |
| 4.8 | | 3.1 | | 1.6 | | 0.2 | | setosa | | -25.9456 | | -0.90071 | |
| 5.4 | | 3.4 | | 1.5 | | 0.4 | | setosa | | -22.7738 | | 0.528339 | |
| 5.2 | | 4.1 | | 1.5 | | 0.1 | | setosa | | -21.4539 | | -1.23107 | |
| 5.5 | | 4.2 | | 1.4 | | 0.2 | | setosa | | -20.9044 | | -0.73607 | |
| 4.9 | | 3.1 | | 1.5 | | 0.2 | | setosa | | -25.7058 | | -0.78132 | |
| 5 | | 3.2 | | 1.2 | | 0.2 | | setosa | | -25.2225 | | -0.03241 | |
| 5.5 | | 3.5 | | 1.3 | | 0.2 | | setosa | | -22.161 | | 0.449673 | |
| 4.9 | | 3.6 | | 1.4 | | 0.1 | | setosa | | -23.9009 | | -1.18547 | |
| 4.4 | | 3 | | 1.3 | | 0.2 | | setosa | | -27.2754 | | 0.008646 | |
| 5.1 | | 3.4 | | 1.5 | | 0.2 | | setosa | | -23.9779 | | -0.25997 | |
| 5 | | 3.5 | | 1.3 | | 0.3 | | setosa | | -23.9616 | | -0.63456 | |
| 4.5 | | 2.3 | | 1.3 | | 0.3 | | setosa | | -27.8629 | | -0.88141 | |
| 4.4 | | 3.2 | | 1.3 | | 0.2 | | setosa | | -26.9254 | | 0.444037 | |
| 5 | | 3.5 | | 1.6 | | 0.6 | | setosa | | -23.8072 | | 0.748349 | |
| 5.1 | | 3.8 | | 1.9 | | 0.4 | | setosa | | -22.272 | | -1.66061 | |
| 4.8 | | 3 | | 1.4 | | 0.3 | | setosa | | -26.5504 | | -0.81561 | |
| 5.1 | | 3.8 | | 1.6 | | 0.2 | | setosa | | -22.4669 | | -1.12466 | |
| 4.6 | | 3.2 | | 1.4 | | 0.2 | | setosa | | -26.4442 | | 0.043642 | |
| 5.3 | | 3.7 | | 1.5 | | 0.2 | | setosa | | -22.3282 | | -0.38781 | |
| 5 | | 3.3 | | 1.4 | | 0.2 | | setosa | | -24.7328 | | -0.37259 | |
| 7 | | 3.2 | | 4.7 | | 1.4 | | versicolor | | 7.670579 | | -1.79082 | |
| 6.4 | | 3.2 | | 4.5 | | 1.5 | | versicolor | | 7.78294 | | -0.07893 | |
| 6.9 | | 3.1 | | 4.9 | | 1.5 | | versicolor | | 8.175531 | | -1.99173 | |
| 5.5 | | 2.3 | | 4 | | 1.3 | | versicolor | | 5.656945 | | 4.655327 | |
| 6.5 | | 2.8 | | 4.6 | | 1.5 | | versicolor | | 8.097627 | | -0.54552 | |
| 5.7 | | 2.8 | | 4.5 | | 1.3 | | versicolor | | 7.185826 | | 2.918333 | |
| 6.3 | | 3.3 | | 4.7 | | 1.6 | | versicolor | | 8.537583 | | 0.057335 | |
| 4.9 | | 2.4 | | 3.3 | | 1 | | versicolor | | 4.090632 | | 5.25111 | |
| 6.6 | | 2.9 | | 4.6 | | 1.3 | | versicolor | | 7.666016 | | -0.76038 | |
| 5.2 | | 2.7 | | 3.9 | | 1.4 | | versicolor | | 6.127455 | | 4.680198 | |
| 5 | | 2 | | 3.5 | | 1 | | versicolor | | 4.399843 | | 5.437026 | |
| 5.9 | | 3 | | 4.2 | | 1.5 | | versicolor | | 6.757307 | | 2.254505 | |
| 6 | | 2.2 | | 4 | | 1 | | versicolor | | 5.74789 | | 5.136689 | |
| 6.1 | | 2.9 | | 4.7 | | 1.4 | | versicolor | | 8.215998 | | 0.872166 | |
| 5.6 | | 2.9 | | 3.6 | | 1.3 | | versicolor | | 4.755993 | | 3.69317 | |
| 6.7 | | 3.1 | | 4.4 | | 1.4 | | versicolor | | 7.310805 | | -0.85404 | |
| 5.6 | | 3 | | 4.5 | | 1.5 | | versicolor | | 7.506555 | | 2.938658 | |
| 5.8 | | 2.7 | | 4.1 | | 1 | | versicolor | | 5.58164 | | 3.325261 | |
| 6.2 | | 2.2 | | 4.5 | | 1.5 | | versicolor | | 9.194669 | | 2.419967 | |
| 5.6 | | 2.5 | | 3.9 | | 1.1 | | versicolor | | 5.350625 | | 4.238191 | |
| 5.9 | | 3.2 | | 4.8 | | 1.8 | | versicolor | | 9.797067 | | 0.876047 | |
| 6.1 | | 2.8 | | 4 | | 1.3 | | versicolor | | 5.856551 | | 2.33509 | |
| 6.3 | | 2.5 | | 4.9 | | 1.5 | | versicolor | | 9.885935 | | -0.73721 | |
| 6.1 | | 2.8 | | 4.7 | | 1.2 | | versicolor | | 7.884478 | | 1.096389 | |
| 6.4 | | 2.9 | | 4.3 | | 1.3 | | versicolor | | 7.06188 | | 0.349349 | |
| 6.6 | | 3 | | 4.4 | | 1.4 | | versicolor | | 7.338409 | | -0.51588 | |
| 6.8 | | 2.8 | | 4.8 | | 1.4 | | versicolor | | 8.129013 | | -1.52181 | |
| 6.7 | | 3 | | 5 | | 1.7 | | versicolor | | 9.117991 | | -2.24973 | |
| 6 | | 2.9 | | 4.5 | | 1.5 | | versicolor | | 7.753469 | | 1.521662 | |
| 5.7 | | 2.6 | | 3.5 | | 1 | | versicolor | | 4.560257 | | 4.232693 | |
| 5.5 | | 2.4 | | 3.8 | | 1.1 | | versicolor | | 5.129465 | | 4.604018 | |
| 5.5 | | 2.4 | | 3.7 | | 1 | | versicolor | | 4.888136 | | 4.670323 | |
| 5.8 | | 2.7 | | 3.9 | | 1.2 | | versicolor | | 5.411786 | | 3.516569 | |
| 6 | | 2.7 | | 5.1 | | 1.6 | | versicolor | | 10.76491 | | -0.29431 | |
| 5.4 | | 3 | | 4.5 | | 1.5 | | versicolor | | 7.523793 | | 3.460769 | |
| 6 | | 3.4 | | 4.5 | | 1.6 | | versicolor | | 8.682961 | | 1.061046 | |
| 6.7 | | 3.1 | | 4.7 | | 1.5 | | versicolor | | 7.926735 | | -1.30351 | |
| 6.3 | | 2.3 | | 4.4 | | 1.3 | | versicolor | | 8.95549 | | 2.469044 | |
| 5.6 | | 3 | | 4.1 | | 1.3 | | versicolor | | 6.357071 | | 3.241376 | |
| 5.5 | | 2.5 | | 4 | | 1.3 | | versicolor | | 5.812013 | | 4.305621 | |
| 5.5 | | 2.6 | | 4.4 | | 1.2 | | versicolor | | 6.752716 | | 3.977745 | |
| 6.1 | | 3 | | 4.6 | | 1.4 | | versicolor | | 7.951187 | | 0.959325 | |
| 5.8 | | 2.6 | | 4 | | 1.2 | | versicolor | | 5.613529 | | 3.682988 | |
| 5 | | 2.3 | | 3.3 | | 1 | | versicolor | | 4.148424 | | 5.234225 | |
| 5.6 | | 2.7 | | 4.2 | | 1.3 | | versicolor | | 6.394744 | | 3.745528 | |
| 5.7 | | 3 | | 4.2 | | 1.2 | | versicolor | | 6.413229 | | 2.948262 | |
| 5.7 | | 2.9 | | 4.2 | | 1.3 | | versicolor | | 6.496102 | | 3.082183 | |
| 6.2 | | 2.9 | | 4.3 | | 1.3 | | versicolor | | 6.992727 | | 1.186414 | |
| 5.1 | | 2.5 | | 3 | | 1.1 | | versicolor | | 3.912029 | | 5.168712 | |
| 5.7 | | 2.8 | | 4.1 | | 1.3 | | versicolor | | 6.112029 | | 3.345749 | |
| 6.3 | | 3.3 | | 6 | | 2.5 | | virginica | | 13.52067 | | -4.71305 | |
| 5.8 | | 2.7 | | 5.1 | | 1.9 | | virginica | | 11.33444 | | 0.373205 | |
| 7.1 | | 3 | | 5.9 | | 2.1 | | virginica | | 12.16881 | | -6.18319 | |
| 6.3 | | 2.9 | | 5.6 | | 1.8 | | virginica | | 11.89575 | | -2.94585 | |
| 6.5 | | 3 | | 5.8 | | 2.2 | | virginica | | 12.52159 | | -4.4955 | |
| 7.6 | | 3 | | 6.6 | | 2.1 | | virginica | | 12.54585 | | -7.60911 | |
| 4.9 | | 2.5 | | 4.5 | | 1.7 | | virginica | | 7.519709 | | 4.734589 | |
| 7.3 | | 2.9 | | 6.3 | | 1.8 | | virginica | | 12.02684 | | -7.1567 | |
| 6.7 | | 2.5 | | 5.8 | | 1.8 | | virginica | | 10.94377 | | -5.45043 | |
| 7.2 | | 3.6 | | 6.1 | | 2.5 | | virginica | | 13.21776 | | -6.44768 | |
| 6.5 | | 3.2 | | 5.1 | | 2 | | virginica | | 10.82053 | | -3.42842 | |
| 6.4 | | 2.7 | | 5.3 | | 1.9 | | virginica | | 11.23392 | | -2.48026 | |
| 6.8 | | 3 | | 5.5 | | 2.1 | | virginica | | 11.77744 | | -4.75986 | |
| 5.7 | | 2.5 | | 5 | | 2 | | virginica | | 11.60147 | | 0.623468 | |
| 5.8 | | 2.8 | | 5.1 | | 2.4 | | virginica | | 12.13465 | | 0.441443 | |
| 6.4 | | 3.2 | | 5.3 | | 2.3 | | virginica | | 12.5989 | | -3.81008 | |
| 6.5 | | 3 | | 5.5 | | 1.8 | | virginica | | 11.64493 | | -3.35743 | |
| 7.7 | | 3.8 | | 6.7 | | 2.2 | | virginica | | 13.3026 | | -7.49872 | |
| 7.7 | | 2.6 | | 6.9 | | 2.3 | | virginica | | 12.4047 | | -7.99148 | |
| 6 | | 2.2 | | 5 | | 1.5 | | virginica | | 11.18727 | | -0.5159 | |
| 6.9 | | 3.2 | | 5.7 | | 2.3 | | virginica | | 12.4108 | | -5.43479 | |
| 5.6 | | 2.8 | | 4.9 | | 2 | | virginica | | 11.34832 | | 0.955082 | |
| 7.7 | | 2.8 | | 6.7 | | 2 | | virginica | | 12.40658 | | -7.78986 | |
| 6.3 | | 2.7 | | 4.9 | | 1.8 | | virginica | | 10.17362 | | -0.72411 | |
| 6.7 | | 3.3 | | 5.7 | | 2.1 | | virginica | | 12.43634 | | -5.04862 | |
| 7.2 | | 3.2 | | 6 | | 1.8 | | virginica | | 12.04517 | | -6.61608 | |
| 6.2 | | 2.8 | | 4.8 | | 1.8 | | virginica | | 9.914613 | | -0.18314 | |
| 6.1 | | 3 | | 4.9 | | 1.8 | | virginica | | 10.02865 | | 0.225165 | |
| 6.4 | | 2.8 | | 5.6 | | 2.1 | | virginica | | 12.05674 | | -3.70011 | |
| 7.2 | | 3 | | 5.8 | | 1.6 | | virginica | | 11.59299 | | -6.55592 | |
| 7.4 | | 2.8 | | 6.1 | | 1.9 | | virginica | | 11.99028 | | -7.05998 | |
| 7.9 | | 3.8 | | 6.4 | | 2 | | virginica | | 13.28991 | | -7.48532 | |
| 6.4 | | 2.8 | | 5.6 | | 2.2 | | virginica | | 12.16747 | | -3.86144 | |
| 6.3 | | 2.8 | | 5.1 | | 1.5 | | virginica | | 10.06742 | | -1.10188 | |
| 6.1 | | 2.6 | | 5.6 | | 1.4 | | virginica | | 11.72579 | | -1.56192 | |
| 7.7 | | 3 | | 6.1 | | 2.3 | | virginica | | 12.59742 | | -7.22445 | |
| 6.3 | | 3.4 | | 5.6 | | 2.4 | | virginica | | 13.27284 | | -4.19394 | |
| 6.4 | | 3.1 | | 5.5 | | 1.8 | | virginica | | 11.75389 | | -3.22706 | |
| 6 | | 3 | | 4.8 | | 1.8 | | virginica | | 9.926422 | | 0.548064 | |
| 6.9 | | 3.1 | | 5.4 | | 2.1 | | virginica | | 11.63022 | | -4.87757 | |
| 6.7 | | 3.1 | | 5.6 | | 2.4 | | virginica | | 12.46354 | | -4.8195 | |
| 6.9 | | 3.1 | | 5.1 | | 2.3 | | virginica | | 11.07405 | | -4.50459 | |
| 5.8 | | 2.7 | | 5.1 | | 1.9 | | virginica | | 11.33444 | | 0.373205 | |
| 6.8 | | 3.2 | | 5.9 | | 2.3 | | virginica | | 12.74059 | | -5.52894 | |
| 6.7 | | 3.3 | | 5.7 | | 2.5 | | virginica | | 13.01659 | | -5.06266 | |
| 6.7 | | 3 | | 5.2 | | 2.3 | | virginica | | 11.3631 | | -4.28908 | |
| 6.3 | | 2.5 | | 5 | | 1.9 | | virginica | | 10.6912 | | -1.01544 | |
| 6.5 | | 3 | | 5.2 | | 2 | | virginica | | 11.09708 | | -3.35718 | |
| 6.2 | | 3.4 | | 5.4 | | 2.3 | | virginica | | 13.19599 | | -3.72455 | |
| 5.9 | | 3 | | 5.1 | | 1.8 | | virginica | | 10.71241 | | 0.427633 | |

一張含有 文字, 螢幕擷取畫面, 軟體, 多媒體軟體 的圖片

自動產生的描述

import pandas as pd

from sklearn.manifold import TSNE

import matplotlib.pyplot as plt

# 讀取 iris 數據集

data = pd.read\_csv('D:/GitHub/NTUST/112-2/MI5118701 人工智慧技術與商業應用/iris.csv')

# 提取特徵和標籤

features = data.iloc[:, :-1].values

labels = data.iloc[:, -1].values

# 使用 t-SNE 進行降維

tsne = TSNE(n\_components=2, random\_state=0)

tsne\_results = tsne.fit\_transform(features)

# 將 t-SNE 結果轉換為 DataFrame

tsne\_df = pd.DataFrame(tsne\_results, columns=['Dimension 1', 'Dimension 2'])

tsne\_df['Label'] = labels

# 顯示原始和降維後的座標

result\_df = pd.DataFrame(features, columns=['Sepal.Length', 'Sepal.Width', 'Petal.Length', 'Petal.Width'])

result\_df['Species'] = labels

result\_df['Dimension 1'] = tsne\_df['Dimension 1']

result\_df['Dimension 2'] = tsne\_df['Dimension 2']

# 印出結果

print(result\_df)

# 保存結果到 CSV 文件

result\_df.to\_csv('iris\_with\_tsne.csv', index=False)

# 顏色字典

colors = {'setosa': 'red', 'versicolor': 'green', 'virginica': 'blue'}

# 繪製 t-SNE 結果

plt.figure(figsize=(10, 8))

for label in tsne\_df['Label'].unique():

    subset = tsne\_df[tsne\_df['Label'] == label]

    plt.scatter(subset['Dimension 1'], subset['Dimension 2'], c=colors[label], label=label)

plt.legend()

plt.title('t-SNE visualization of Iris dataset')

plt.xlabel('Dimension 1')

plt.ylabel('Dimension 2')

plt.savefig('iris\_tsne\_visualization.png')

plt.show()