1 TUGAS PRAKTIKUM JOBSHEET 7

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Link Google Colab :

https://colab.research.google.com/drive/1NdCFfp7yk8W92czh6gzq141trsKnm7IR#scrollTo=Rb6U9sD_Jl7b

Buatlah sebuah model K-Means dengan ketentuan:

1. Gunakan data 'Mall_Customers.csv'
2. Tentukan fitur apa yang tepat untuk melakukan clustering (minimal 2)
3. Buatlah model K-Means dengan mempertimbangkan jumlah k yang terbaik.
4. Buatlah implementasi model SOM untuk segmentasi citra lain

1.1 1. Gunakan data 'Mall_Customers.csv'

[2]:

```
import pandas as pd
import numpy as np
from sklearn.preprocessing import StandardScaler
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt
from skimage import io
```

[3]:

```
# Load the data
from google.colab import drive
drive.mount('/content/drive')

path = "/content/drive/MyDrive/Elis-3C/SMT 5/ML/Jobsheet 7/dataset/
  ↪Mall_Customers.csv"
df = pd.read_csv(path)

df.head()
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call
drive.mount("/content/drive", force_remount=True).
```

[3]:

```
   CustomerID  Gender  Age  Annual Income (k$)  Spending Score (1-100)
0           1    Male   19                  15                      39
1           2    Male   21                  15                      81
2           3  Female   20                  16                       6
3           4  Female   23                  16                      77
4           5  Female   31                  17                      40
```

[4]:

```python
# Cek kolom null
print(df.isnull().sum())
```

```
CustomerID                0
Gender                    0
Age                       0
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

1.2 2. Tentukan fitur apa yang tepat untuk melakukan clustering (minimal 2)

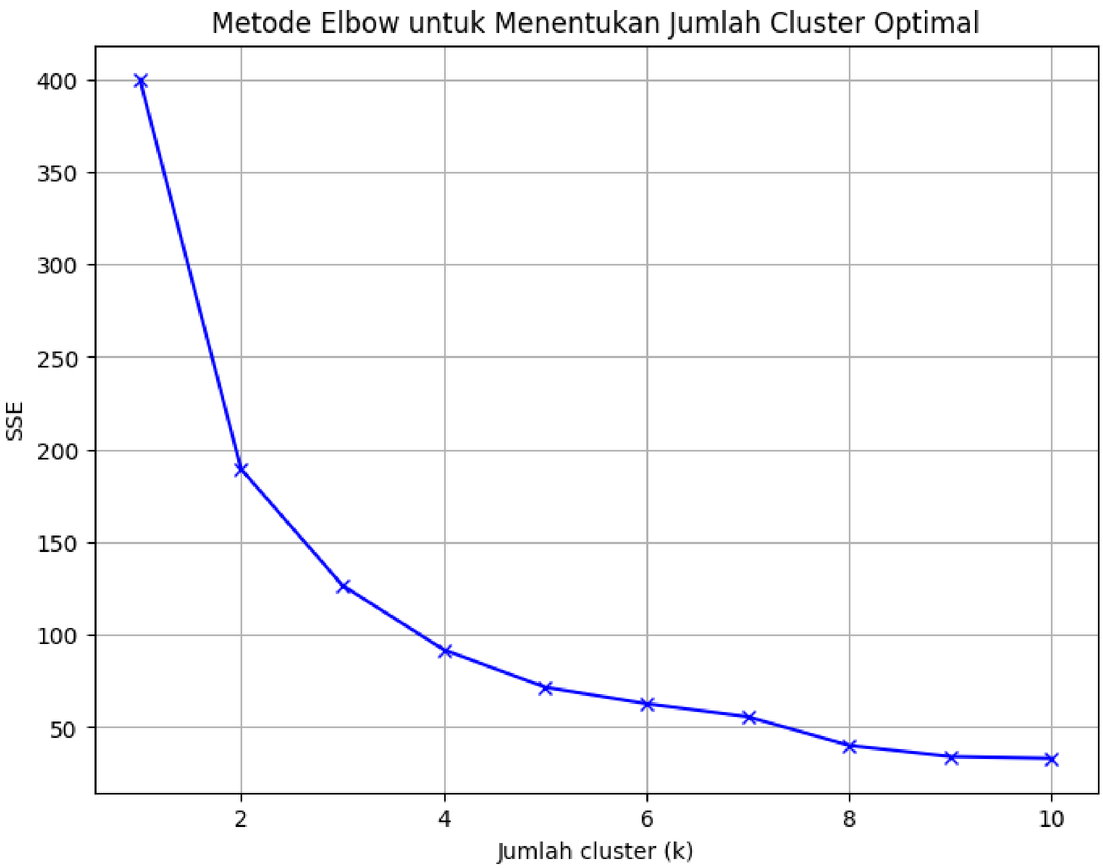
[5]:

```python
features = df[['Age', 'Spending Score (1-100)']]
scaler = StandardScaler()
scaled_features = scaler.fit_transform(features)
```

1.3 3. Buatlah model K-Means dengan mempertimbangkan jumlah yang terbaik

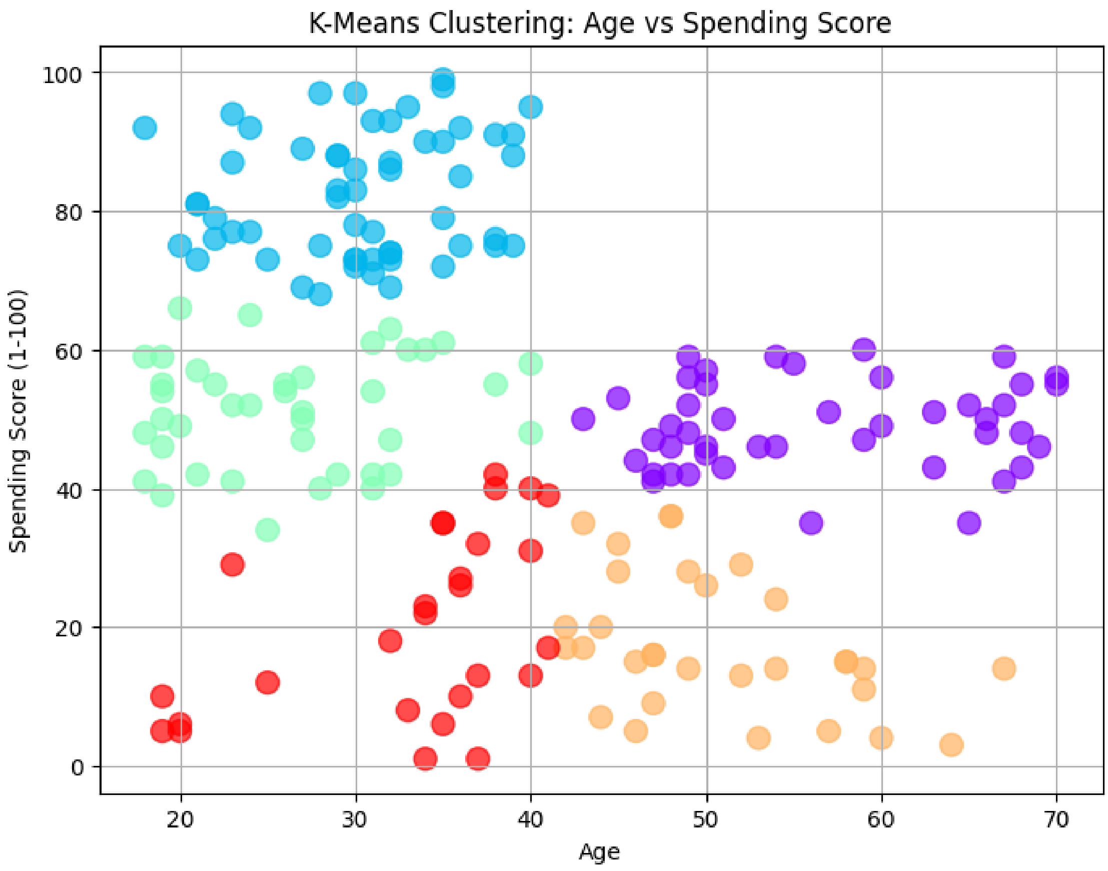
[6]:

```python
# Elbow method for finding the optimal k
sse = []
K = range(1, 11)

for k in K:
    kmeans = KMeans(n_clusters=k, random_state=42)
    kmeans.fit(scaled_features)
    sse.append(kmeans.inertia_)

# Menampilkan plot Elbow
plt.figure(figsize=(8, 6))
plt.plot(K, sse, 'bx-')
plt.xlabel('Jumlah cluster (k)')
plt.ylabel('SSE')
plt.title('Metode Elbow untuk Menentukan Jumlah Cluster Optimal')
plt.grid()
plt.show()
```



[7]:

```
# Asumsikan jumlah cluster terbaik berdasarkan plot adalah k=5
optimal_k = 5
kmeans = KMeans(n_clusters=optimal_k, random_state=42)
cluster_labels = kmeans.fit_predict(scaled_features)

# Menambahkan label cluster ke data asli
df['Cluster'] = cluster_labels

# Visualisasi hasil clustering
plt.figure(figsize=(8, 6))
plt.scatter(df['Age'], df['Spending Score (1-100)'], c=cluster_labels,␣
 ↪cmap='rainbow', s=100, alpha=0.7)
plt.title('K-Means Clustering: Age vs Spending Score')
plt.xlabel('Age')
plt.ylabel('Spending Score (1-100)')
plt.grid()
plt.show()
```



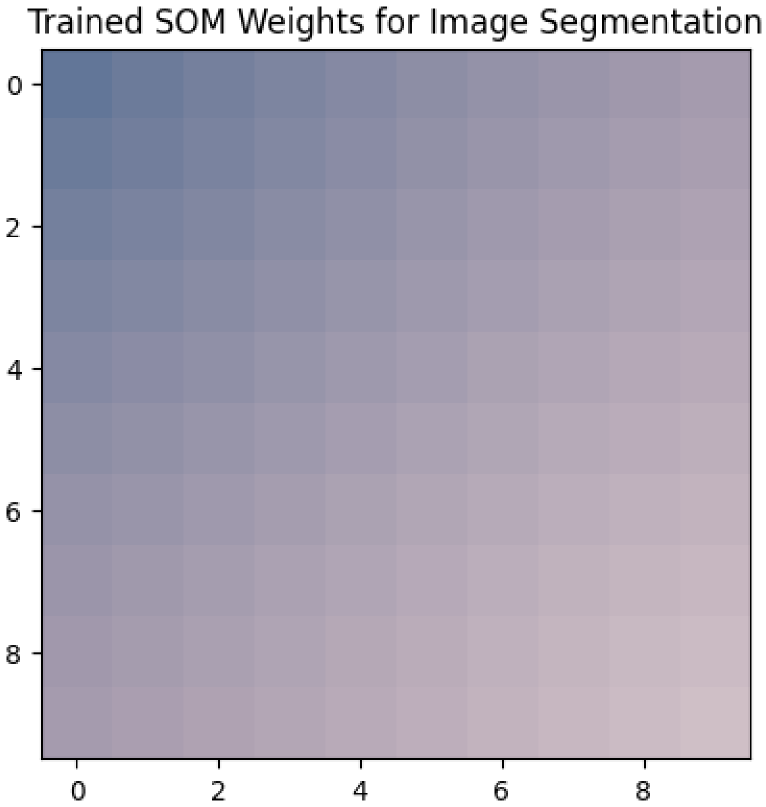
1.4 4. Buatlah implementasi model SOM untuk segmentasi citra lain

[1]:

```
import numpy as np
import matplotlib.pyplot as plt
from skimage import io, transform

# Fungsi untuk menginisialisasi bobot SOM
def initialize_weights(input_shape, output_shape):
    return np.random.rand(output_shape[0], output_shape[1], input_shape[2])

# Fungsi untuk menghitung jarak antara vektor input dan bobot SOM
def calculate_distance(input_vector, weights):
    return np.linalg.norm(input_vector - weights, axis=2)

# Fungsi untuk menemukan indeks unit pemenang (unit dengan bobot terdekat)
def find_winner_unit_in_image(input_vector, weights):
    distances = calculate_distance(input_vector, weights)
    return np.unravel_index(np.argmin(distances), distances.shape)
```

```
# Fungsi untuk memperbarui bobot SOM
def update_weights(input_vector, weights, winner, learning_rate,␣
 ↪neighborhood_radius):
    # Menghitung jarak antara unit SOM dan unit pemenang
    distances = np.linalg.norm(np.indices(weights.shape[:2]).T - np.
 ↪array(winner).reshape(1, -1), axis=2)
    # Menghitung pengaruh tetangga
    influence = np.exp(-distances / (2 * neighborhood_radius**2))
    # Update bobot dengan vektor input
    weights += learning_rate * influence[:, :, np.newaxis] * (input_vector -␣
 ↪weights)

# Fungsi untuk melatih SOM
def train_som(image, num_epochs, initial_learning_rate,␣
 ↪initial_neighborhood_radius):
    input_shape = image.shape
    som_shape = (10, 10, input_shape[2])  # Ukuran SOM sesuai dengan jumlah␣
 ↪saluran warna
    weights = initialize_weights(input_shape, som_shape)

    # Mengambil subset data secara acak untuk mempercepat pelatihan
    indices = np.random.choice(input_shape[0] * input_shape[1], size=1000,␣
 ↪replace=False)
    row_indices, col_indices = np.unravel_index(indices, (input_shape[0],␣
 ↪input_shape[1]))

    for epoch in range(num_epochs):
        # Update parameter pembelajaran dan radius tetangga
        learning_rate = initial_learning_rate * np.exp(-epoch / num_epochs)
        neighborhood_radius = initial_neighborhood_radius * np.exp(-epoch /␣
 ↪num_epochs)

        # Pemrosesan SOM
        for idx in range(len(row_indices)):
            i, j = row_indices[idx], col_indices[idx]
            input_vector = image[i, j, :]
            winner = find_winner_unit_in_image(input_vector, weights)
            update_weights(input_vector, weights, winner, learning_rate,␣
 ↪neighborhood_radius)

    return weights

# Load citra untuk segmentasi
jekey_path = "/content/drive/MyDrive/Elis-3C/SMT 5/ML/Jobsheet 7/dataset/jekey.
 ↪jpeg"
image = io.imread(jekey_path) / 255.0  # Normalisasi intensitas piksel
```

```python
image = transform.resize(image, (image.shape[0] // 2, image.shape[1] // 2), anti_aliasing=True)

# Latih SOM
num_epochs = 50  # Mengurangi jumlah epoch
initial_learning_rate = 0.1
initial_neighborhood_radius = 5
trained_weights = train_som(image, num_epochs, initial_learning_rate, initial_neighborhood_radius)

# Visualisasi bobot SOM
plt.imshow(trained_weights)
plt.title('Trained SOM Weights for Image Segmentation')
plt.show()
```


Trained SOM Weights for Image Segmentation