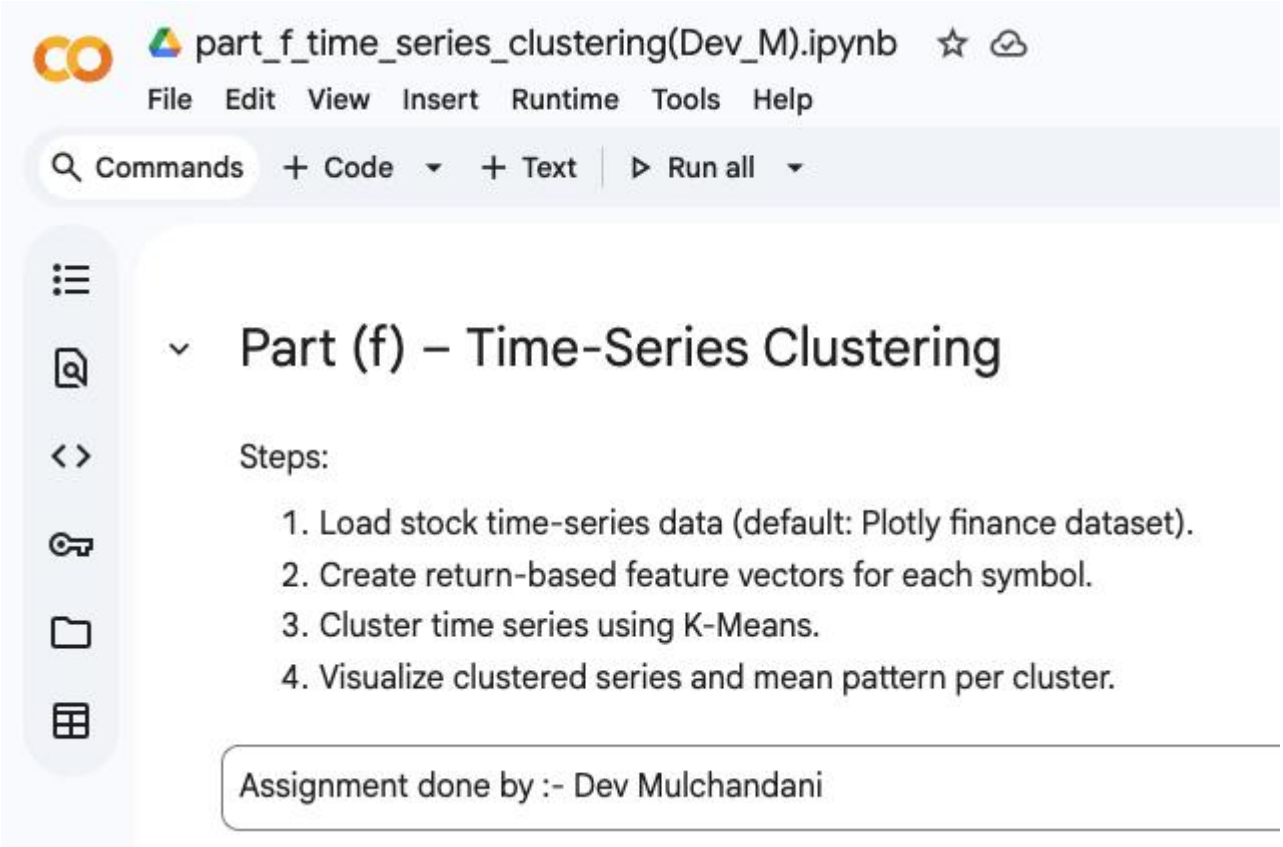
Clustering Assignments

❖ Assignment done by :- Dev Mulchandani

❖ Part-F :– Time-Series Clustering

In Part F, I explored clustering for time-series data using stock price time series. After organizing the data by ticker symbol, I converted each stock's historical price string into a feature vector by computing daily percentage returns. Using these features, I applied K-Means to group stocks with similar temporal patterns. I evaluated the clustering using silhouette score and visualized each cluster by plotting the individual time series along with their mean trend. This demonstrated how clustering can reveal similar movement behaviors across different time-series sequences.

❖ Screenshots:-



Load dataset (upload / URL / Kaggle)

[5] ✓ 12s

```
# @title Load dataset (upload / URL / Kaggle)
import pandas as pd
import zipfile
from pathlib import Path

try:
    from google.colab import files  # type: ignore
    IN_COLAB = True
except Exception:
    IN_COLAB = False

DEFAULT_URL = "https://raw.githubusercontent.com/plotly/datasets/master/finance-charts-apple.csv"  # You can change this to another CSV URL

print("How do you want to load the dataset?")
print("1 = upload CSV file manually")
print("2 = download from URL (uses DEFAULT_URL above)")
print("3 = download from Kaggle (you must provide kaggle.json & dataset name)")
choice = input("Enter 1, 2, or 3: ").strip()

if choice == "1":
    if not IN_COLAB:
        raise RuntimeError("Manual upload only works in Google Colab.")
    uploaded = files.upload()
    fname = list(uploaded.keys())[0]
    df = pd.read_csv(fname)
    print("Loaded:", fname, "shape:", df.shape)
elif choice == "2":
    if not DEFAULT_URL:
        raise ValueError("DEFAULT_URL is empty. Please set it to a valid CSV URL or choose another option.")
    df = pd.read_csv(DEFAULT_URL)
    print("Loaded from URL. Shape:", df.shape)
elif choice == "3":
    import os, subprocess
```

```
    if IN_COLAB:
        from google.colab import files  # type: ignore
        print("Please upload your kaggle.json file (from your Kaggle account).")
        uploaded = files.upload()
        kaggle_path = Path("~/.kaggle").expanduser()
        kaggle_path.mkdir(parents=True, exist_ok=True)
        for fn in uploaded:
            Path(fn).replace(kaggle_path / "kaggle.json")
        os.chmod(kaggle_path / "kaggle.json", 0o600)

    # Install kaggle CLI
    import sys
    !pip -q install kaggle

    DATASET_SLUG = input("Enter Kaggle dataset slug (e.g. 'uciml/iris'): ").strip()

    # Download entire dataset (may contain multiple files)
    !kaggle datasets download -d $DATASET_SLUG -p kaggle_data

    # Unzip everything
    kaggle_dir = Path("kaggle_data")
    kaggle_dir.mkdir(exist_ok=True)
    for zpath in kaggle_dir.glob("*.zip"):
        with zipfile.ZipFile(zpath, "r") as zf:
            zf.extractall(kaggle_dir)

    csv_files = list(kaggle_dir.rglob("*.csv"))
    if not csv_files:
        raise FileNotFoundError("No CSV files found in Kaggle dataset; please inspect kaggle_data/ manually.")
    csv_path = csv_files[0]
    print("Using CSV:", csv_path)
    df = pd.read_csv(csv_path)
    print("Loaded from Kaggle. Shape:", df.shape)
else:
    raise ValueError("Invalid choice. Please run this cell again.")

df.head()
```

```
How do you want to load the dataset?
1 = upload CSV file manually
2 = download from URL (uses DEFAULT_URL above)
3 = download from Kaggle (you must provide kaggle.json & dataset name)
Enter 1, 2, or 3: 1
```

Choose files new_timeseries.csv

new_timeseries.csv(text/csv) - 39169 bytes, last modified: 02/12/2025 - 100% done

```
Saving new_timeseries.csv to new_timeseries.csv
Loaded: new_timeseries.csv shape: (200, 11)
```

	Date	STOCK1.Close	STOCK2.Close	STOCK3.Close	STOCK4.Close	STOCK5.Close	STOCK6.Close	STOCK7.Close	STOCK8.Close	STOCK9.Close	STOCK10.Close
0	2020-01-01	100.154149	100.229805	99.820907	100.181372	101.268247	99.090056	99.339959	99.560272	99.556804	101.881789
1	2020-01-02	100.340684	98.286149	98.431575	99.601155	101.847684	98.418164	100.127222	99.029804	98.443431	103.436515
2	2020-01-03	100.642266	99.422532	97.750786	97.784273	100.924380	98.106476	101.597840	98.476269	97.354574	103.144811
3	2020-01-04	102.230904	99.031156	97.084078	97.921730	100.868769	97.103764	101.640103	98.162761	99.095275	102.634748
4	2020-01-05	103.817205	98.844659	97.514192	98.183903	99.904956	97.187244	101.813939	97.205917	99.998863	101.755556

Next steps: Generate code with df | New interactive sheet

Prepare multivariate time series per symbol

[6] ✓ 0s

```python
# @title Prepare multivariate time series per symbol
import pandas as pd
import numpy as np

df_ts = df.copy()
price_cols = [c for c in df_ts.columns if c.endswith(".Close")]

if "Date" in df_ts.columns and price_cols:
    symbols = [c.split(".")[0] for c in price_cols]
    print("Detected symbols:", sorted(set(symbols)))
    prices = df_ts[price_cols]
    prices.columns = [c.split(".")[0] for c in price_cols]
    prices.index = pd.to_datetime(df_ts["Date"])
else:
    raise ValueError("Expected a finance-style dataset with 'Date' and '*.Close' columns.")

returns = prices.pct_change().dropna()
features = returns.T.values
print("Feature matrix shape (symbols x time):", features.shape)
```

```
Detected symbols: ['STOCK1', 'STOCK10', 'STOCK2', 'STOCK3', 'STOCK4', 'STOCK5', 'STOCK6', 'STOCK7', 'STOCK8', 'STOCK9']
Feature matrix shape (symbols x time): (10, 199)
```

Cluster time series with K-Means

[7] ✓ 0s

```python
# @title Cluster time series with K-Means
from sklearn.cluster import KMeans
from sklearn.metrics import silhouette_score

k = 3
kmeans = KMeans(n_clusters=k, random_state=42, n_init=10)
labels = kmeans.fit_predict(features)

score = silhouette_score(features, labels)
print(f"Silhouette score: {score:.3f}")

for cluster_id in range(k):
    members = prices.columns[labels == cluster_id]
    print(f"Cluster {cluster_id}: {list(members)}")
```

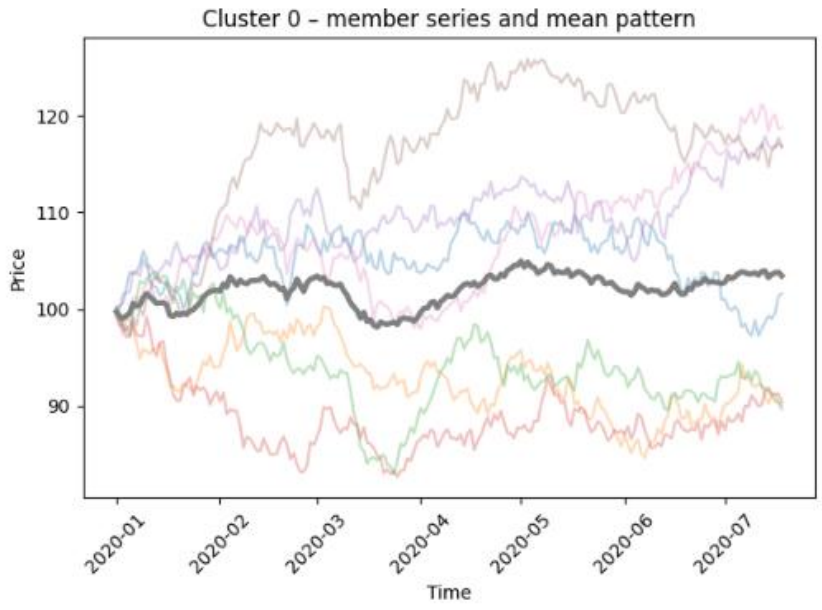
```
Silhouette score: 0.009
Cluster 0: ['STOCK1', 'STOCK2', 'STOCK4', 'STOCK6', 'STOCK7', 'STOCK8', 'STOCK9']
Cluster 1: ['STOCK3']
Cluster 2: ['STOCK5', 'STOCK10']
```

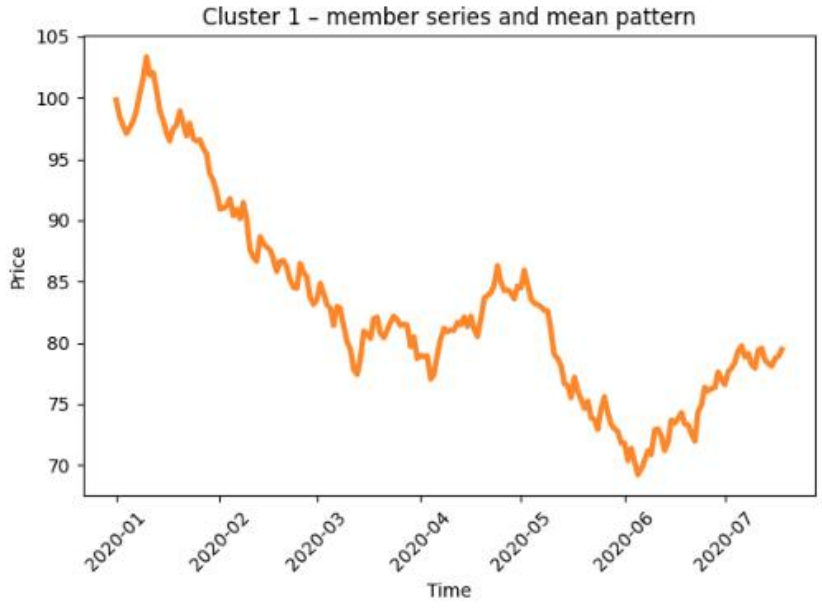
Plot clusters and mean series

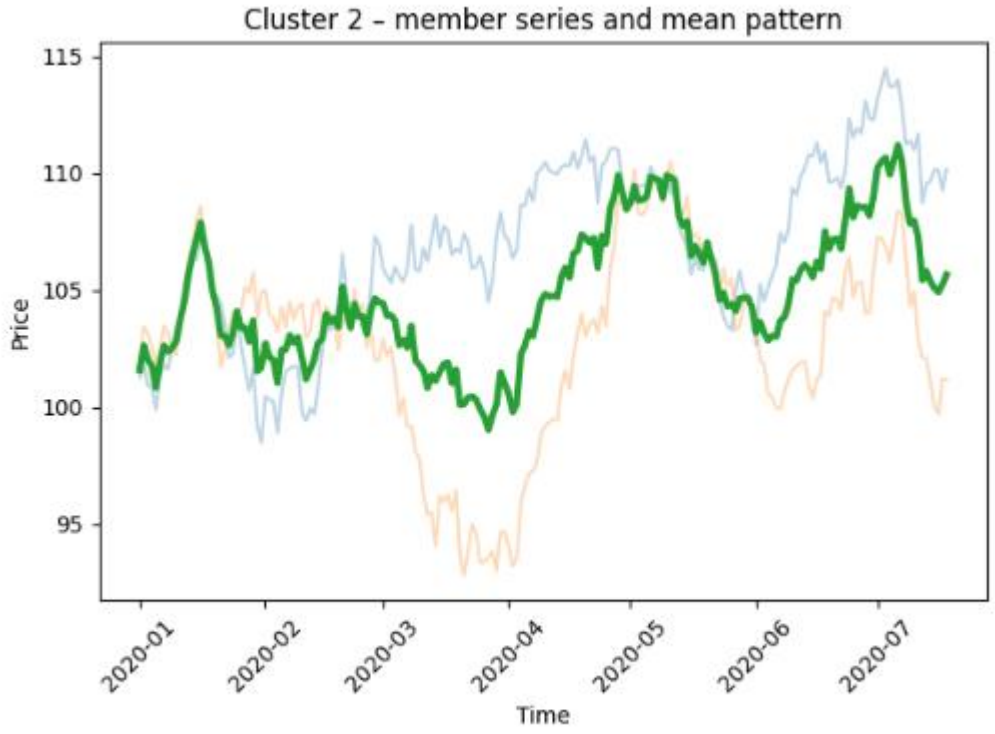
[8]
✓ 0s

```python
# @title Plot clusters and mean series
import matplotlib.pyplot as plt

k = len(set(labels))
for cluster_id in range(k):
    members = prices.columns[labels == cluster_id]
    if len(members) == 0:
        continue
    mean_series = prices[members].mean(axis=1)
    plt.figure()
    for sym in members:
        plt.plot(prices.index, prices[sym], alpha=0.3)
    plt.plot(prices.index, mean_series, linewidth=3)
    plt.title(f"Cluster {cluster_id} – member series and mean pattern")
    plt.xlabel("Time")
    plt.ylabel("Price")
    plt.xticks(rotation=45)
    plt.tight_layout()
    plt.show()
```






Cluster 2 – member series and mean pattern
115
110
105
100
95
Price
2020-01
2020-02
2020-03
2020-04
2020-05
2020-06
2020-07
Time