

Clustering Dow Jones Stocks

1. Introduction

This assignment clusters Dow Jones stocks (AAPL, MSFT, JNJ, JPM, V) based on residuals after regressing individual stock returns against SPY returns. The objective is to identify stock behavioral patterns over time.

2. Data Collection

Daily adjusted close prices were collected for AAPL, MSFT, JNJ, JPM, V, and SPY from April 2019 to April 2024. Daily returns were calculated, and monthly linear regressions were performed to extract residuals.

3. K-Means Clustering and Elbow Method

The Elbow method was used by plotting inertia vs the number of clusters ($k = 3$ to 7). From the elbow plot, $k=4$ was selected as the optimal number of clusters.

4. Time-Cluster Trajectories

Cluster trajectories for each stock over 60 months were plotted. Different stocks exhibited different patterns of cluster memberships across time.

5. Hamming Distance Analysis

The Hamming distances between the cluster trajectories of the stocks were computed. The resulting Hamming Distance Matrix is summarized below:

	AAPL	MSFT	JNJ	JPM	V
AAPL	0.0	0.518	0.593	0.852	0.722
MSFT	0.518	0.0	0.574	0.852	0.518
JNJ	0.593	0.574	0.0	0.759	0.611
JPM	0.852	0.852	0.759	0.0	0.759
V	0.722	0.518	0.611	0.759	0.0

6. Key Observations

- Stocks with the largest Hamming distance: AAPL and JPM
- Stocks with the smallest Hamming distance: AAPL and MSFT
- Average Hamming distance: 0.5407

7. First 2 Years vs Last 2 Years Comparison

The Hamming distance comparison between the first 2 years and the last 2 years is pending. However, based on the trajectory plots, some stocks like AAPL and MSFT exhibited more stable clustering behavior compared to more dynamic stocks like JPM.

8. Conclusion

Clustering using residual-based features reveals the dynamic or stable behavior of different Dow Jones stocks. Stocks with more volatile clustering patterns indicate higher sensitivity to changes unrelated to market-wide movements (SPY). Hamming distances effectively quantify similarity or divergence among stock behaviors.