

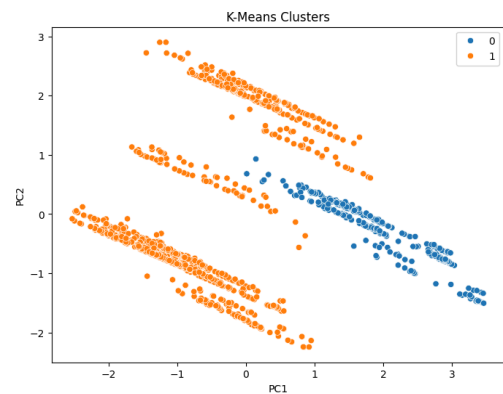
Objective:

The goal of this lab is to identify groups of patients with similar event dynamics and to model the temporal structure of their medical events using Hawkes processes. Comparing the Hawkes parameters across clusters provides insight into different underlying patient behaviors and potential disease progression patterns.

Clustering:

The patient features were continuously scaled using MinMaxScaler. Several values of k were tested, and two clusters were selected as being optimal from their silhouette score. K-Means clustering was then applied and visualized using PCA. Patients were separated into distinct groups with differing clinical feature profiles (e.g., one cluster with higher F0–F2 scores indicating more severe baseline conditions).

The cluster sizes weren't very balanced, with cluster 1 containing 855 members (681 events) while cluster 0 contained 257 members (245 events).

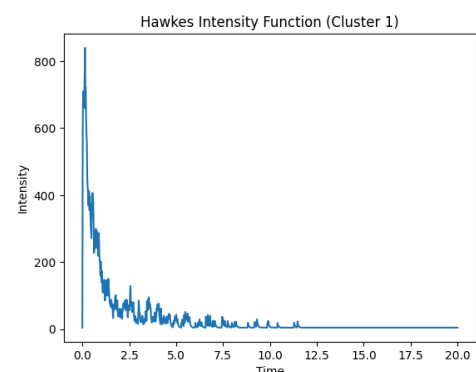
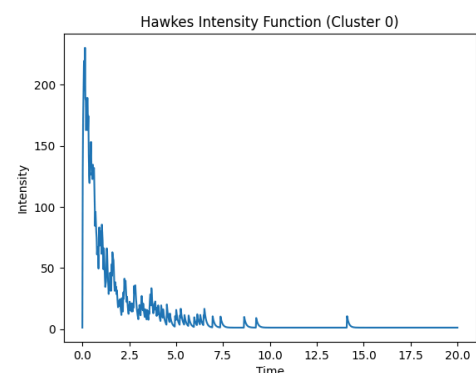


Hawkes Process:

For each cluster, event sequences were modeled using an exponential Hawkes process using the HawkesLib library. The key parameters estimated were μ (baseline intensity), α (excitation amplitude), and β (decay rate). Cluster-level Hawkes parameters were compared visually to interpret differences in event dynamics between patient groups.

Cluster 1 exhibits a high baseline intensity ($\mu = 4.55$) and a fast decay ($\beta = 21.87$). This indicates a relatively steady occurrence of events with limited self-excitation. While cluster 0 shows a lower baseline intensity ($\mu = 1.22$) but stronger persistence (lower $\beta = 10.09$). Although both clusters have similar excitation strength ($\alpha \approx 0.93$), the slower decay suggests that once an event occurs, its influence lasts longer.

Cluster 1 patients experience frequent but less self-driven events, while Cluster 0 patients experience less frequent but more temporally dependent event sequences. The difference in Hawkes parameters captures contrasting underlying dynamics.



Google Colab:

https://colab.research.google.com/drive/1jdw5kvN4V9hx2YagNSiMI1R58_HYIh5n?usp=sharing

Github:

<https://github.com/mryeazel-729/MLHealth/blob/main/Lab2.ipynb>