**Title: A clustering approach to portfolio construction**

**Goal :** Use filtering methods and clustering to enhance the global minimum variance portfolio ( GMVP) estimation

* **Correlation estimation**
  + Instead of using HY, we will first synchronize data using the refresh time sampling approach from Barndorff-Nielsen, Hansen, Lunde, and Shephard (2011)
  + Then we will compute the returns BAHC correlation matrix / sample returns correlation matrix / filtered sample returns correlation matrix using eigenvalue clipping
* **Clustering:** we willuse the correlation matrix estimates as null models and apply the Louvain clustering algorithm.
* **Backtest of a simple trading strategy:** 
  + On each cluster, we will create an EW portfolio. *Asset that minimize distance ( different distance)*
  + Considering each EW portfolio as a single asset we will compute the GMVP weights.
  + We will use 1 day of data to compute those weights
  + We will compute the in-sample GMVP return and volatility and used the weights on the next day data to compute the out-sample return and volatility of the GMVP.
  + We will compare the clustered-GMVP with the GMVP compute without using clustering