**Evolutionary Clustering**

**Definition of Evolutionary Clustering –** framework for clustering data that evolves overtime. The traditional clustering optimizes fit to the current data whereas evolutionary clustering balances between snapshot quality (how well the clustering represents the data at the current time) and history cost (how consistent the clustering remains with previous time steps).

The trade-off between these two aspects avoids abrupt changes in clusters, providing smoother, more interpretable transitions across time. A parameter used to control this trade-off is cp.

The two algorithms adapted to the evolutionary setting were k-means and agglomerative hierarchical clustering, but it can extend to other algorithms, supporting both online and offline data. A crucial aspect is that the input at each timestep is represented as a similarity matrix, which can be constructed from bipartite graphs or from temporal correlations between past observations. The importance of this graph relies on it enabling the track of correspondence between clusters of consecutive timesteps.

Experiments were made and the following conclusions about evolutionary clustering were drawn:

* Produces smoother cluster trajectories
* Reduces noise sensitivity
* Helps track correspondence of clusters across time