Probabilistic Graphical Models : Homework 3

Raphael Avalos
raphael@avalos.fr

December 5, 2018

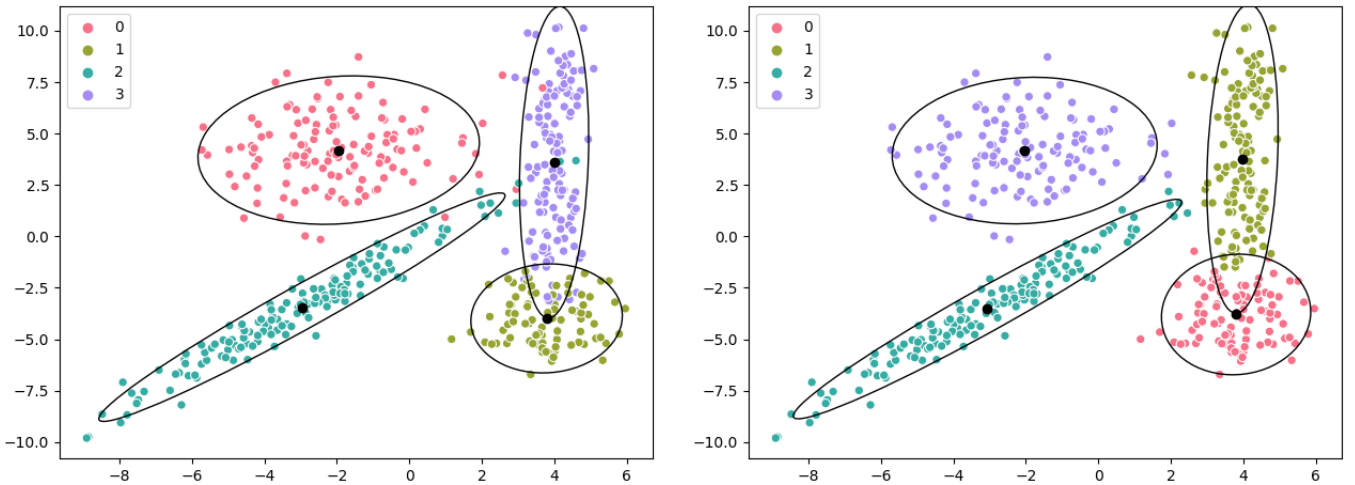## Equations

Writing the complete log likelihood and applying the method for EM we get the following equations.

$$\pi = p(q_0 \mid u)$$
$$A_{i,j} = \frac{\sum_t p(q_{t+1} = i, q_t = j \mid u)}{\sum_{i,t} p(q_{t+1} = i, q_t = j \mid u)}$$
$$\mu_k = \frac{\sum_t p(q_t = k \mid u)u_t}{\sum_t p(q_t = k \mid u)}$$
$$\Sigma_k = \frac{\sum_t p(q_t = k \mid u)(u_t - \mu_k)(u_t - \mu_k)^T}{\sum_t p(q_t = k \mid u)}$$

Results

Log Likelihood	Iso	General	HMM
Train	-2682	-2345	-1899
Test	-2733	-2426	-1959

Figure 1: HMM vs GMM

HMM seems to take into account the fact that the categories overlapse compared to GMM. The log likelihood increase significantly so we have more confidence in the HMM model.