Mixture of Gaussians

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Link to code: https://github.com/Santiagomrn/mixture_of_gaussians.git

I. Data set

Define the parameters of 3 Gaussian distribution functions in two dimensions and generate 300 points in total, 100 points from each of the 3 Gaussians.
The following parameters were used:

$$Mean = \begin{bmatrix} 20 & -20 \end{bmatrix}$$

$$Covariance\ matrix = \begin{bmatrix} 100 & 1 \\ 1 & 100 \end{bmatrix}$$

$$Mean = \begin{bmatrix} 100 & 10 \end{bmatrix}$$

$$Covariance\ matrix = \begin{bmatrix} 200 & 3 \\ 3 & 100 \end{bmatrix}$$

$$Mean = \begin{bmatrix} 50 & 40 \end{bmatrix}$$

$$Covariance\ matrix = \begin{bmatrix} 200 & 40 \\ 40 & 200 \end{bmatrix}$$

The result was the following:

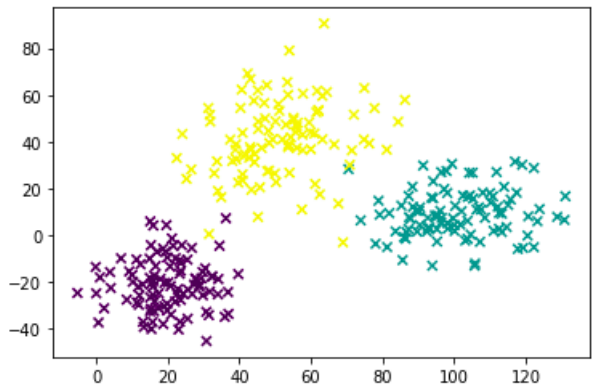

Fig. 1. Training set.

II. EM algorithm to solve the Mixture of Gaussians

As a result of the training, the following parameters were obtained:

$$Mean = \begin{bmatrix} 19.83347161 & -20.97608553 \end{bmatrix}$$

$$Covariance\ matrix = \begin{bmatrix} 83.88449524 & 2.62630164 \\ 2.62630164 & 117.19907236 \end{bmatrix}$$

$$Mean = \begin{bmatrix} 100.86030203 & 9.19818453 \end{bmatrix}$$

$$Covariance\ matrix = \begin{bmatrix} 179.33648879 & 19.35525177 \\ 19.35525177 & 101.16417633 \end{bmatrix}$$

$$Mean = \begin{bmatrix} 51.04992293 & 41.64851779 \end{bmatrix}$$

$$Covariance\ matrix = \begin{bmatrix} 178.87349552 & 54.47982899 \\ 54.47982899 & 235.40496753 \end{bmatrix}$$

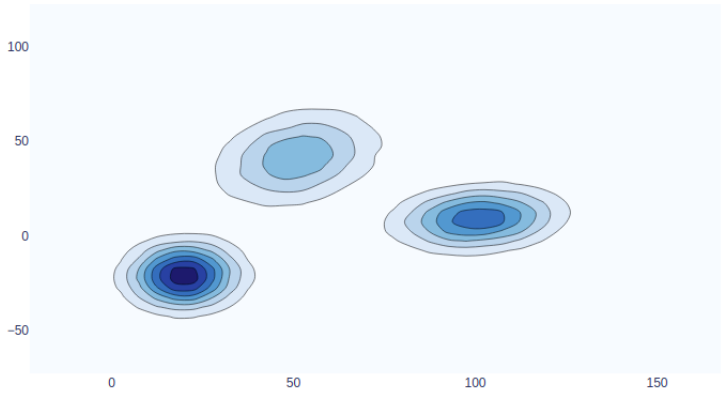

Fig. 2. Contours of Gaussian functions.

With the obtained parameters, predictions were made on the data set.

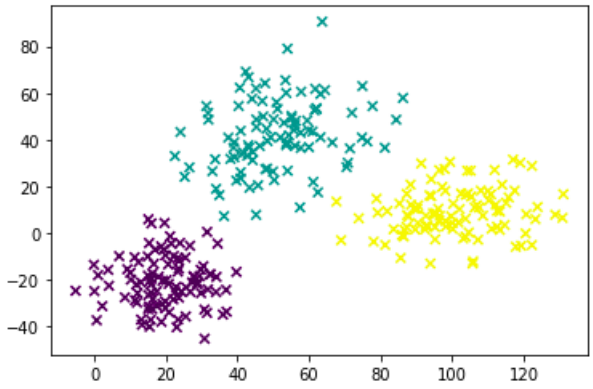

Fig. 3. Predictions.

III. K-MEANS

As a result of the training, the following parameters were obtained:

$$Centroid = \begin{bmatrix} 101.16397301 & 9.10936031 \end{bmatrix}$$

$$Centroid = \begin{bmatrix} 19.98148699 & -20.65642081 \end{bmatrix}$$

$$Centroid = \begin{bmatrix} 51.43441023 & 41.91603322 \end{bmatrix}$$

With the obtained parameters, predictions were made on the data set.

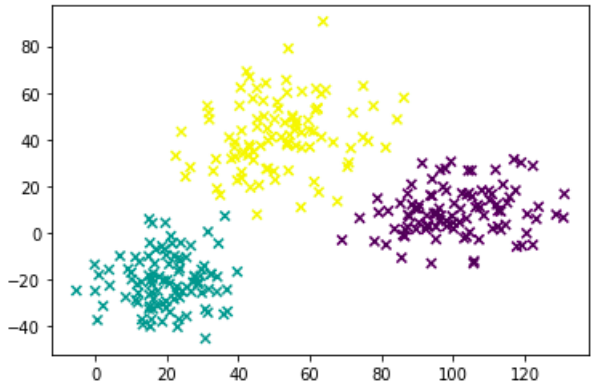

Fig. 4. Predictions.