Image Segmentation using Max-flow

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Image Segmentation

Overview:

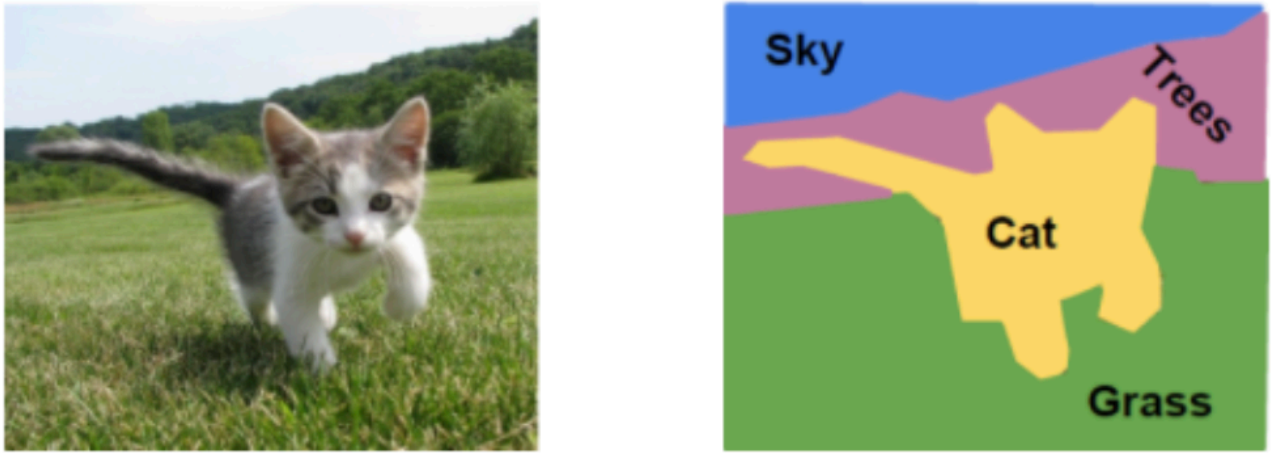
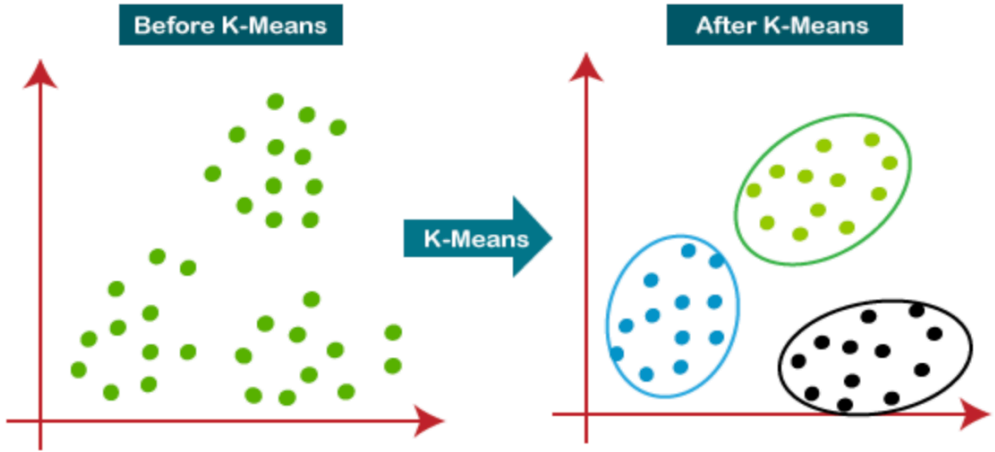


Figure 1: Example of Image Segmentation

Methods For Image Segmentation



- Determining Optimal K-Centers
- Data Point Assignment to Closest Centroid

Figure 2: Working of the K-means Clustering Algorithm

How does the K-means Algorithm work

Step-1: Select the number K to decide the number of clusters.

Step-2: Select random K points or centroids. (It can be other from the input dataset).

Step-3: Assign each data point to their closest centroid, which will form the predefined K clusters.

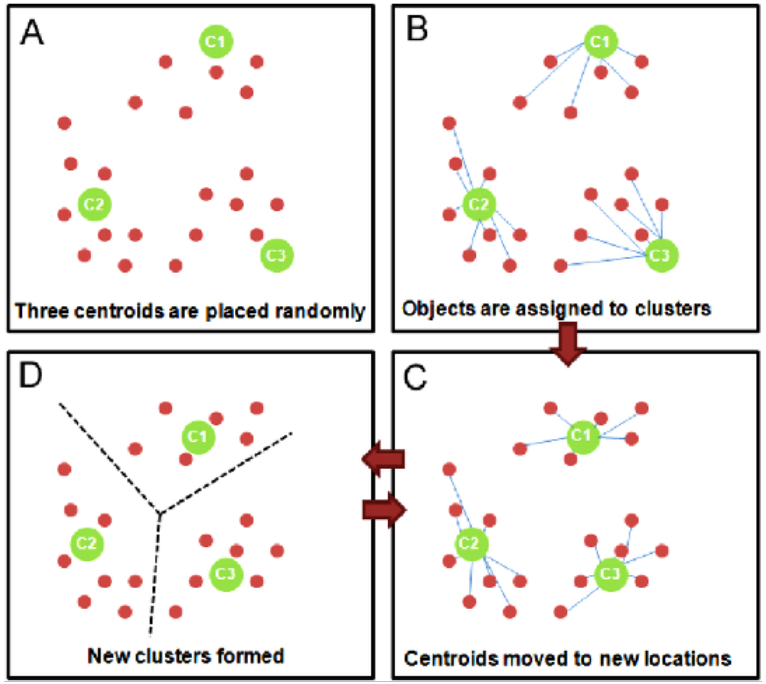
Step-4: Calculate the variance and place a new centroid of each cluster.

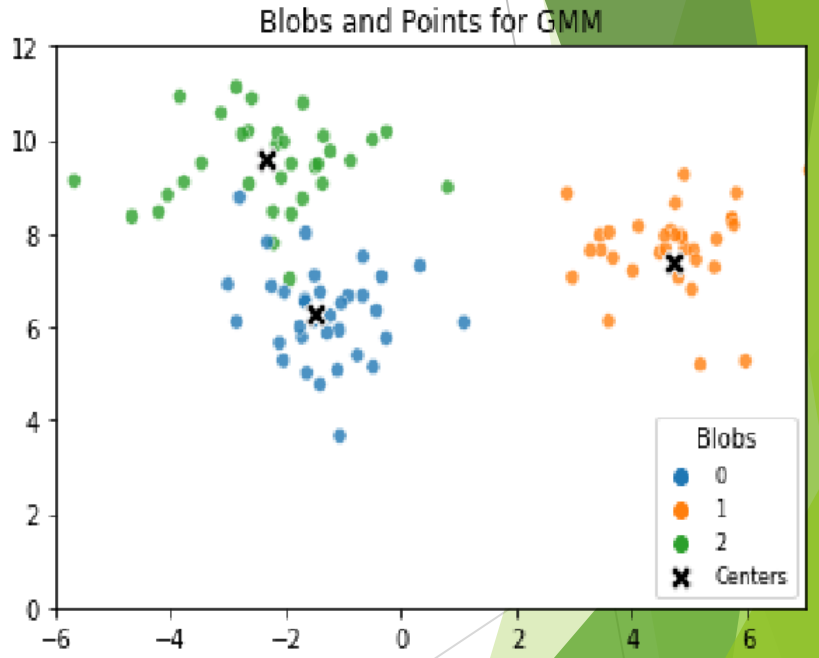
Step-5: Repeat the third steps, which means re-assign each datapoint to the new closest centroid of each cluster.

Step-6: If any reassignment occurs, then go to step-4 else go to FINISH.

Step-7: The model is ready.

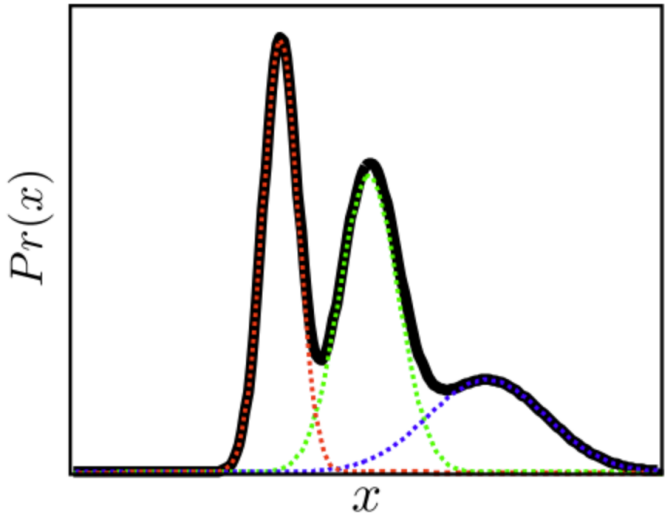
K means & Gaussian Mixture Model(GMM)





Gaussian Mixture Model(GMM)

Gaussian Mixture Model (GMM) refers to the linear combination of multiple Gaussian distribution functions. Theoretically, GMM can fit any type of distribution, and is usually used to solve the situation where the data in the same set contains several different distributions

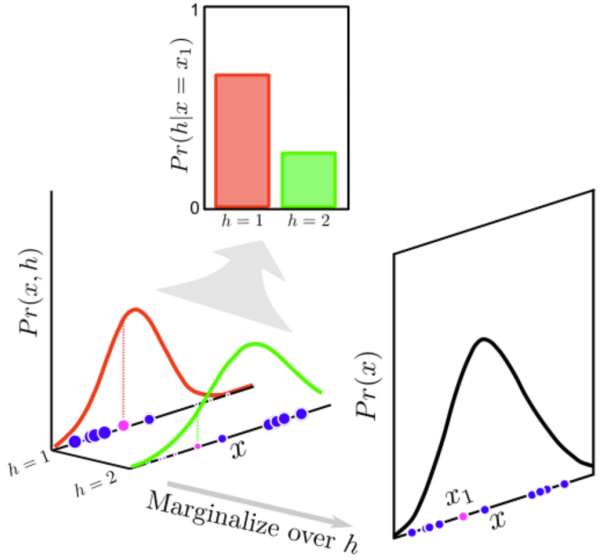


GMM & EM algorithm

Iterate until convergence:

E-step: For each pixel point, calculate the probability of being generated by each component within the mixture model.

M-step: Adjust the model parameters to maximize the likelihood of the model generating these parameters.



comparison between k-means cluster and GMM

original

K means segment

GMM segment

difference bt k and GMM

comparison between k-means cluster and GMM

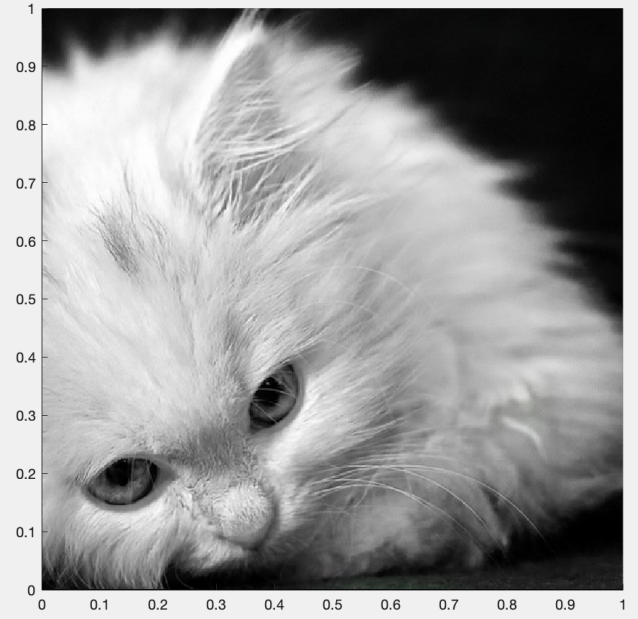
original

K means segment

GMM segment

difference bt k and GMM

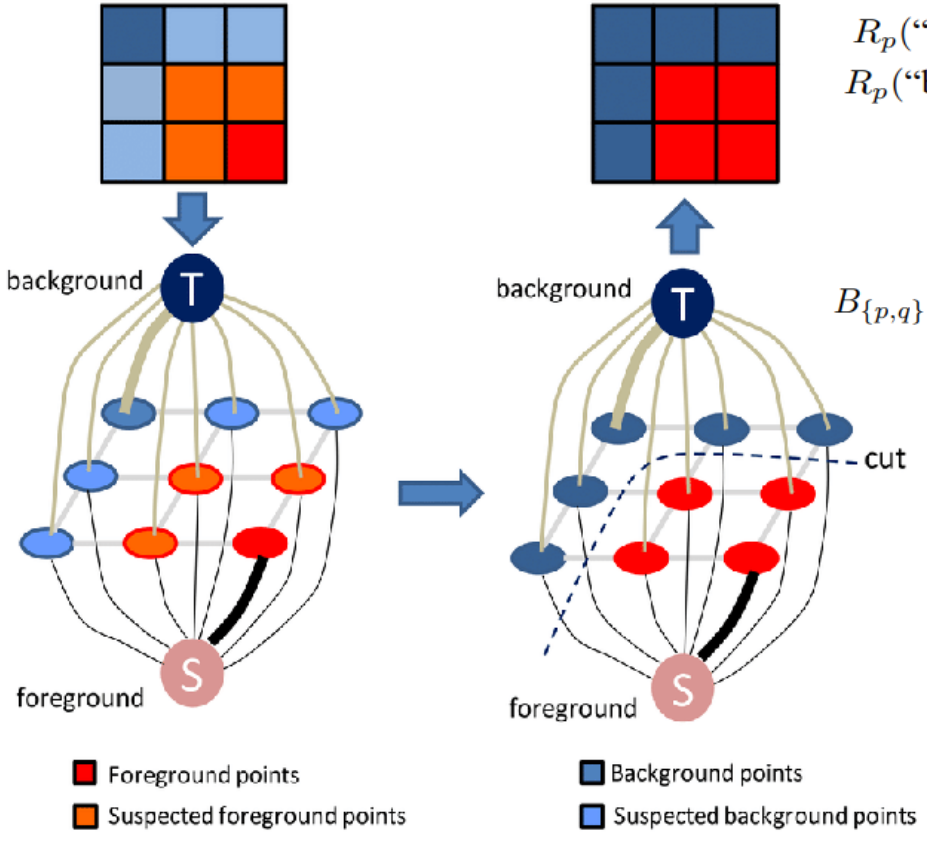
Click Interaction



Select Image X: 0.37241 Y: 0.70391

users can manually select the starting and ending node from foreground and background with the user interface we provide.

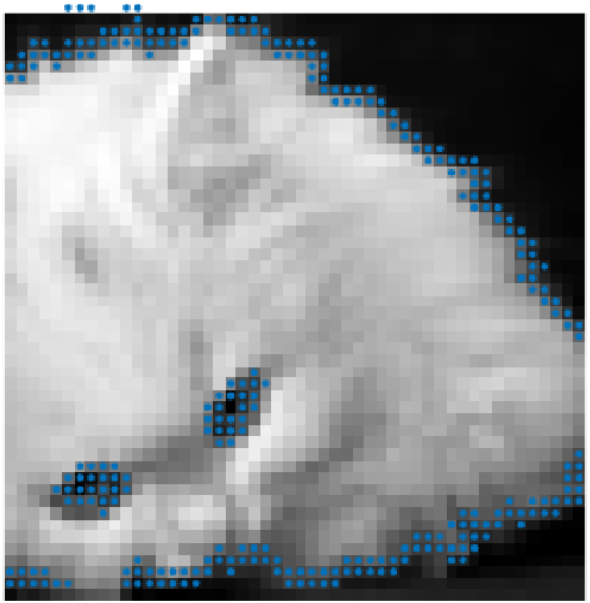
Graph cut & min cut-max flow



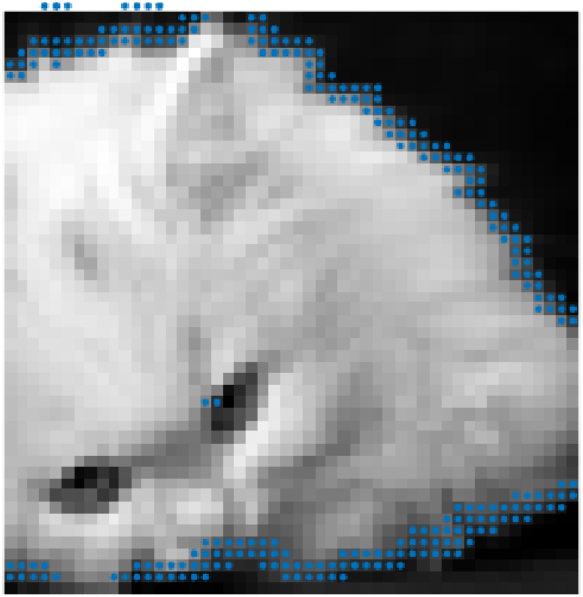
$$R_p(\text{“obj”}) = -\ln \Pr(I_p|\mathcal{O})$$
$$R_p(\text{“bkg”}) = -\ln \Pr(I_p|\mathcal{B}).$$

$$B_{\{p,q\}} \propto exp\left(-\frac{(I_p - I_q)^2}{2\sigma^2}\right) \cdot \frac{1}{dist(p,q)}.$$

Parameter tuning



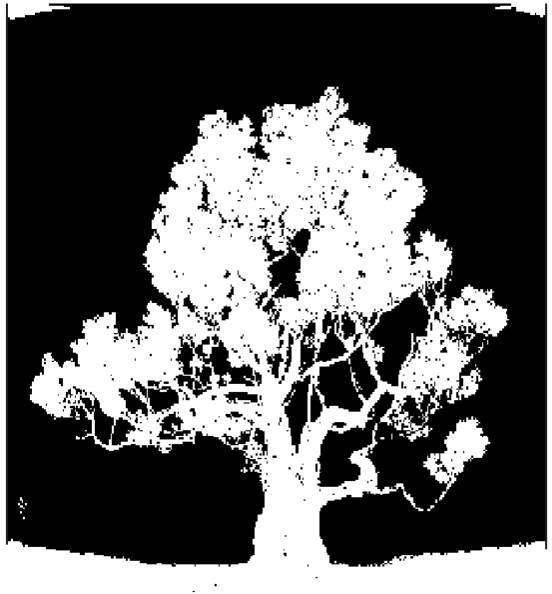
Lambda = 3



Lambda = 0.5

Comparison between GMM and graph cut

GMM segment



Future work:

1. Increase efficiency

2. Find more exact edge

3. Color channel