IMAGE SEGMENTATION USING GAUSSIAN MIXTURE MODELS

Rahman.Farnoosh, Gholamhossein.Yari, Behnam.Zarpak
Department of Applied Mathematics
University of Science and Technology
16844, Narmak, Tehran, Iran
$\{rfarnoosh, yari, zarpak\}$@$iust.ac.ir$

Abstract

Recently stochastic models such as mixture models, graphical models, Markov random fields and hidden Markov models are key role in probabilistic data analysis. Gaussian mixture model as generalized normal distribution is also an important tool in image data analysis. Also image segmentation means to divide one picture into different types of classes or regions, for example a picture of nature has some classes like 'sky','mountains', 'trees','river' and so on. Therefore we can suppose that each class has normal distribution with specify mean,variance and generally a picture has Gaussian mixture model. This is independent identically distribution (i.i.d) case which is well known. In this paper we have learned Gaussian mixture model to the pixels of an image as training data and the parameters of the model are learned by EM-algorithm. Meanwhile pixel labeling corresponded to each pixel of true image is done by Bayes rule. This hidden Markov image is the form of Potts Markov random field, So we can automatically classify an image with this hidden or labeled image. In addition it is natural to assume that Markov property of upper orders holds in each regions. It means that data in each class are close together with uniform means, low variations and high correlations. Thus we can do Gaussian mixture models in spatial domain that is if each class has Gaussian Markov random field so the general image is a Gaussian mixture Markov random field. We then show some experiments.

Key Words: Gaussian Mixture Model (GMM), Image Segmentation, Bayes Rule, Expectation-Maximization (EM)Algorithm, Potts Markov Random Field (PMRF), Gaussian Markov Random Field (GMRF), Gaussian Mixture Markov Random Field (GMMRF).