PR02 Color Segmentation

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Summary

In this paper Lucchese and Mitra have discussed and categorize various existing approaches for performing color image segmentation. They have suggested below classification scheme for color segmentation algorithms. [2].

1. **Feature space based techniques**. Since pixels related to same object hold similarity in color features spaces(RGB, HSI, Lab etc). Similarity between pixels can be quantified in terms of distance measurements(L1, L2) or other variant of distance measurements in these spaces. Hence A number of researcher purposed segmentation of objects by applying **clustering** algorithms like k-mean in these feature spaces which assign nearby pixels in feature space to same cluster. However good segmentations approach should not only based on feature similarity between pixels but it should also consider spatial connectivity between pixels. Traditional clustering based approach doesn't model spatial connectivity between pixels.Chang et al. suggested a sliding window based **Adaptive Clustering** approach which introduced spatial homogeneity constraint to the clustering. Since various peaks in the **Histogram** distribution of an image channel/s intensity represent different objects, researchers have suggested many segmentation algorithms which apply constrains on **Histogram-distribution** for extracting various objects.

2. **Image domain based techniques**. An segmentation algorithm, can not only maintaining spatial connectivity between regions while iteratively subdivide the image into regions or growing regions from small patches on image. But it can also maintain feature space homogeneity by deciding the directing of region dividing or region growing process based on feature similarity between regions. **Split and merge techniques** and **Region growing techniques** works on this same principle.
   Since edges in a image represent boundary between various regions of the image, researchers have suggested a number of **Edge based techniques** for achieving segmentation. In these approaches by applying gradient based edge detection algorithms on various color spaces, contours around regions have been generated.
   Instead of explicitly formulating feature similarity and spatial homogeneity, data driven approaches based on **Neural-networks** have also been used for segmentation.

3. **Physics based**. Colored materials can be categorized in three categories namely: optically inhomogeneous dielectrics, optically homogeneous dielectrics and metals. Amount of radiance of light from an inhomogeneous dielectric object depends on the two independent components: objects surface and object's geometric parameters. Researchers have used geometric parameters information with other Image domain approaches for performing segmentation.

References

[1] Michael M. Chang, M. Ibrahim Sezan, and A. Murat Tekalp. Journal of electronic imaging 3(4), 404-414 (october 1994). adaptive bayesian segmentation of color images.

[2] L. Lucchese and S. K. Mitra. Color image segmentation: A state-of-the-art survey.