Public Abstract

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Title:Interactive Image Segmentation
Using a Few Seed-Points

Image segmentation is a fundamental problem in image processing and computer vision. The goal is to extract regions associated with objects of interest from the given image. Automatic segmentation methods are often employed for the task of segmentation however these methods can cause over segmentation and fail to produce satisfactory result. These methods also fail in the case of complex image scenes with weak boundary edges, foreground and background sharing similar color distributions or textured images. To segment a region of interest one can use manual annotations but human ground truth annotations can be both time consuming and expensive. Semi-automatic methods often work well in such cases as they lie somewhere in between the automatic methods and high quality manual annotations. Semi-automatic methods use the human knowledge to guide the segmentation process. As a result, interactive image segmentation has received a lot of attention and popularity in recent years to segment images as it overcomes some of the inherent problems associated with very precise unsupervised image segmentation. In this work we are proposing a new spline based model for the task of interactive image segmentation. This model has been previously used for the task of image registration. In this work we are using it for the task of interactive image segmentation. For the task of interactive image segmentation user first provide some input/information about the foreground (region which we are interested in segmenting) and background (region which we are not interested in) by marking scribble or by drawing a box around the object of interest. This user provided information is then used to learn the spline coefficients of the regression model. The learned model is used to determine the labels of other unknown region in the image. The regression model has lot of advantages compared with existing technique firstly unlike other methods it does not learn the foreground background color model. Secondly regression based framework require labelling of only few pixel (8-10) compared with the scribble or drawing a box where user label thousands of pixel in an image. In this work we have used different types of splines like elastic body spline (EBS), Gaussian elastic body spline (GEBS) and Multiquadric spline to perform the interactive image segmentation. We have compared the performances of spline based methods with popular interactive image segmentation like graph cut, random walker, and other regression based methods like ridge regression, kernel regression, logistic regression. In total 16 methods are compared. We have used three bench mark data sets in our experiments BSD500 (Berkeley data set), Grab-cut and Weizmann data set. The last two data sets are specifically designed to test interactive segmentation methods. BSD500 consist of natural images along with the human ground truth which can be used to create a data set that used to test an interactive segmentation method. In total 410 images were used from these three datasets. We have used five evaluation metric F-measure, Jaccard coefficient, Rand index, normalized mutual information and accuracy to compare the segmentation quality. Experimental results showed that the EBS and Multiquadric spline have the best performances among 16 methods used in the comparison. We have also applied these spline based methods for testing the real data like bio-medical and aerial images and our results shows that these spline based methods work well for the biomedical and aerial imagery. Potential application of this work is to integrate this in a existing interactive segmentation or visualization tool as a separate module and let user use this module to test different type of images (biomedical, aerial, satellite etc.)