Learning Biological Shape Models

Nicolae Duta and Anil K. Jain
Department of Computer Science and Engineering, Michigan State University
{dutanico, jain}@cse.msu.edu, http://web.cse.msu.edu/~dutanico

Object learning is an important problem in machine vision with direct implications on the ability of a computer to understand an image. Usually, an object is defined by its shape, color and/or texture, and sometimes, by its relationships to other objects in the scene. A current trend in automatic image interpretation is to use model-based methods. Typically, the models are handcrafted based on the prior knowledge the user has about the object of interest. More recently, automatic model design has emerged as a powerful tool for learning object characteristics.

Our work concentrates on learning $2D$ shape models. They are especially useful when the object of interest has a homogeneous appearance and can be distinguished from other objects mostly by its shape. One important application for shape-based object recognition is in medical image analysis. During the past decade there has been a lot of work in shape-based automatic segmentation of flexible structures for medical diagnosis. However, regardless of the application, the training data usually consists of a set of coordinates of some points along the contour of the object of interest from several images. It is desirable for a model to describe an *average object* (prototype), to capture information about shape variations within the training set and to be independent of the object pose. In order to compute object prototypes with these properties, we have designed a new method for flexible shape alignment. Once the models are obtained, we can also segment new instances of the learned objects in different images.

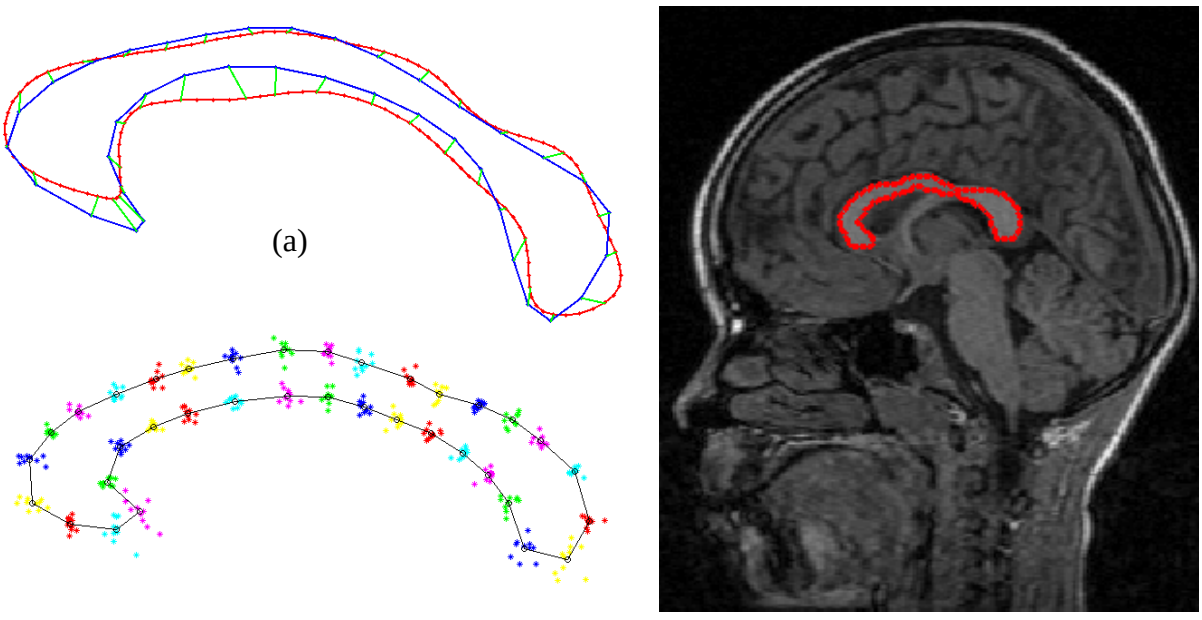

Figure 1: Corpus Callosum (CC) learning. Alignment of two CC examples (a). Learned model of CC (b). Segmentation of a new instance of Corpus Callosum in a MR brain image (c).