DATA MINING IN IMAGES

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EXTENDED TUTORIAL ABSTRACT

Image analysis is quite image specific. Different images have different properties, sizes, resolutions etc and require different methods to extract the optimum amount of data.

With all images however, the basics like linear filters, thresholding and other methods come into play. In this tutorial, we will briefly cover what these are and how they are used. Using a retina fundus image as an example, it becomes very apparent how understanding the properties of the image plays an important role to understand what tools should be used.

After the basic functions have been completed, higher level operations come into play. Unlike the previous operations, these operations let us analyse what is actually in the image. This may seem trivial us, but to a computer that understands only numbers, it is a huge challenge as a computer does not understand concepts or ideas but has to be told what they are. The task here is to use methods like curve-fitting, matched filters, active contours and others to find out what features are in the image.

The problem with higher level operations is noise. If we were to look for an object of a particular shape in the image, the object may or may not be a perfectly formed shape. How perfect the shape is has a huge impact on the kind of methods used and its accuracy. Another example will be to deal with missing information. This is because objects in the image may be only partial, fragmented or overlapped with other objects. These are the 2 major problems in image processing that are most trivial to us and show just how far computers are behind us on the evolutionary curve. Solving these problems then require us to look into the human psyche as described by Gestalt psychology, for clues on how to relate fragmented data and even then as we will see, it is not perfect.

In the second section of the talk, an efficient shape-based target detection technique will be discussed in the context of a robotic visually-guided autonomous navigation system that has been developed by the speaker.

3-D objects are represented by a set of 2-D views of the object. A Canny edge detector (takes as input a gray scale image, and produces as output an image showing the positions of tracked intensity discontinuities) is used to convert the grayscale image from the “eye” of the robot to a binary image. Models of the objects that are to be recognized are created off-line from these binary images. Target recognition can then proceed on-line by comparing the images that the robot is “seeing” with a database of these models. The Hausdorff distance (measures the extent to which each point of a model set lies near some point of an image set) is used to find the degree of resemblance between the model of an object and the image. The Hausdorff distance computation is different from other shape comparison techniques such as binary correlation in that no correspondence between model and image points is required, and hence is more robust to noise and occlusion. The speaker will go through the steps involved in an efficient algorithm for computing the Hausdorff distance. These include the Distance Transform and Multi-Resolution Search techniques which allow large areas of the information space to be processed during the real-time operation of the robot.