"Pattern Recognition and Computer Vision"

Image analysis and pattern recognition involves the use of image processing methods that are designed in an attempt to provide a machine interpretation of an image. Many of these 'methods' are based on models and computational procedures that are consistent with those used for image processing such as convolution, correlation, Fourier analysis and moving window-based data processing. Pattern recognition uses a range of techniques and image processing methods which are not necessarily based on any one particular theme or unified theoretical approach. The main problem is that, to date, there is no complete theoretical model for simulating the processes that take place when a human interprets an image generated by the eye. Hence, machine or computer vision remains a rather elusive subject area in which automatic inspection systems are advanced without having a fully operational theoretical framework as a guide. Vision can be thought of as a process of linking parts of the visual field (objects) with stored information or templates about their significance for the observer. There are a number of questions concerning vision such as: (i) what are the goals and constraints? (ii) what type of algorithm or set of algorithms is required to effect vision? (iii) what are the implications for the process given the types of hardware that might be available? (iv) what are the levels of representation required to achieve vision? The levels of representation are dependent on what type of segmentation can and/or should be applied to an image. This allows sets of raw components to be generated, e.g. regions of pixels with similar intensity values or sets of lines obtained by isolating the edges of an image scene and computed by locating regions where there is a significant difference in the intensity. However, such sets are subject to inherent ambiguities when computed from a given input image and associated with those from which an existing data base has been constructed. Such ambiguities can only be overcome by the application of high-level rules, based on how humans interpret images, but the nature of this interpretation is not always clear. Nevertheless, parts of an image will tend to have an association if they share size, colour, figural similarity, continuity, shading and texture, for example. For this purpose, we are required to consider how best to segment an image and what form this segmentation should take.

Compared to image processing, computer vision (which incorporates machine vision) is more than automated image processing. It results in a conclusion, based on a machine performing an inspection of its own. The machine must be programmed to be sensitive to the same aspects of the visual field as humans find meaningful. Segmentation is concerned with the process of dividing an image into meaningful regions or segments. It is used in image analysis to separate features or regions of a pre-determined type from the background and is the first step in automatic image analysis and pattern recognition. In this lecture, the principal themes associated with pattern recognition are considered, including methods of image segmentation using both Euclidean and Fractal geometry.

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