COMPUTER VISION, GRAPHICS, AND IMAGE PROCESSING **22**, iii (1983)

GUEST EDITORIAL

There is much activity in the computer vision research area. The problem begins with one or more digital images which are typically perspective projections of some objects in a three-dimensional world. If there are multiple images, they may be taken simultaneously from different positions, or taken in time sequence from the same or different positions. The problem is to define a computational technique which can analyze such images. The purpose of the analysis is to produce descriptions of surface orientation, position, and reflectance for all visible object surfaces.

The computer vision problem is, in fact, a collection of problems ranging from image processing to artificial intelligence. The papers in the special issue also reflect this fact. The papers by Hildreth and Haralick address the low level image feature extraction problems of edge finding and ridge/valley finding. The paper by Grimson discusses how a complete object surface can be described from knowledge of the position of only a few of its points. Brady and Horn discuss the properties and use of the rotationally symmetric quadratic variation performance index in situations where low level surface information might be spatially incomplete and there is a need to make it complete by interpolation.

Ballard and Kimball discuss how images of a moving object taken in time sequence from a fixed position can determine the nature of the motion. Lawton discusses how images taken in time sequence from a translating position can determine the depth of the stationary objects. Both papers make use of optical flow.

Shafer and Kanade discuss how to determine surface orientations of object parts by using their shadows. Lee and Fu discuss how to determine the 3D shape of an object on the basis of the perspective projection of the contour of the object. Both these papers derive relationships using camera geometry. By contrast, Ullmann's paper uses a relational framework and discusses under what assumptions it is possible to determine which objects occlude one another. Ullmann's discussion, however, is only in one dimension.

On the basis of these papers one can surmise a trend in computer vision research: it is moving away from adhockery and moving toward mathematical models driven by the pattern in the digital image or the geometry/physics of the sensing camera. Thus there is hope for a theory of computer vision. With a theory we will be able to solve the practical problems of how to design particular or general purpose vision modules for robots and other purposes.

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0734-189X/83 $3.00