e n g i n u i t y

Into the third dimension

There are various ways of fooling the eyes into believing they are looking at a three-dimensional image (see '3D television looks a reality' in the first issue of enginuity), perhaps the simplest of these being the donning of a pair of red and green glasses to look at a split image. Dr Roberto Cipolla has a different approach. The rationale behind his method, which is aimed towards producing a 3D image from a standard 2D screen, is to detect the movement of the face looking at the screen and present the observer with screen images of the 3D object or scene, appropriate to that viewing angle. Of course, this is not as easy as it sounds, as for practical reasons the images presented to the viewer have to he derived from a limited numher of views taken from a minimum of two cameras looking at the object or scene. The camera positioned on the computer also has to be trained in face detection and tracking which, given the wide range of facial characteristics in the human population, is no mean feat.

A new approach...

An engineering viewpoint

This is part of a more ambitious project on understanding vision and making machines see. We are tackling this problem from an engineering rather than a biological viewpoint,' explains Dr Cipolla. 'The human brain processes visual information at a rate of around three Gigabytes/second which is way beyond the computing power of today's most powerful computers.' How should this information be processed to recover the positions and shapes of the visible surfaces and to recognise familiar objects in the scene? 'Geometry plays an important role,' says Dr Cipolla. 'The position and shape of visible objects can he deduced from the differences in images from different viewpoints, and from the distortions in 2D projections of 3D images. For recognising a familiar object, however, we are not interested in what changes with viewpoint but with what remains invariant.'

Hand/eye coordination

Mathematical models to reproduce these competences, which humans perform effortlessly, are heing advanced in Dr Cipolla's group. They are attempting to specify, in mathematical terms, processes for handling visual information, and then using computers to bring the mathematics to life in systems that can act on that information. They have already succeeded in building a vision system for a robot that teaches itself sufficient hand/eye coordination to pick up an unknown object in an unstructured environment, using images from a pair of cameras. The robot can also select and pick up an object that is pointed to by a human hand. This is the first step to the ultimate quest of making a machine that can see.

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