A B S T R A C T

There is much current interest in the subject of image analysis, the recognition of objects in photographic images. One way of recognizing objects is in terms of their boundaries. Edges are primitive features of an image that are widely used to outline the boundaries of objects.

The research described here is concerned with the detection of edges within two dimensional black and white images.

A single type of operators is proposed for processing of image information for finding edges. The proposed operators are based on Chebyshev's orthogonal polynomials.

Least square approximation of a continuous image by Chebyshev's orthogonal polynomials is analogous to separable linear transformation defined by the proposed operators.

These operators perform elementary type of orthogonal differencing operations. Some of these operations are digital analogues of the elementary operations performed by neurons on retina at the time of visual perception.

With the proposed operators it is possible to illustrate the phenomenon of apparent invisibility of a gray line on a black spot and the fact that the visual acuity in the horizontal

and vertical directions is superior to the visual acuity in the diagonal directions.

Analytically the proposed operators exhibit better performance as edge detectors than Roberts, Sobel and Prewitt edge detectors.

Since these operators are Hueckel-type of edge detectors, it is possible to frame an edge-fitting edge detection model based on these operators.

The proposed operators have their statistical counterparts. With these counterparts it is possible to combine an edge-fitting or template matching edge detection scheme with noise assumption for evaluation of significance of edge strength measure. In this statistical counterpart of the Chebyshev's orthogonal polynomial based approach, for fitting an ideal edge into a given picture neighbourhood, an image region is fitted into a linear surface. Unlike all the known cases the spatial model underlying the approach is not different from the fitting model underlying the statistical approach.