

Image Segmentation Based on Feature Analysis of Variances of Gray Values

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In the present thesis, models of edge and region are analyzed in the image segmentation problem. Based on this analysis an edge detector is proposed and features derived from the analysis are applied to region segmentation.

For edge features, variances within a window are analyzed over the cross section aligned normal to a boundary between regions. From this analysis we state necessity of a measure which can discriminate a clear edge with small edge height from a noisy edge with large edge height, that is, edge reliability. Then a 1-D edge feature extractor is proposed based on this analysis.

Next, by using the vectorization technique, the 1-D edge-feature extractor is generalized to 2-D, that is, to an edge-vector feature extractor. Then it is proved that the extractor can calculate the orientation and the height of edges accurately and also reduce computation time.

Thirdly, for detecting edge points in multiple edge cases, the condition for calculating accurate edge locations is clarified by analyzing the edge-height function. From this analysis a method suggested for determining edge points by thresholding edge height.

Finally, our detector is compared to Canny's detector both in synthetic models and in real images and it is demonstrated that our method produces better results in edge locations than Canny's does.

For region features, variances within one or two regions are analyzed. From this analysis three kinds of uniformity are derived. A region segmentation method is proposed by using the edge and region features discussed above.