# Active Contour based Medical Image Segmentation



by

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## Certification of Supervisors

We certify that the candidate has incorporated all corrections, additions, and amendments recommended by the examiners.

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# DECLARATION

The work described in this thesis was carried out by me under the supervision of Prof. R.G.N. Meegama, Department of Computer Science, Faculty of Applied Sciences, University of Sri Jayewardenepura and Dr. Mahesha Kapurubandara, Department of Information Technology, Faculty of Computing, Sri Lanka Institute of Information Technology, and a report on this has not been submitted in whole or in part to any university or any other institution for any other Degree.

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| | |
|---|---|
| MRI | Magnetic Resonance Imaging |
| CT | Computer Tomography |
| CAD | Computer-Aided Diagnosis |
| BLAID | Boundaries from Locally Adaptive Isotropic Detection |
| ACID | Affine Cell Decomposition |
| GVF | Gradient Vector Flow |
| NURBS | Non-Uniform Rational B-Spline |
| D-NURBS | Dynamic Non-Uniform Rational B-Spline |
| SSD | Sum of Squared Difference |
| SUSAN | Smallest Uni-value Segment with an Assimilating Nucleus |
| FAST | Feature from Accelerated Segment Test |
| SURF | Speeded Up Robust Features |
| ROI | Region of Interest |
| CCN | Consistency of Corner Numbers |
| SNR | Signal to Noise Ratio |

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## Active Contour based Medical Image Segmentation

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# ABSTRACT

The main contribution of this research study is to devise an effective active contour model to segment discontinuous boundaries in X-ray Images. This involves the improvement of the active contour's capability in detecting sharp corners by incorporating prior knowledge about the significant corners of the object of interest, while preserving the general energy terms.

Active contours are a form of curves that deform according to an energy minimising function and are widely used in computer vision and image processing applications. In this research study, a new technique of active contour model to extract boundaries of objects having sharp corners is devised. By incorporating a priori knowledge of significant corners of the object into the deforming contour, the proposed active contour is able to deform towards the boundaries of the object without surpassing the corners.

Moreover, all the significant corner points/discontinuous regions of the targeted object should be identified accurately during the initialization step of the proposed snake model. In order to perform this task with less user involvement, a competent corner detection operator should be integrated with the proposed snake model. Therefore a novel corner detection operator known as BLAID (Boundaries from Locally Adaptive Isotropic

Detection), which is capable of detecting corner points that exist only on the boundary of an object, is integrated with the proposed snake model.

The ability of the new technique to accurately extract features of interest of anatomical structures in medical X-ray images having sharp corners is tested. The proposed model demonstrated significantly better results on detecting corners comparatively with the other existing models. We demonstrated the efficiency of our snake model by testing it on images with additive Gaussian noise. The experimental results demonstrate that the proposed snake model performs well for the images having an SNR of > 20.