

PREFACE

The amount of increasing digital images in today's world empowers us in various ways, like photo and information sharing, medical imaging, simulation, and military purposes. Together with the empowerment, it is necessary to organize these images and use them for various computer vision purposes. One of the most critical computer vision tasks is salient object detection. Salient object detection is the process of finding important objects in an image. Humans can do this task automatically. Machines can learn to do this task by understanding the human visual attention mechanism. It has applications in various fields like an object of interest image segmentation, object recognition, content-based image retrieval, image, and video compression and video summarization. The subject of this thesis is to develop methods and models for salient object detection and apply it to the field of image annotation.

The scope of this thesis is to generate models for salient object detection for general images and show its applications in the field of medical imaging and image annotation. While designing these models, an attempt is made to handle issues in existing algorithms, like, obtaining sharp and precise edges, heterogeneous objects, completeness of objects, and reducing tagging time. For this, a comprehensive literature survey is performed. Issues and challenges of these fields are identified. After that, statistical, machine learning, and deep learning-based models are developed for salient object detection. The application of the model is shown in the field of

colon tumor localization and automatic image annotation.

In this thesis, five models are developed for salient object detection. Three statistical models are developed. For two of the statistical models, the active contour is used after the salient object is localized based on intensity thresholding and edge cues. For the third statistical model, gradient vector flow is used along with directional contrast to find the salient object. The fourth model of salient object detection is based on Bayesian classifier. For this model, an ensemble of techniques is used. Background subtraction, generating foreground maps from directional background contrast, obtaining object proposals, texture segmentation using Gabor filters, and graph-segmentation are used. The fifth model is built using deep learning techniques. For this, YOLOv2, Faster R-CNN, and Resnet are used for object detection. Lazy snapping is used for final boundary correction. A similar technique is used for the proposed colon tumor localization method using three input variants. An application of salient object detection is shown in automatic image annotation. The procedure first identifies salient objects in an image, extracts features, performs feature selection, and then multi-label classification is performed. A very comprehensive study of eighteen feature selection methods is done, and a new feature selection method is proposed which can reduce tagging time and increase the accuracy.

The approaches of this thesis have been designed in a way so that the conventional, as well as newer models like deep learning, are covered. Not only are models developed, their applications in the real world for colon tumor localization and automatic image annotation are also studied. A comparative analysis of all the models is also

developed. All the models are compared against state-of-the-art algorithms and evaluated on benchmark databases. Possible future works are also discussed.