AUTOMATIC DETECTION OF ELONGATED OBJECTS IN X-RAY IMAGES OF LUGGAGE

by

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(ABSTRACT)

This thesis presents a part of the research work at Virginia Tech on developing a prototype automatic luggage scanner for explosive detection, and it deals with the automatic detection of elongated objects (detonators) in x-ray images using matched filtering, the Hough transform, and information fusion techniques. A sophisticated algorithm has been developed for detonator detection in x-ray images, and computer software utilizing this algorithm was programmed to implement the detection on both UNIX and PC platforms. A variety of template matching techniques were evaluated, and the filtering parameters (template size, template model, thresholding value, etc.) were optimized. A variation of matched filtering was found to be reasonably effective, while a Gabor-filtering method was found not to be suitable for this problem. The developed software for both single orientations and multiple orientations was tested on x-ray images generated on AS&E and Fiscan inspection systems, and was found to work well for a variety of images. The effects of object overlapping, luggage position on the conveyor, and detonator orientation variation were also investigated using the single-orientation algorithm. It was found that the effectiveness of the software depended on the extent of overlapping as well as on the objects the detonator overlapped. The software was found to work well regardless of the position of the luggage bag on the conveyor, and it was able to tolerate a moderate amount of orientation change.

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TABLE OF CONTENTS

List of Figures

List of Tables