

**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

<b>1. Introduction .....</b>	<b>1</b>
<i>1.1. Background .....</i>	<i>1</i>
<i>1.2. Contributions of this Thesis .....</i>	<i>4</i>
<i>1.3. Organization of this Thesis .....</i>	<i>5</i>
<b>2. Imaging Geometry .....</b>	<b>7</b>
<b>3. Theoretical Background.....</b>	<b>17</b>
<i>3.1. Introduction .....</i>	<i>17</i>
<i>3.2. Correlation-based Matching.....</i>	<i>18</i>
<i>3.3. Hough Transform .....</i>	<i>20</i>
<i>3.4. Gabor Filters.....</i>	<i>23</i>
<i>3.5. Information Fusion.....</i>	<i>27</i>
<i>3.6. Approach of this Thesis .....</i>	<i>28</i>
<b>4. Algorithm Development.....</b>	<b>33</b>
<i>4.1. Gabor Filters.....</i>	<i>33</i>
<i>4.2. Correlation-based Matching.....</i>	<i>42</i>
<i>4.3. Hough Transformation.....</i>	<i>50</i>
<i>4.4. Information Fusion.....</i>	<i>52</i>
<b>5. Test Results.....</b>	<b>54</b>
<i>5.1. Test Results for Single-Orientation Detection.....</i>	<i>54</i>
<i>5.2. Test Results for Arbitrary In-plane Orientation.....</i>	<i>73</i>
<b>6. Conclusions.....</b>	<b>88</b>
<b>Bibliography.....</b>	<b>90</b>
<b>Appendix.....</b>	<b>92</b>

## List of Figures

Fig. 1.1. An example of x-ray images used in this thesis.	4
Fig. 2.1. Schematic of a AS&E x-ray inspection system.	8
Fig. 2.2. Schematic of the rotating collimation disc.	10
Fig. 2.3. Schematic of the system cross section along the x-ray path.	10
Fig. 2.4. Effect of physical rotation on the orientation of the object in the image.	13
Fig. 2.5. Effect of luggage position on the conveyor on the image orientation.	14
Fig. 2.6. Schematic of the Fiscan x-ray inspection system.	16
Fig. 3.1. Relation of rectangular to polar representation of a line.	21
Fig. 3.2. Gabor function plots for RGF and IGF.	26
Fig. 3.3. Example templates used in this research.	30
Fig. 3.4. Block diagram for the detonator detection algorithm.	31
Fig. 3.5. Schematic of cutoff window for the Hough transform.	32
Fig. 4.1. An original image with the detonator at row 250 and column 250.	34
Fig. 4.2. The RGF with $a = 2, b = 20, f = 25.4^\circ$ and the corresponding output result.	35
Fig. 4.3. The RGF with $a = 3, b = 20, f = 25.4^\circ$ and the corresponding output result.	36
Fig. 4.4. The RGF with $a = 4, b = 20, f = 25.4^\circ$ and the corresponding output result.	37
Fig. 4.5. The RGF with $a = 5, b = 20, f = 25.4^\circ$ and the corresponding output result.	38
Fig. 4.6. The corresponding output result of the RGF with $a = 4, b = 20, f = 25.4^\circ$ .	39
Fig. 4.7. The corresponding output result of the RGF with $a = 4, b = 20, f = 30.4^\circ$ .	40
Fig. 4.8. The corresponding output result of the RGF with $a=4, b=20, f=35.4^\circ$ .	40
Fig. 4.9. An original image with the detonator around row 400 and column 140.	42
Fig. 4.10. The output results of the middle-point templates with different sizes.	43
Fig. 4.11. The analytical middle-point template.	45

Fig. 4.12. Comparison of analytical and empirical templates in matched filtering.	46
Fig. 4.13. The empirical middle-point template.	47
Fig. 4.14. Example of the output of the middle-point templates with different thresholds.	49
Fig. 4.15. Illustration of a binary template with 1s along the detonator orientation and 0s on other pixels.	51
Fig. 5.1. Example of the detonator partially overlapping a wooden board.	56
Fig. 5.2. Example of the detonator overlapping a wooden board slightly.	57
Fig. 5.3. Example of the detonator completely overlapping a wooden board.	58
Fig. 5.4. Example of the detonator overlapping a box of fudge.	59
Fig. 5.5. Example of a detonator partially overlapping a box of fudge.	60
Fig. 5.6. Example of a detonator completely overlapping a box of fudge.	61
Fig. 5.7. Example of a detonator overlapping a coil of wire.	62
Fig. 5.8. Example of a detonator partially overlapping a pair of shoes.	63
Fig. 5.9. Example of a detonator completely overlapping a pair of shoes.	64
Fig. 5.10. The luggage is as far as possible from the x-ray source.	66
Fig. 5.11. The luggage is near the x-ray source.	67
Fig. 5.12. Example of the detonator with an in-plane orientation in the image of $26.6^\circ$ .	70
Fig. 5.13. Example of the detonator with an in-plane orientation in the image of $55.8^\circ$ .	71
Fig. 5.14. Example of the detonator with an out-of-plane orientation of $30^\circ$ .	72
Fig. 5.15. The relationship between physical orientation and orientation in the image.	74
Fig. 5.16. Example of arbitrary orientation algorithm.	78
Fig. 5.17. Example of arbitrary orientation algorithm.	79
Fig. 5.18. Example of arbitrary orientation algorithm.	80
Fig. 5.19. Example of a false positive.	81
Fig. 5.20. Example of a false negative.	83
Fig. 5.21. Effect of thresholding on detection ability.	84

Fig. 5.22. Second example of a false negative.	86
Fig. A.1. Projection of the AS&E image onto the imaginary cylinder.	91
Fig. A.2. Projection of the Fiscan image onto the imaginary cylinder.	91
Fig. A.3. Relationship between the AS&E images and the imaginary cylinder projection.	93
Fig. A.4. Relationship between the Fiscan images and the imaginary cylinder projection.	93
Fig. A.5. Illustration of image registration.	95
Fig. A.6. Image, computed by subtracting Fig. A.5c from A.5d.	96

## **List of Tables**

Table 5.1. The correlation between the physical orientation and the image orientation of the detonator.	69
Table 5.2. The relationship between physical orientation and orientation in the image.	75
Table 5.3. The angle of the correlation filter in the multi-orientation detection system.	76