Finding Bolin

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Abstraction

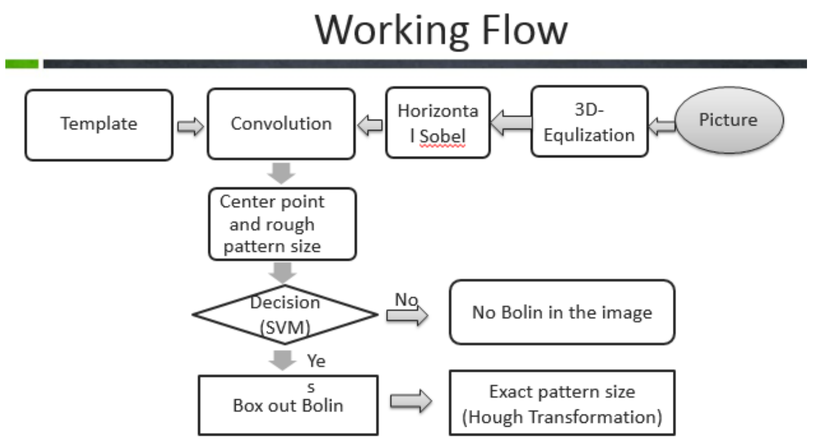
Liu Bolin is a Chinese artist, who is famous for camouflage image by hiding himself in the background. In his artworks, the main interference of detection are largely involved with high-contrast background and relevant ripple edge between him and the background, which cause a falling result if we simple use the face detection or body detection. Our project(ECE 590.03) is to expose him to public in a efficient and accurate way.

Introduction

In the majority of Bolin's works, he is standing alone with fixed posture.

No matter how the Bolin camouflage himself, some body details can still be identified by the difference between camouflage part and background part.

Working Flow



Method

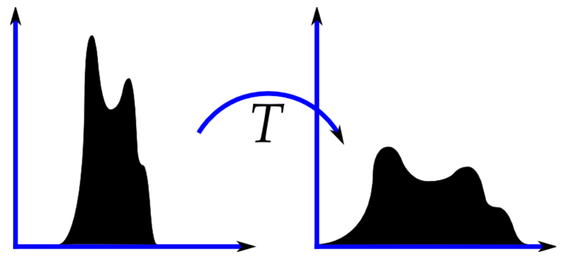
(1) Build the Template

Since BoLin's posture is fixed, a template of Bolin's body can be used as a prior to match the same pattern in the artwork. The Gaussian weight is assigned to the body shape, which give the tolerance for any missing match.

The template convolutes with the matching picture. The maximum points is chosen as a interesting point for further selection.

(2) Preprocess the artwork by 3-D Equalization

The edge between Bolin and background is much smaller than the edges within backgrounds, which generate interference in identification. To solve this problem, we apply the histogram equalization in R,G,B channel. This method usually increases the global contrast of many images, especially when the usable data of the image is represented by close contrast values.[1]



(3) Edge Detection

The standing posture of Bolin results in a large amount of vertical lines in the edge of Bolin. To explore these vertical line in a maximum way, only the horizontal Sobel operator is used for edge detection.[2]

$$\mathbf{G}_x = \begin{bmatrix} -1 & 0 & +1 \\ -2 & 0 & +2 \\ -1 & 0 & +1 \end{bmatrix} * \mathbf{A}$$

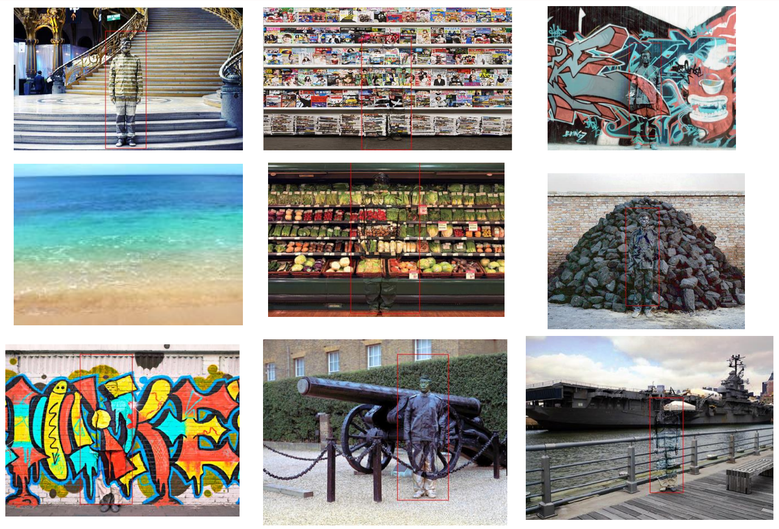
(4)Making Decision By Support Vector Machine (SVM)

Normalized maximal value to decide the threshold based on the 20 Bolin's images and 10 non-Bolin's image. Through the train by SVM, Threshold is trained to decide if Bolin is in the image.

(5) Box Bolin by local Hough Transform

In the certain areas where we have roughly obtained where Bolin is, Hough Transformation is implemented to obtain the exactly size. Two arm boundary lines can be used to estimate the size of box.[3]

Result



Conclusion

Our project implements a real-time method to box out the Bolin. The test result shows relatively high recognition rate about 24/30, including the pictures with Bolin and without Bolin.

However, we apply the template as the prior, leading to our project that can only work for the standing images of Bolin. In addition, the determination identifying the existence of Bolin is sensitive to the different threshold. A inappropriate threshold can box out the different object which has higher normalized value than the threshold.

1. "Histogram equalization". *http://en.wikipedia.org/wiki/Histogram_equalization*

2. Umbaugh, SShapiro, Linda and Stockman, George. "Computer Vision", Prentice-Hall, Inc. 2001 cott E (2010). *Digital image processing and analysis : human and computer vision applications with CVIPtools* (2nd ed. ed.). Boca Raton, FL: CRC Press. ISBN 9-7814-3980-2052.

3. Shapiro, Linda and Stockman, George. "Computer Vision", Prentice-Hall, Inc. 2001