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A Target Detection Algorithm Based on Gray Distribution Characteristics

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INTRODUCTION

In target detection and tracking, the description of target features directly affects the effect of detection and tracking. Digital image is a two-dimensional matrix of pixel data, which is the two-dimensional distribution of gray in space. If the gray level of the image is directly used as the target feature for corresponding processing, it is easy to be affected by the rotation, deformation of the target and the change of ambient light. In order to complete the task of intelligent processing better, many methods to describe the two-dimensional distribution of target gray are proposed and applied, such as two-dimensional histogram, gray level co-occurrence matrix, and local binary patterns. These methods have some limitations. In order to improve the effect of target detection and tracking, a GRD (Gray Relative Distribution) operator is proposed..

OBJECTIVES

GRD(Gray Relative Distribution) operator is designed around the following properties:

- **Anti environmental illumination change**
- **Resist the influence of target rotation and deformation**
- **Acceptable amount of calculation.**

METHODS

The steps of target detection using GRD operator:

1) Take the gray value of the central pixel of the template as the reference value

2) Calculate the gray difference between each pixel of the template and the central pixel, and grade the gray difference(dg), for example, every 10 gray differences can be one level. How to grade can be comprehensively considered according to the algorithm performance and calculation amount. If each gray difference is one level, the value range of the gray difference(dg) is: $-255 \le dg \le 255$, That is to say, there are 511 eigenvalues. If every 10 grayscale differences are one level, there are 51 eigenvalues. The eigenvalues of each level are the number of template pixels of that level.

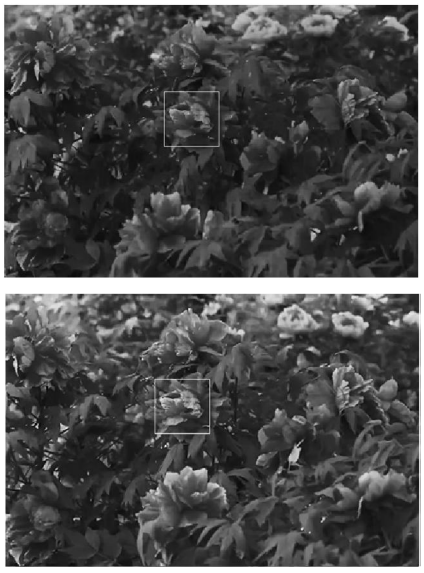
3) Use GRD operator to extract the feature vector of template image

4) Use GRD operator to extract the feature vector of the search subgraph at the search position of the detection image

5) Use Pearson correlation coefficient formula to calculate the correlation coefficients of two eigenvectors, and the position of the subgraph with the largest correlation coefficient of the eigenvector of the detected image and the template image is determined as the best matching position.

RESULTS

The target detection test is carried out. It can be seen that the target in the upside image has rotation, deformation and illumination change compared with the downside image. Using GRD operator can detect the target well.



CONCLUSIONS

GRD operator is designed to better describe the two-dimensional distribution characteristics of gray scale of image target, which can resist the influence of target rotation, deformation and environmental light change. Under the same template size, GRD correlation detection takes less time than gray correlation detection. GRD operator is a good new algorithm for target detection and tracking.