

Template Matching with Distortion

Class: INT3404 20

Student: Phan Quang Hùng – 18020582

I. Introduction

Template matching is a technique widely used for finding patterns in digital images. An efficient template matching algorithm should be able to detect template instances that have undergone geometric transformation or change of perspective.

This report will introduce a color template matching algorithm called Color-Ciratefi, which is a color-based algorithm invariant to rotation, scale, translation, brightness, and contrast that takes into account the color information.

This report based on the paper: “Color-Ciratefi: A color-based RST-invariant template matching algorithm”.

II. Algorithm Introduction

Color provides high discriminative power. However, the main problem of color template matching is how to extract color information that remains constant with the illumination change.

Based on the original Ciratefi technique, Sidnei Alves de Araújo and Hae Yong Kim introduce a new color template matching algorithm named Color-Ciratefi, which is invariant to rotation, scaling and translation, and robust to some common distortions such as blurring and minor viewpoint variations.

III. Ciratefi Technique

Ciratefi is a grayscale template-matching algorithm composed by three steps of filtering, Cifi, Rafi and Tefi that successively excludes pixels that have no chance of matching the query template.

The name Ciratefi can be easily seen as a combination of those three filters.

To shed some light on this algorithm, let A be the grayscale image to be analyzed and T the query grayscale template for instance. The goal of Ciratefi is to find all occurrences of T in A , with respective orientation angle and scale. The instances of T in A may appear rotated, scaled, shifted and with diverse brightness and contrast. Below we present a brief description of Ciratefi.

1. First Filter: Cifi – Circular sampling Filter

Cifi uses the projections of the images A and T on a set of circles to detect the “first grade candidate pixels”. For each candidate pixel, the “probable scale factor” is also computed.

2. Second Filter: Rafi – Radical sampling Filter

This step uses projections of images A and T on a set of radial lines to upgrade some of the first grade candidate pixels to the second grade. Rafi also estimates the probable rotation angle for each second grade candidate pixel.

3. Third Filter: Tefi – Template matching Filter

This step filters the second grade candidate pixels using a conventional template matching with correlation coefficient as metric. This task is fast because Cifi and Rafi computed the probable scale and angle for each candidate pixel.

IV. Color-Ciratefi

The goal of Color Ciratefi is: given a pair of color images A and T , detect all the instances of T that appear in A . The instances of T in A can

be affected by different geometric and photometric transformations such as scale, rotation, minor viewpoint variations, blur and illumination.