Chapter 7
Robust Image Matching for Information Systems Using Randomly Uniform Distributed SURF Features

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ABSTRACT

Detection of similar images taken in different perspectives is a big concern in digital image processing. Fast and robust methods have been proposed in this area. In this chapter, a novel image matching approach is proposed by using speeded-up robust features (SURF). SURF is a local feature detector and descriptor that can be used for tasks such as object recognition or registration or classification or 3D reconstruction. Successful detection of the images is achieved by finding and matching corresponding interest points using SURF features. The task of finding correspondences between two images is performed through using a novel brute-force method which uniformly generates random pairs for matching similarity. Experimental results show that the proposed method yields better results than conventional brute force methods in which at least 5% accuracy increment is obtained.

INTRODUCTION

Detection of similar images taken in different perspectives is a big concern in digital image processing. Fast and robust methods have been proposed in this area. In

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computer vision and image processing areas, the machine learning subject occupies an important position in rapidly evolving technology with cognitive applications being studied (Kashif et al., 2016). Object recognition applications, which are one of the basic functions of evolving robots, have become a system that has been intensively researched in recent years (Wang et al., 2022). However, for these systems to succeed in real-world applications, they must not be able to change quickly for certain changes (Satone et al., 2013) after enhancing the image quality (Küpeli et al., 2020), (Ince et al., 2019).

Visual characteristics are very important in computer vision and image processing (Dagher et al., 2006), (Bulut, 2021). The feature search process is used to highlight prominent visual cues in digital images (Ghazali et al., 2007). It is called the definition of the associated image primitive (point, line / curve, area, etc.) (Mazloum et al., 2012). Feature extraction is the process of recognizing a shape, extracting important properties of a shape, and getting a property vector (Li et al., 2010). Feature detectors and descriptions are often used in object recognition, object tracking, 3D reconstruction, image compositing, and visual mapping (Vinay et al., 2015).

The attribute detector selects points of interest with unique content in the image. The key to feature detection is to find features that do not change locally. Therefore, it is important to achieve invariant properties for all deformation conditions, such as rotation, scale, and lighting changes. The ideal functional detector should provide reproducibility, distinctiveness, locality, quantity, accuracy, and efficiency.

Speeded-Up Robust Features (SURF) is a local feature detector and descriptor that can be used for tasks such as object recognition or registration or classification or 3D reconstruction. SURF descriptors can be used to locate and recognize objects, people, or faces, to make 3D scenes, to track objects, and to extract points of interest (Loiseau–Witon et al., 2022). SURF has a comparable performance with the other existing detectors. It has a high repeatable mechanism that can recursively find the required points under different viewing conditions. Its methodological concept has been derived from David Lowe's SIFT (Gupta et al., 2021).

In this area, many studies have been released. Only a few of them which have been recently published are examined here. Verma et al. has proposed a method to match the objects using SURF features (Verma et al., 2016). To detect the proximities between two objects simultaneously and robustly, the proposed method starts by intelligently picking the SURF points based on proximity and stability in the prototype image. SURF points of the image are discovered and matched on the prototype image. The notion of FGV (Feature Grid Vector) and FGC (Feature Grid Cluster) is presented to the group the SURF.

Nawaz et al. has proposed a hybrid medical watermarking method through the SURF features and DCT (discrete cosine transform). In the experiments, the watermarking algorithm, named URF-DCT perceptual hashing, has maintained a

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