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An Overview on Segmenting Fingerprint Images

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Description

Any intrinsic physical or behavioural characteristics that can be utilised to identify or verify the person are considered biometrics. Face, speech, iris, fingerprint, gait, and signature are the most popular biometrics. Due to its universality, distinctiveness, and durability, as well as the numerous advancements and new researchers who have entered this field, the fingerprint is a very widespread and popular biometric of type behaviour features. Even though the Automated Fingerprint Identification System (AFIS) can successfully match a test sample fingerprint picture with a fingerprint image that has previously been stored in the database, incomplete or latent fingerprint images continue to perform poorly.

Latent fingerprints are typically taken from a crime scene and mixed with other images or elements, such as background noise or other fingerprints, or they can be found on a wall's surface that has been accidentally touched or handled. The algorithms are effective for rolled and plain fingerprints, but they have substantial weaknesses when used to detect suspects or latent images of criminals. One of the key processes in fingerprint pre-processing is called fingerprint segmentation, and it involves splitting or separating the image into two distinct parts known as the foreground and background. Therefore, the ultimate purpose of the segmentation method is to increase AFIS performance by lowering noise, lowering the quantity of false minutiae, clearly differentiating background and foreground images, and discarding the background [1-3].

One factor affecting performance in the system for automatic fingerprint identification is segmentation. Over thirty years' worth of literature exists regarding the method or process of image segmentation. These early methodologies for clustering can be utilised for segmentation, which serves as the basis for many new methods, including boundary-based segmentation such as Canny edge detection, as they are explained in their book. Researchers provide a thorough set of objectives for the computation of edge detection sites in this method. They put forth an algorithm for segmenting images that are intensity images with particular qualities like robustness, speed, and freedom from tuning factors [4].

The six basic segmentation methods are contrasted and examined using a variety of criteria, including measuring parameters, computational complexity, limitations, benefits, and applications. Parameters for Measuring: In regions with organised high noise, the Fidelity Weight coefficient, written as, is crucial in determining whether the region should be filtered out of the texture or not. Coherence, mean, and variation are further possible measurement metrics. Calculating the value of the Fidelity Weight coefficient in various fingerprint regions is a measure of computational complexity. It takes a lot of processing to process the latent fingerprint algorithm. Limitations: Latent fingerprint images are not well suited for the adaptive total variation model [2,5].

Due to the noise, it might be very difficult to distinguish between the region of interest and the backdrop, making segmentation extremely difficult. Various segmentation techniques are developed. Nevertheless, these approaches fall short of being fully effective. For instance, these algorithms will fail to separate the Region of Interest from the background area if a background area with significant noise surrounds the front of the unique fingerprint image with weak differentiation. To address lower quality noisy images, a robust and effective segmentation approach is needed. We have covered six distinct types of segmentation algorithms in this study, each with a different level of accuracy for separating fingerprint images [3].

A few algorithms, such as an adaptive total variation model and a directional total variation model, are able to handle and process latent fingerprint images. The paper concludes that almost all of the algorithms discussed above perform well in terms of accuracy, execution time, and other crucial parameters.

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Conflict of Interest

The author reported no potential conflict of interest.

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