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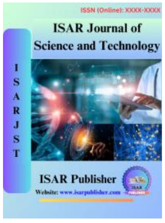

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Feature Extraction and Iris recognition in Moving Image Sequences

Abdulkadir Abubakar Bichi[1*], Usman Alhaji Abdurrahman[1], Abubakar Ado Rogo[1]

Yusuf Maitama Sule University, Kano.

***Corresponding Author**

Abdulkadir Abubakar Bichi

Yusuf Maitama Sule University, Kano.

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Abstract: Motion images are now available everywhere due to the technological advancements and the growing demand for engaging content in social media and communication. The motion images offer better user experience and allow for more effective storytelling and interaction in a visually driven digital landscape. The features from the motion images can be utilized for biometric security, healthcare, and beyond if extracted with high degree of accuracy. This study proposed a novel framework for iris features extraction from a sequence of motion image. The method entails capturing and analyzing iris features while the subject's eye is in motion. The proposed framework has 4 stages: preprocessing, image segmentation, graph representation and features extraction.

Keywords: Iris Recognition; Motion Image, Feature extraction, Pattern recognition.

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1. Background

Iris recognition has gained significant attention in recent years due to its high accuracy and reliability in biometric identification. Daugman's pioneering work in 1993 laid the foundation for iris recognition systems (Daugman, 1993). Afterward, researchers have explored various techniques to enhance the performance of iris recognition systems, especially in dynamic environments. Iris recognition in motion images involves capturing and analyzing iris features while the subject's eye is in motion. The target image is usually generated from a complicated scene (Golabi, Shamsi, & Sedaaghi, 2020; J. Wang, Song, Sun, Huang, & Wang, 2020; P. Wang, Liu, Wang, & Gao, 2018). The process typically involves segmenting of an iris image in a motion picture or a sequence of images and then extracting relevant features from the iris region. Acquiring image from moving objects such as surveillance video or recorded movies involves many aspects, such as image processing, pattern recognition, and computer vision (Song et al., 2020). The image generated from motion pictures usually have some drawbacks such as interference noise (Wu, Li, Li, Guo, & Zhang, 2019); waves of the surface (Baumgartner et al., 2017); light changes (Haider, Malik, & Khalid, 2019) and local occlusion (Song et al., 2020) that results in unpredictable changes in the pixels of the image.

The image features are categorized into: global features and local features (He & Chen, 2019). The image local features extraction is performed in 2 stages: feature region detection and feature region description (Song et al., 2020). The feature region detection is achieved by considering the invariance features of the image. Kim and Rhee (2018) stated that features are invariant to brightness, scale, translation, and rotation. To identify the target image, 3 main physical characteristics are used, which include: spectral, texture, and shape characteristics (Dean, Patterson, & Young, 2018). The tools to identify the spectral features are gray-scale histograms of single-band images and color histograms of multi-spectral images. The spectral features alone are not sufficient to accurately identify the target image; as other background images may have the same spectral characteristics.

Feature extraction plays a crucial role in iris recognition systems. Traditional methods such as Daugman's algorithm extract iris features based on texture analysis of the iris patterns. However, in moving image sequences, where the iris may undergo deformations and motion blur, robust feature extraction methods are required. L. Li, Han, Huijuan, Liu, and Cao (2020) proposed a motion-based feature extraction technique for iris recognition in video sequences, achieving promising results (L. Li et al., 2020).

The contribution of this article is the introduction of a complete framework for moving target recognition. The remainder of this article is organized as follows. Section II discusses related works. Section III describe the research methodology. Section IV presents proposed framework. Section V present the study conclusion.

2. Related Works

X. Li and Zhang (2018) proposed motion-based features extraction for iris recognition by extracting the iris images from the sequences of video frames. To address the challenges of motion blur and occlusions, Zhang, Li, and Shi (2019) developed a dynamic iris recognition framework that integrates feature tracking and motion compensation techniques. Özyurt, Tuncer, and Avci (2019) proposed sparse selection method that can extract around 200 to 3000 features of a given image. Another study introduced image characteristics that performs better when applied to a specific domain (Chen, Zhu, & Zhu, 2019).

3. Research Method

There are four stages in the iris recognition system: Image acquisition; Iris preprocessing; Iris feature extraction; and Template matching. A detail explanation of the stages is provided in the following subsections:

i. The image acquisition is the process of acquiring the iris image. In this case, the image is acquired from a sequence of motion images.

ii. Image preprocessing refers to selectively highlighting visually obvious features that are helpful for target detection in the image, and weakening features that are not related to the target in the image background. The iris preprocessing stage consists of two steps namely segmentation and normalization. This preprocessing stage gives desirability and precise measurement of the iris area in the image used for the iris feature extraction and matching stages. The image sequence contains a lot of information, and the image sequence per second includes 25-30 frames.

iii. The feature extraction stage follows after the image preprocessing. In this stage, the unique iris features are extracted. The process requires accuracy and low computational time (Shah, Sharif, Raza, & Azeem, 2013).

iv. Finally, the available databases of registered users are used for template matching.

4. Proposed Framework

The proposed framework has 3 distinct steps. The preprocessing; graph representation and feature extraction. As explained in the following subsections:

4.1 Preprocessing

The Model takes an input the Motion Iris Image, which is generated from a series of motion image frames containing the iris region. The iris region is then localized and segmented from the motion images using Hough transform.

4.2 Graph Representation

The segmented iris region is represented with graph structure. The graph is typically made of 2 part; the graph nodes which are the vertices of the graph and the graph edges which the links between the nodes. The nodes of the graph represent important iris features such as ridge endings, edge contours, and texture. On the hand the edges represent spatial relationships between nodes which are indicating the topological structure of the iris.

4.3 Feature Extraction using GNN

A Graph Neural Network (GNN) applies to extract spatial relationships between different features of the iris. The GNN performs multiple message-passing steps over the graph to compute node embedding that capture both local and global feature interactions in the iris. Temporal features will be aggregated using recurrent neural networks (RNNs) to capture changes over time. The iris pattern is then identified using passing the extracted features over classification layer. Finally, the model uses matching algorithms to compare the extracted features with a stored database for iris recognition.

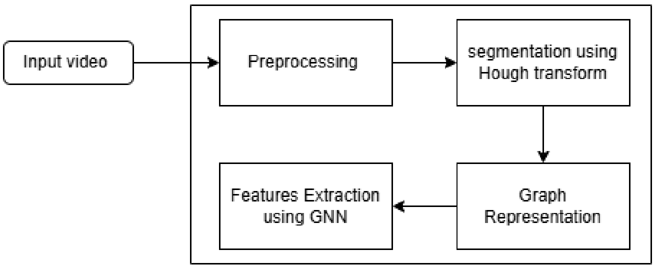

Figure 4.1 Proposed framework for extracting iris features from motion images using Graph Neural Networks (GNNs)

5. Conclusions

This paper proposes an algorithm for moving target recognition. For the description of the target, we use the invariant moment base descriptor to describe the shape of the extracted target area and the boundary base Fourier shape descriptor to describe the edge shape of the target.

The applications of feature extraction and iris recognition in moving image sequences are vast, ranging from biometric security and surveillance to healthcare and human-computer interaction. However, further research is needed to address the scalability and real-time processing requirements of iris recognition systems in dynamic environments. Future studies may explore the fusion of deep learning with traditional feature extraction techniques to enhance the robustness and efficiency of iris recognition systems.

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