

Article

A Survey on the Biometric Recognition of Humans using Inaccessible Parts of the Human Eye

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A B S T R A C T

Biometrics finds a lot of application in the modern day security aspects whether it may be in industrial sector, defense sector or in domestic sectors. In this world, without biometrics, it is exceedingly difficult to incorporate the security measures in any organization. Hence, personal identification can be especially important problem in any bio-metric recognition scenarios. Entry of a person into an organization in the work environment plays an especially important role as unauthorized persons if entered a premise may create a flutter, inviable to some terrorist attacks. Hence, biometrics of an authorized person into the work environment plays a very im-portant role. Quite a no. of bio-metric methods exists for identification purposes, viz, physiological, behavioral. Several of them are hand, voice, iris, human face, finger-print, ear, gait/gesture, posture, vien, code, thumb, ear, password, signature, pattern, palm print, etc. As quite a substantial no. of biometric methods for detecting the human beings exists by automatic means, retina scan is being considered as the biometric identity in the examination work commenced by us because of several benefits over the other biometric identities. For biometric recognition of a person using retina scans, a few methods exist in the literature. In this context, fractal dimension method is one of the methods that could be used. Hence, the retinal recognition is achieved in our proposed work for identifying the person by creating new approaches using Fractal Dimension methodologies. In this paper, 100s of papers are being analyzed upon the chosen research topic and a brief survey of the existing methodologies that are used for the biometric recognition of personnel using the human being's retina is being presented. This survey paper aims at delivering a basic info about the on-going current works the completed works in the field of biometric recognition using the retina so that the paper give a base for the other researchers to start the their work. In this paper, a brief survey on the biometric recognition of humans using inaccessible parts of the human eye is being presented.

Keywords: Biometrics, Retina Scan, Physiological, Behavioural, Matlab, Simulation, Security, Eyes, Fractal Dimension, Pre-processing, Segmentation, Feature Extraction, Nerve Fibres, Computations

Introduction

Paper presentation in this research article is as follows one by one. A brief introduction into the research topic is presented in section II. The Retinal Recognition System (RRS) is briefly described in section III supported by the different methods that are used for the recognition process in section IV. A brief review of the literature survey is given in section V, next it is followed by the advantages and future scope in section VI. The paper finally concludes with the conclusions in section VII followed by many references till date.

Biometrics is the space craft of differentiating an individualistic by different skills. Recognizing or reinforcing one's recognition utilizing bio-metrics is pulling in impressive deliberation in this cutting edge computerized world, one the primary reason being the security issues in several extraordinarily delicate spots (defense areas). It is the wonderful investigation of programmed ID of people that utilizes the one of a kind physical or conduct attributes/qualities of people to think of them. Since biometrics is to a great degree hard to produce and can't be overlooked or stolen, biometric confirmation offers a helpful, precise, vital and high secure option for a person, which has a colossal preference over the customary cryptography-based authentication plans.¹

Retinal Recognition System

In the section, the composition of the retinal recognition system is nature introduced in a nutshell. The human eye structure is displayed in the Figure 1, along with the retinal parts, which is our Region of Interest (ROI). The defending external layer of the eye is called as sclera.

Fibers (RNF) inside the retina send electrical signs to the mind, which at that point translates these signs as visual pictures. Retina is roughly 0.5 mm thick spreads the inward side at the rear end of the eye, where the images are also formed. Several blood vessels (BV) are present all over the eyes to provide nutrition to various parts of the eye. The mean dia of the retinal blood vessel is $\pm 250 \mu\text{m}$, the retina connects all the optic nerves to the brain.²

Literature Review

Numerous works have been projected on retina biometric human recognition system for secure authentication till date. This section provides the knowledge about the remaining technologies, its advantages and disadvantages, work done by other authors till date. Subsequent paragraphs explain how the researchers have contributed to the field of biometric recognition using retina scans. To start with, 100's of research papers was collected from various sources, studied @ length, breadth and its outcomes were studied, analyzed to start with and the outline for the survey or the review paper was given. The next subsequent paragraphs follow a brief review of the works by various authors.³ A wavelet based energy methodology for recognition of the retinas was developed by Rita A Vora and HB Kekre. To inexpensively extract concentrated smoothness info in digital pictures, the wavelets are used in their work. Nazariy K Shaydyuk and Timothy Cleland proposed retina affirmation methodology with liveness recognizable proof using dab separate imaging. To make the acquiring structure less exposed to cheating, there was an inborn essential for liveness area, which was the necessity in their investigation work.⁴

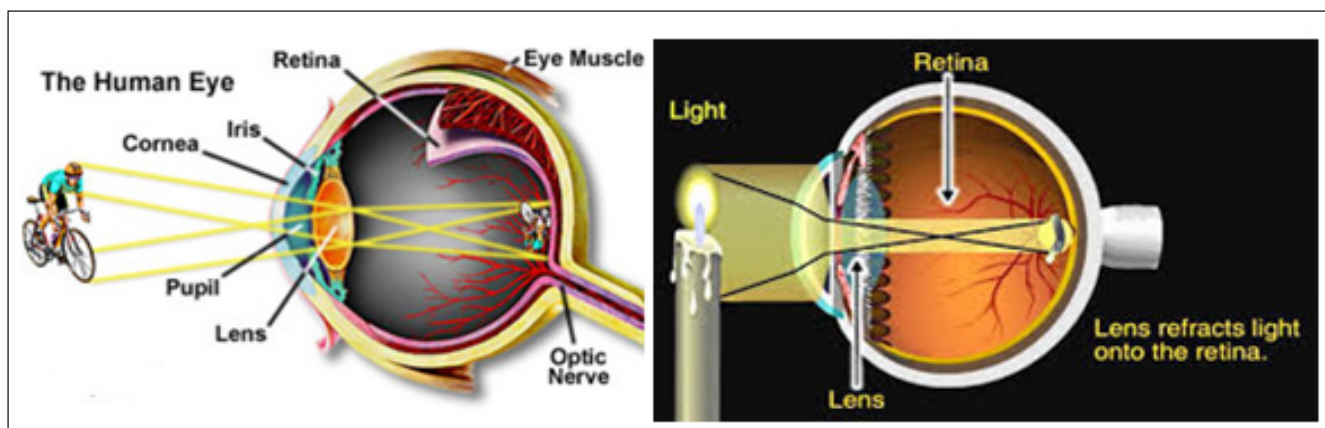


Figure 1. A Front View of the Human Retina Along with its Different Parts

Alternate parts of the eye are cornea, focal point's lens area, retina and the iris. The retina is the light delicate tissue which frames the internal side of eye (rear end of the eye). The optical components of the eye center the picture onto the retina, along these lines starting a progression of compound and electrical occasions inside the retina. Nerve

SS Bisht, Annapurna Singh, presented comparatively less complex and efficient method for extracting blood vessels from retinal image which can be used for retina recognition by using Kirsch's templates, which gave satisfactory results. Zahra Waheed, Amna Waheed, M Usman Akram proposed a method for retina acknowledgment utilizing auxiliary

highlights of retinal picture their method involved vessel-based matching by using feature vector points.⁵

Akter Hussai et al., created biometric security application dependent on retinal vessel highlight in their examination work. A modified system was associated with recognize a lot vascular branches and mixture centers in the retina zone. These were planned from veins in the retinal picture. To acknowledge or dismiss a guaranteed personality from a man, the system was trained by models. Abu Hasnat et al., proposed retinal acknowledgment framework dependent on quick standardized cross-connection (NCC). This biometric conspire depended on RGB retinal fundus pictures. The element vector was of moderately more modest measurements and created better acknowledgment that empowered to utilize this technique for constant (RT) applications.⁶

In, Ungureanu et al., worked on the individual distinctive evidence using fractal examination of retinal pictures and made incredible results. In their work, a retina-based biometric incorporates the assessment of the veins organized at the rear of the eye was thought of. In this work, they presented a method, which used the fractal examination to depict the retina pictures. The Fractal Dimension (FD) of retina vessels was estimated for various 20 pictures and afterward got for various estimations of FD for each picture. Their calculation gave a decent precision and was additionally simple to execute.⁷

Fan Huang and their examination group investigated on the unwavering quality of utilizing retinal vascular fractal measurement as a biomarker and created way breaking results. Modarresi et al., worked on the retinal biometric acknowledgment utilizing shearlets changes. Meanwhile the fundamental features of retinal images were contained of dissimilar orders and locations, in their work, they attempted to analyze the retinal images by means of a multi-scale method, which is based on shearlets transform that is an effective directional multi-scale system for image assessment.⁸

In a concise prologue to how to assess the various kinds of biometric frameworks was introduced by the group of specialists drove by Phillips et al., where they introduced a synopsis of the distinctive innovative plans that could be applied for the biometric validation measure. This paper gave a knowledge into the focal points and the hindrances of the iris acknowledgment frameworks. In biometric verification, FD plan could be utilized dependent on the connection of the integrals on the streaming information. This idea was advanced by the group of scientists drove by Wong et al., in their contributory paper.⁹

The authors contrasted their proposed works and others and indicated how quick they can gauge the fractals in the

recognition cycle. As the retinal picture is made of high goal pixels, at some point there would be a disappointment of the case including calculation, in such cases, it would get unreasonable to apply it for the biometric acknowledgment cycle of individuals. This idea was advanced by the group of creators, Greenside et al.

A concise audit on the presentation investigation of iris validation framework was introduced by Reeta & Vandana in their overview paper. Retinal picture could be considered as perhaps the most hearty and exact biometrics for acknowledgment purposes. Another biometric acknowledgment framework dependent on blend of Fourier Transform (FT), Wavelet Transform (WT) was developed by the group of authors led by Masoud Sabaghi in their research paper. They from the start restricted the OD utilizing TM procedures and afterward utilized it to pivot the retinal pictures to some reference or standard position. Precise apportioning with the structure on extent range of retinal pictures and WT was utilized for distinguishing the highlights. Toward the end, they utilized the Euclidean distance for coordinating the highlights. The work was applied of a standard information base that was comprising of more than 400 pictures of the retina taken from 40 people. A wide range of pictures was there in this information base. They accomplished a recognizable proof effectiveness of more than 99%.

A tale retinal recognizable proof bio-decimal standard was proposed by Farzin et al. Likewise, a wavelet based retinal acknowledgment module was proposed by Shahnazi et al. Ideas of fluffy was utilized by Tabatabaee et al., to recognize people utilizing retina. Ortega et al., proposed some combination of algos for biometric verification. Morteza Modarresi in their exploration paper tended to the issue of utilizing the Mahalanobis distance to survey the biometric design closeness and human ID is feasible however tackling the amplification for the coordinating scores. The creators utilized the multi-goal highlight extraction strategy to accomplish their objective.

Work on the retina recognizable proof which was reliant on the vein design utilizing the idea of parceling utilizing spiral and rakish methods was done by Amiri et al. They utilized 2 sorts of parceling of the retinal veins and utilized it for biometric acknowledgment utilizing the checked retinal pictures. Ortega's examination bunch chipped away at the check of retina utilizing the idea of highlight focuses reliant on the biometric design and created magnificent outcomes as they had utilized a mixture idea of highlight extraction and acknowledgment.

An efficient retina pattern recognition algo for identifying the human beings was proposed by Islam, Siddiqui and Paul in their research article. Rotation in-variant retina recognition method which was based on the sketch of

retinal blood vessels was developed by Barkhoda et al. The authors used the concept of angular partitioning for biometric recognition and produced fruitful results in comparison with the work done by others. Dehghani et al., developed a retina identification protocol based on the rotation of the invariant moments.

Biometric retinal ID robotized structure subject to fake neural frameworks (ANNs) was reached upon by Mr Selin Üzelaltinbulat in his recommendation work. The structure of affirmation course of action of retinal pictures was arranged in their work. Preprocessing was associated with change the retina pictures to GS regards and concentrate the l/ p features from the retina pictures. These features were given as l/ p signals for the Artificial Neural Networks. ANN was then associated with portray the retina plans in an affirmation step using a coordinated technique and developed the learning computations. The Back Propagation figuring was then associated with plan neural frameworks to obtain an ideal biometric affirmation plot.

Cemal Köse, Cevatiki'Baş worked on the retinal bio-metric identification scheme in, produced astonishing results. In their study, they propose a personal identification system which was based on retinal vasculatures network analysis in the fundus images of the human eyes. To accurately identify a person their approach first segments the vessel structure and then employs similarity measurement along with the tolerations.

In greater part of the work done by the different creators/ specialists presented in the previous paragraphs in this literature survey disadvantages. Some of the major drawbacks of pre-existing methods mentioned earlier were.

Conclusion

Retinal in this outline/ overview paper, the assessment work done work date in the field of bio-metric affirmation utilizing retina checks done by different creators till date is introduced, which was assembled from various sources. Various issues w.r.t. the downsides of the works done by the different analysts was profoundly inspected, examined, concentrated in more noteworthy profundity in more noticeable significance. This article consequently may discover of more significance as a base paper for the individuals who need to seek after additional examination in the field of biometric acknowledgment utilizing retinal piece of the natural eyes.

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