Inner Iris Localization and Statistical Feature Extraction of CASIA and KVKR Databases

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ABSTRACT
A new system for personal identification based on inner iris localization and calculate statistical features is presented in this paper. It is collected of iris image acquisition, image preprocessing and statistical feature extraction. The algorithm for iris feature extraction is based on digital image processing techniques. This algorithm is tested on CASIA iris image database, which is online available and local database collected from KVKR research lab.

Keywords
Iris Localization, Statistical Features

1. INTRODUCTION
With the distinct need for consistent personal identification, iris recognition has become an important permitting technology in our society. While an iris pattern is naturally a supreme identifier, the development of a high-performance iris recognition algorithm and transferring it from research lab to practical applications is still a challenging task. Iris, is a kind of physical biometric feature. It contains distinctive texture and is complex ample to be used as a biometric signature. Associated with other biometric features such as fingerprint and face, iris patterns are more stable and consistent. It is inimitable to people and stable with age. Also, iris recognition systems can be non-invasive. For localization of inner iris we have collected the 40 Iris images from CASIA image dataset[1]and 40 Iris images collected from KVKR Iris database. KVKR iris is collected by live four subjects from biometric research lab of dept. of CS & IT, Dr. B. A. M. University, Aurangabad. Today's e-security are in acute need of finding accurate, secure and cost-effective alternatives to passwords and personal identification numbers as financial damages increase intensely year over year from computer-based scam such as computer hacking and identity theft [2]. Biometric solutions report these fundamental problems, because aperson's biometric data is distinctive and cannot be relocated. Biometrics which mentions to recognizing an individual by his or her physiological or behavioral appearances has ability to distinguish between accredited user and an imposter. An advantage of using biometric validation is that it cannot be lost or elapsed, as the person has to be physically present during at the point of identification procedure[3]. Biometrics is characteristically more reliable and accomplished than traditional information based and token based techniques. The commonly used biometric features include fingerprint, speech, Iris, face, voice, hand geometry, retinal identification, and body aroma identification [4].

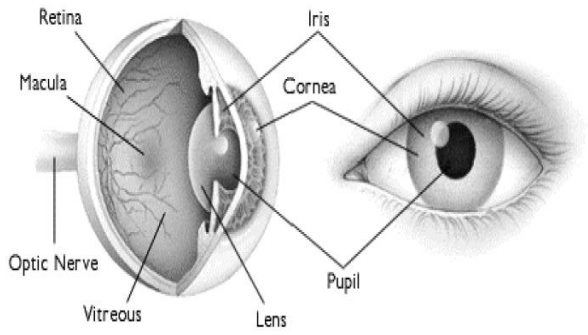

Fig 1: Structure of iris

2. METHODOLOGY
The proposed algorithm is design for localization of inner iris, shown in figure 2. In this algorithm firstly, preprocessing is done by renovating the image into gray. Afterwards apply histogram equalization for image enhancement. After image enhancement, image complement operation is done for highlighting the iris. Subsequently image adjustment is done by using contrast stretching method. After applying the contrast stretching function, some noise is get added, to remove that noise median filter is used. After removing the salt and pepper noise threshold operation is done for extraction of inner iris. Following are the mathematical formulations is use for extraction and localizing of inner iris.

Histogram equalization function for enhancing the gray image:

$$h(v) = \text{round}\left(\frac{cdf(v)-cdf_{min}}{(M\times N)-cdf_{min}} \times (L-1)\right) \quad (1)$$

Here cdf_{min} is the minimum value of the cumulative distribution function, M × N gives the image's number of pixels and L is the number of grey levels.
2D median filter is use for removing the salt and pepper noise.

$$y[m,n] = \text{median}\{x[i,j],(i,j) \in \omega\} \quad (2)$$

Here ω Represents a neighborhood centered around location (m, n) in the image.

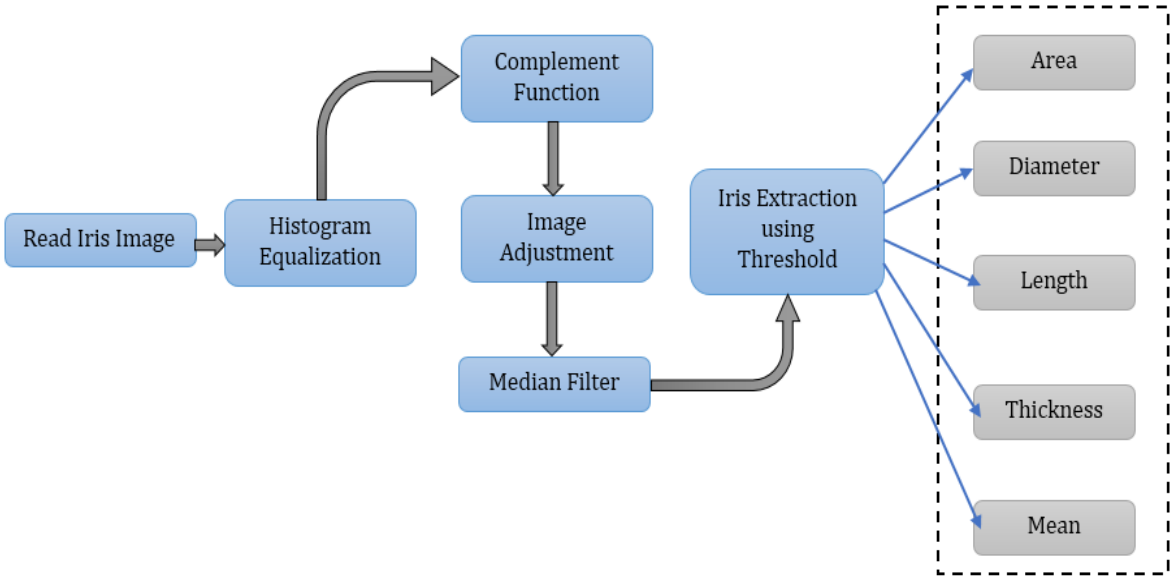

Fig 2: Workflow for inner iris extraction and localization

Threshold function for extracting the retinal blood vessels.

$$T = \frac{1}{2}(m1 + m2) \qquad (3)$$

Here m1 & m2 are the Intensity Values.

3. RESULT

By using digital image processing techniques we have extract the inner iris following figure 3 shows the output of inner iris localization. After extraction of inner iris we have calculated the statistical features like area, diameter, length, thickness and mean.

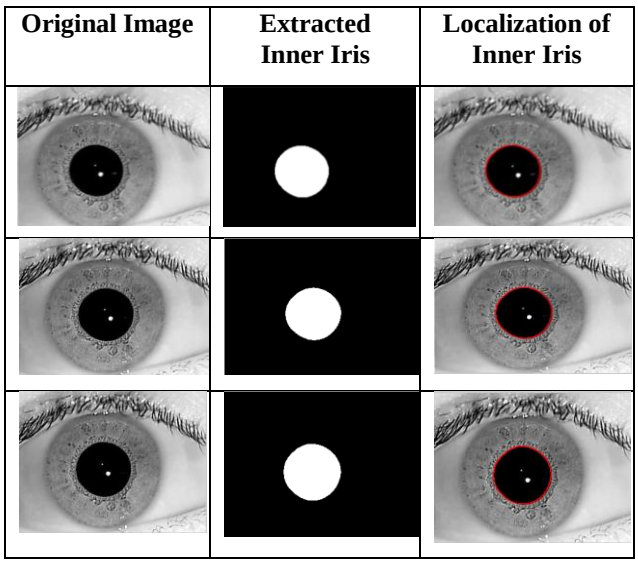

Fig 3: Inner iris localization

Following table show the statistical features of CASIA Iris image database.

Table 1. Feature data of CASIA iris databse

Sr. No	Image Name	Area	Diameter	Length	Thickness	Mean
1.	Image001	5999.88	247	3000	2	77.46
2.	Image002	6518.13	257	3259	2	80.73
3.	Image003	6746.38	261	3373	2	82.14
4.	Image004	6969.38	266	3485	2	83.48
5.	Image005	6963	266	3482	2	83.44
6.	Image006	10853.88	332	5427	2	104.18
7.	Image007	11487.38	341	5744	2	107.18
8.	Image008	11876.88	347	5938	2	108.98
9.	Image009	11448.63	341	5724	2	107
10.	Image010	9874.25	316	4937	2	99.37
11.	Image011	3877.38	198	1939	2	62.27
12.	Image012	3414.75	186	1707	2	58.44
13.	Image013	4174.13	206	2087	2	64.61
14.	Image014	4235.63	207	2118	2	65.08
15.	Image015	4418	212	2209	2	66.47
16.	Image016	10474.13	326	5237	2	102.34
17.	Image017	10492.5	326	5246	2	102.43
18.	Image018	10867.88	332	5434	2	104.25
19.	Image019	10971.75	333	5486	2	104.75
20.	Image020	10892.5	332	5446	2	104.37
21.	Image021	5999.88	247	3000	2	77.46
22.	Image022	6518.13	257	3259	2	80.73
23.	Image023	6746.38	261	3373	2	82.14
24.	Image024	6969.38	266	3485	2	83.48
25.	Image025	6963	266	3482	2	83.44
26.	Image026	10853.88	332	5427	2	104.18
27.	Image027	11487.38	341	5744	2	107.18
28.	Image028	11876.88	347	5938	2	108.98
29.	Image029	11448.63	341	5724	2	107
30.	Image030	9874.25	316	4937	2	99.37
31.	Image031	5999.88	247	3000	2	77.46
32.	Image032	9874.25	316	4937	2	99.37
33.	Image033	3877.38	198	1939	2	62.27
34.	Image034	3414.75	186	1707	2	58.44
35.	Image035	4174.13	206	2087	2	64.61
36.	Image036	4235.63	207	2118	2	65.08
37.	Image037	9874.25	316	4937	2	99.37
38.	Image038	11876.88	347	5938	2	108.98
39.	Image039	11448.63	341	5724	2	107
40.	Image040	9874.25	316	4937	2	99.37

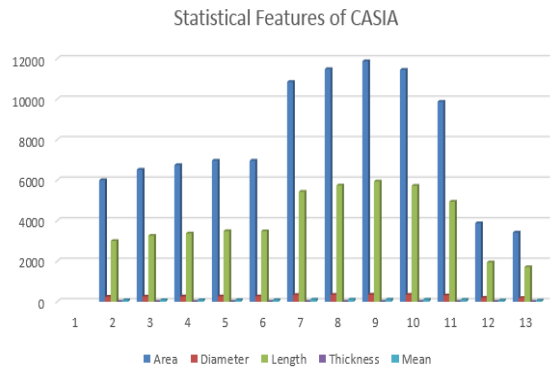

Fig 4: Statistical Features of CASIA

Following table show the statistical features of KVKR Iris image database.

Table 2. Feature data of KVKR iris databse

Sr. No	Image Name	Area	Diameter	Length	Thickness	Mean
1.	Image001	9836.63	316	4918	2	99.18
2.	Image002	7222.88	271	3611	2	84.99
3.	Image003	9180	305	4590	2	95.81
4.	Image004	3152.75	179	1576	2	56.15
5.	Image005	1060.25	104	530	2	32.56
6.	Image006	1915.38	139	958	2	43.76
7.	Image007	4751	219	2376	2	68.93
8.	Image008	5636.5	239	2818	2	75.08
9.	Image009	4194.38	206	2097	2	64.76
10.	Image010	2980.88	174	1490	2	54.6
11.	Image011	2430.25	157	1215	2	49.3
12.	Image012	3044.75	176	1522	2	55.18
13.	Image013	2363.38	155	1182	2	48.61
14.	Image014	3309	183	1655	2	57.52
15.	Image015	2975.5	174	1488	2	54.55
16.	Image016	3110.88	178	1555	2	55.78
17.	Image017	1952.13	141	976	2	44.18
18.	Image018	3698	194	1849	2	60.81
19.	Image019	4228.13	207	2114	2	65.02
20.	Image020	4225.5	207	2113	2	65
21.	Image021	3711.75	194	1856	2	60.92
22.	Image022	2756	167	1378	2	52.5
23.	Image023	3767.63	195	1884	2	61.38
24.	Image024	3823.38	197	1912	2	61.83
25.	Image025	3825	197	1913	2	61.85
26.	Image026	6241.88	251	3121	2	79.01
27.	Image027	9836.63	316	4918	2	99.18
28.	Image028	7222.88	271	3611	2	84.99
29.	Image029	9180	305	4590	2	95.81
30.	Image030	3152.75	179	1576	2	56.15
31.	Image031	1060.25	104	530	2	32.56
32.	Image032	1915.38	139	958	2	43.76
33.	Image033	4751	219	2376	2	68.93
34.	Image034	5636.5	239	2818	2	75.08
35.	Image035	4194.38	206	2097	2	64.76
36.	Image036	2980.88	174	1490	2	54.6
37.	Image037	2430.25	157	1215	2	49.3
38.	Image038	3044.75	176	1522	2	55.18
39.	Image039	2363.38	155	1182	2	48.61
40.	Image040	3309	183	1655	2	57.52

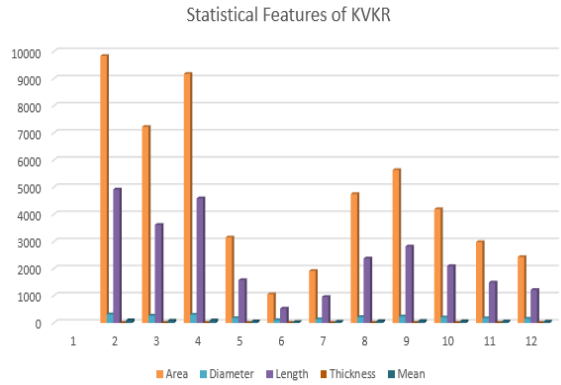

Fig 4: Statistical Features of KVKR

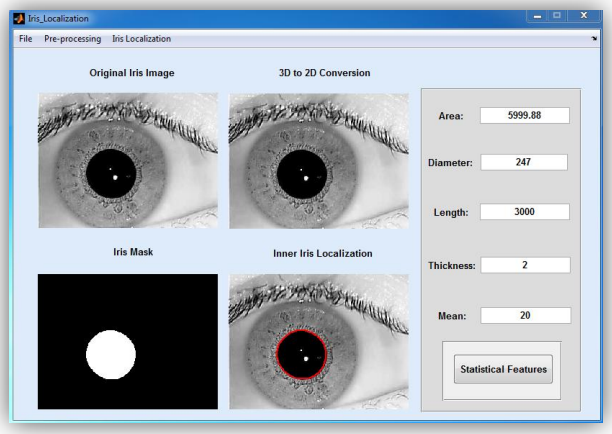

Fig 5: Graphical user interface for inner iris localization

4. CONCLUSION

For localization and extraction of inner iris we have use digital image processing techniques depicted in figure 2. For analysis of this techniques we have use online CASIA database and local database collected from KVKR research lab (Department of Computer Science & IT, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad).After extraction of inner iris, we have calculated the statistical features like area, diameter, length, thickness, and mean. For performance analysis, receiver operating characteristic curve is used. The proposed algorithm achieves sensitivity of 94.92 % and specificity of 100%.

5. ACKNOWLEDGMENT

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