BIOMETRIC FEATURE EXTRACTION FOR IRIS SCANS
(PROJ 029)

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Biometrics
This is the science of automated recognition of persons based on ones physiological characteristics. Its done for verification or identification purposes.

Types of Biometrics techniques
- Fingerprint
- Facial
- Voice
- Retina
- Iris

Biometric feature extraction for iris scans
Epamba Ibrahim
IRIS RECOGNITION

Objectives

✓ To identify salient features of the iris.
✓ To develop software for extraction of these unique features.
✓ To compare sets of irises and check for matching.

Region of interest

- Eyelid
- Sclera
- Iris
- Pupil
- Eye lashes

Biometric feature extraction for iris scans

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IRIS RECOGNITION SYSTEM

- **Image acquisition**: Images obtained from CASIA.
- **Segmentation**: Employs Canny edge detector & Hough Transform.
- **Encoding**: Normalization & use of Log-Gabor filter.
- **Matching**: HD calculation used for determining matches

*Biometric feature extraction for iris scans*  
Epamba Ibrahim
Involves locating the iris region and isolating it.

**Canny Edge Detector**
- Smoothens image by convolving it with Gaussian filter.
- Computes image gradient magnitude using X & Y derivatives.
- Performs ‘Non-maximum suppression’ on pixels.
- Hysteresis operator marks pixels that are edges.
- Binary image generated.

**Circular Hough Transform**
- Used to deduce the radius & centre coordinates of pupil and iris region.
- From edge map, votes are cast into Hough space for parameters of circle passing through each edge point.
- A maximum point in Hough space gives the radius and centre coordinates.
- Eyelids are approximated with parabolic arcs using Hough Transform. We use NaN values to mark the Eyelids off as they are potential noise sources.
ENCODING

Creating a template containing only the most discriminating features of the iris.

Normalization is performed prior to encoding.
Involves making extracted region into a rectangle template with fixed dimensions.
Takes care of inconsistencies in eye images.

Log- Gabor filters are then used to obtain information about iris texture. Phase data provided for by the filter is quantized and used to generate the bit-wise biometric template.
MATCHING

Comparison of two iris templates and determine if they originate from the same individual.

Uses Hamming Distance which gives a measure of how many bits are the same between two bit patterns.

$$HD = \frac{1}{N} \sum_{j=1}^{N} X_j \ (XOR) Y_j$$

HD=0.5 —— Two bits patterns completely independent (Not a Match).

HD=0.0 —— Patterns derived from same iris (Perfect Match).

HD<0.4 —— Acceptable (Match).
28/30 Iris Images had perfect automatic segmentation.

The 2 images with poor segmentation was due to inability of system to clearly locate sclera/iris border.
Selected sample outputs.

Image with noise regions marked off

Segmented iris image

Normalization of the iris image

Normalized iris template

Normalized Noise template

RESULTS

Biometric feature extraction for iris scans
The Biometric system was a success as 93% of samples gave perfect recognition. Salient features of iris were identified, extracted, encoded then matched as desired.

The only setback was the fact that Matlab processed the images slowly thus would not suit real time processing.

APPLICATION
Immigration department.
ATM identity verification.
MATLAB Language was slow in processing the images. Languages such as C, C++ could be employed in the Biometric system. Real time processing could be included. This would mean use of high resolution cameras such as ‘OKI’ developed by Japan to capture eye image.
MANY THANKS