• **Outline**
  – Iris Recognition
  – Deployed Recognition Systems
    • IRIS System: United Kingdom Border Control
    • IrisGuard: United Arab Emirates Border Control
  – Imaging Constraints
    • Further Directions
  – References
Can be regarded as one of the “best” biometric traits, considering the usual properties of Uniqueness, Universality, Permanence, Collectability, Performance, Acceptability and Circumvention.

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<th>Trait</th>
<th>Uniqueness</th>
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<th>Permanence</th>
<th>Collectability</th>
<th>Performance</th>
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(Adapted and averaged from [1], [2], [3], [4], [5], [6], [7], [8], [9] and [10])
Iris Recognition: Block Diagram

1. Image Capturing
2. Preprocessing
3. Segmentation
4. Signature Encoding
5. Signatures Matching
6. Normalization
7. OK / KO
Iris Recognition

- Due to the afore mentioned properties and favourable comparisons with other traits, the use of the iris has been increasingly encouraged by both governamental and private entities.
- Nationwide applications are starting to be deployed.
- This type of applications is regarded as “the grand challenge” [11] for the Pattern Recognition community itself.
- Near 50% of the publications cited in a recent survey [12] were – at most – from 2005.
The **IRIS** (Iris Recognition Immigration System) is a means of border control that allows registered passengers to enter the United Kingdom quickly through automated barriers at certain airports.

It is presently working in:
- All five Heathrow terminals;
- Manchester terminals 1 and 2;
- Birmingham terminal 1;
- Gatwick North and South terminals.

The policy is to open its use to as many people (adults) as possible: British and non-British citizens, permanent United Kingdom residents and short-term visitors, ...

**Source:** http://www.ukba.homeoffice.gov.uk/managingborders/technology/iris/registeriris/caniregisteriris/.
Although requiring high levels of cooperation, the recognition process performs relatively quick (about 2 seconds).

- It usually takes between 5 and 10 minutes to register for IRIS.
- Other European airports have installed the Daugman-based recognition systems for passenger screening and immigration control in lieu of passport presentation: Amsterdam Schiphol, Frankfurt, and Athens.

Source: http://www.cl.cam.ac.uk/~jgd1000/iris_recognition.html
However, there remain several **Imaging Constraints**:  
- Glasses are not allowed during enrollment.  
- No sunglasses are allowed during the enrollment nor recognition.  
- Plain contact lenses are allowed either for enrollment / recognition.

This leaflet describes how to use the UK’s IRIS system at London Heathrow Airport.

Source:  
IrisGuard: United Arab Emirates Border Control

- The United Arab Emirates (UAE) Ministry of Interior has used iris recognition of foreigners entering the UAE at 35 air, land, and sea ports.
- Each traveler is compared against about a million IrisCodes on a watch-list;
- The time required for an exhaustive search through the database is about 1 second.

Source: http://www.cl.cam.ac.uk/~jgd1000/deployments.html
IrisGuard: United Arab Emirates Border Control

- So far not a single False Match has been made, despite some 2.7 billion iris cross-comparisons being done every day [13].

- More than 9,500 persons have been caught by this system, travelling with forged identities [13].

- It is the largest deployed system in the world, both in terms of number of signatures enrolled (more than 840,751) and number of iris comparisons performed daily 6,225,761,155 (6.2 billion) in 'all-against-all' search mode [14].
• The iris has two extremely important advantages, when compared with other biometric traits:
  – Uses the lower and middle low frequency components to encode most of the discriminating information between individuals.
  • Propitiates higher robustness to noise.
  – It was largely reported an extremely low (almost infimum) probability for the occurrence of false matches (even on high degraded data)
  • Increases the confidence on any match reported
Main Result: “Any reported match should be genuine”:

Histogram of the dissimilarities between 204 Million Cross Comparisons (source: http://www.cl.cam.ac.uk/~jgd1000/UA Edeployment.pdf)

Histogram of the dissimilarities between 1000 iris templates and 20 000 samples extracted from non-iris, partial and degraded iris data [15]
• **Imaging Constraints**
  - In addition to performance, it should be considered the high subjective levels of users’ satisfaction with the recognition system.
  - Often, systems that impose long/heavy physical contact or mental workload are found to be distasteful.
  - The system shouldn’t negatively affect users’ physical and mental well-being, either immediately or with longer-term use.
  - As reported in a recent study conducted by Aton Origin for the United Kingdom Passport Service, “*the imaging constraints are a major obstacle for the nationwide deployment of iris recognition systems*”.
• Here, when compared with other traits, the iris scored relatively low, due to excessive efforts demanded to subjects in the image acquisition process.
• **Imaging Constraints: Illustration** (source: “Googled” images)

**Conclusion:** At close imaging distances, **stop-and-stare** interfaces and constrained **lighting** conditions, deployed iris recognition technology achieves **remarkable low error rates**.
Further Directions

What if the images are acquired in less constrained conditions?

- Moving subjects
- At large imaging distances
- Without requiring cooperation
- Within dynamic lighting environments

These conditions lead to the appearance of heavily degraded data:

- Poor focused, motion blurred, off-angle data, heavy occluded due to eyelids, eyelashes, glasses, specular and glossy reflections.
• **Further Directions**

  – A growing number of research works concern about the minimization of the image acquisition constraints to perform iris recognition with enough confidence.

  – **Examples:**
    
    • Iris-on-the-Move [16], Fancourt *et al.* [17], Narayanswamy and Silveira [18], He *et al.* [19], Boyce *et al.* [20] Chen *et al.* [21], Schuckers *et al.* [22]...

  – Is it possible to move one step ahead (now?, in a near future?) toward reliable covert iris recognition?

  • Extremely challenging conditions!
Degraded Data: Examples of visible wavelength images captured at-a-distance and on-the-move: which ones enable biometric recognition?
• **Further Directions**
  
  – What are the specific circumstances that enable reliable recognition? (remains mostly to be done)
    - Acquisition distances?
    - Types of allowed movements?
    - Minimal lighting conditions constraints?
  
  – Is the use of visible wavelength realistic? (partially to be done)
  
  – **Major Motivations for Covert Iris Recognition**
    1. Any reported match should be genuine.
    2. Any reported match results from completely human-free efforts.
    3. Any match should be regarded as an overplus, due to (1) and (2).
• References


References

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