



Quality Assessment in Iris Recognition for Mobile Applications

MSc Dissertation - Electrical and Computer Engineering

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Outline

- Biometrics & Iris Recognition
- Iris Databases
- Dissertation main topics
 - Liveness Detection
 - Spoof Attacks
 - Patterned Contact Lenses
 - Methods chosen
 - Preliminary Results
 - Quality Assessment
- Future work

Biometrics & Iris Recognition

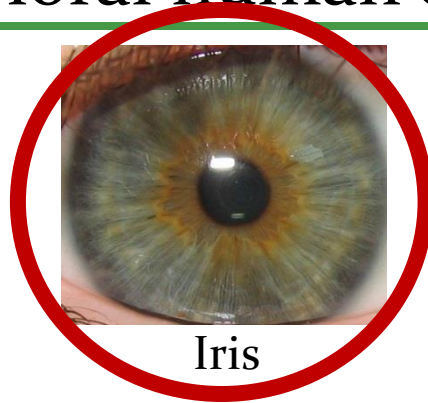
- **Biometrics** - method of authenticating people based on anatomical or behavioral human characteristics



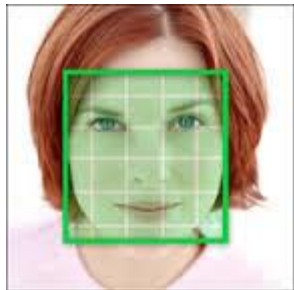
Fingerprint



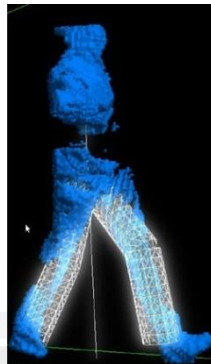
Hand



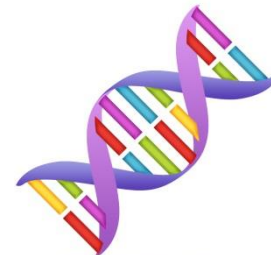
Iris



Face



Gait



DNA



Keystroke



Voice



Signature



Iris Databases

- BATH
- CASIA
- ICE
- WVU
- UBIRIS
- MMU
- UPOL
- MobBIO
- VCMU

With fake samples:

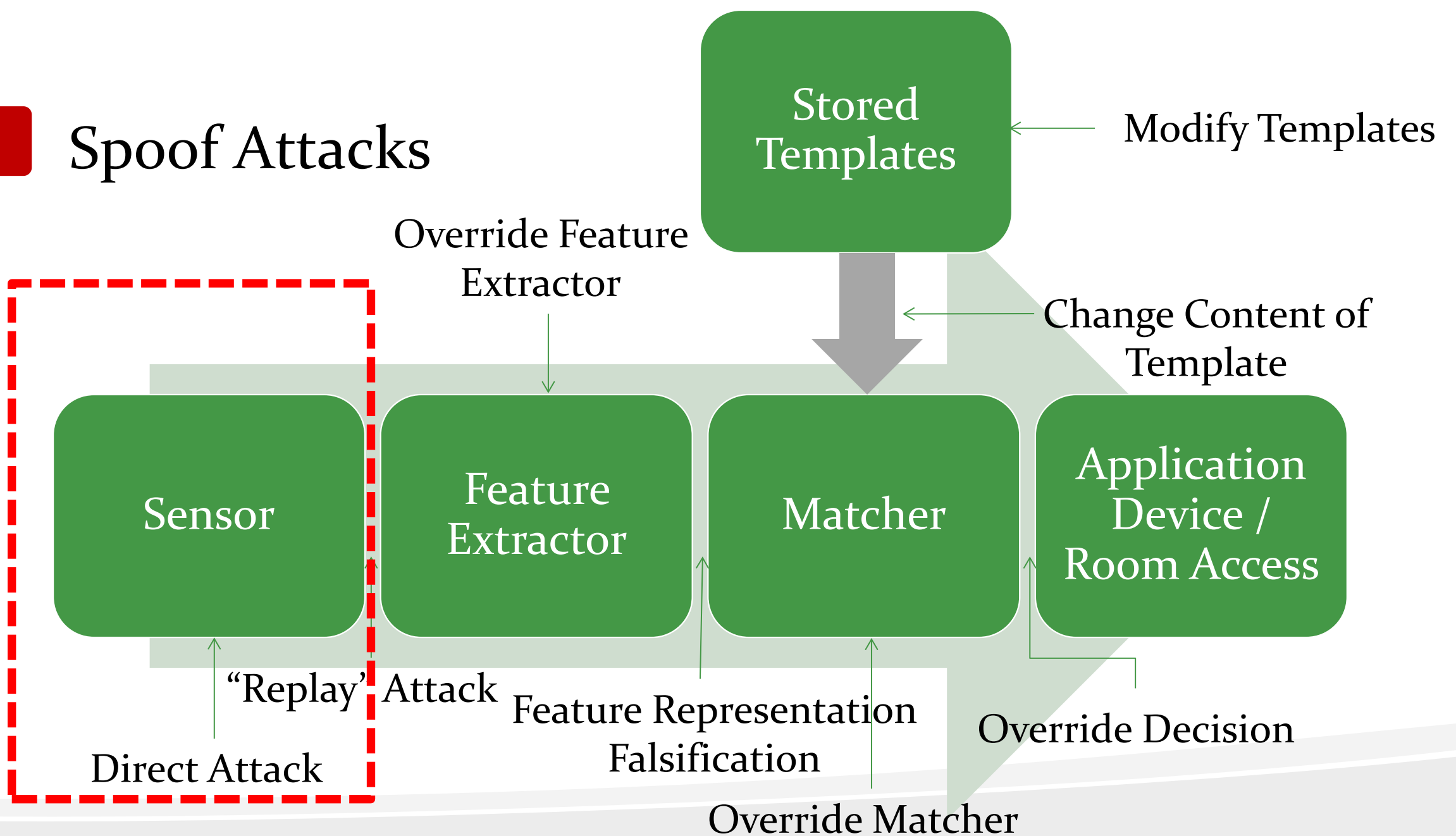
- CLARKSON
- NOTRE DAME
- WARSAW
- MobBIOfake
- BIOSEC



Part I – Liveness detection

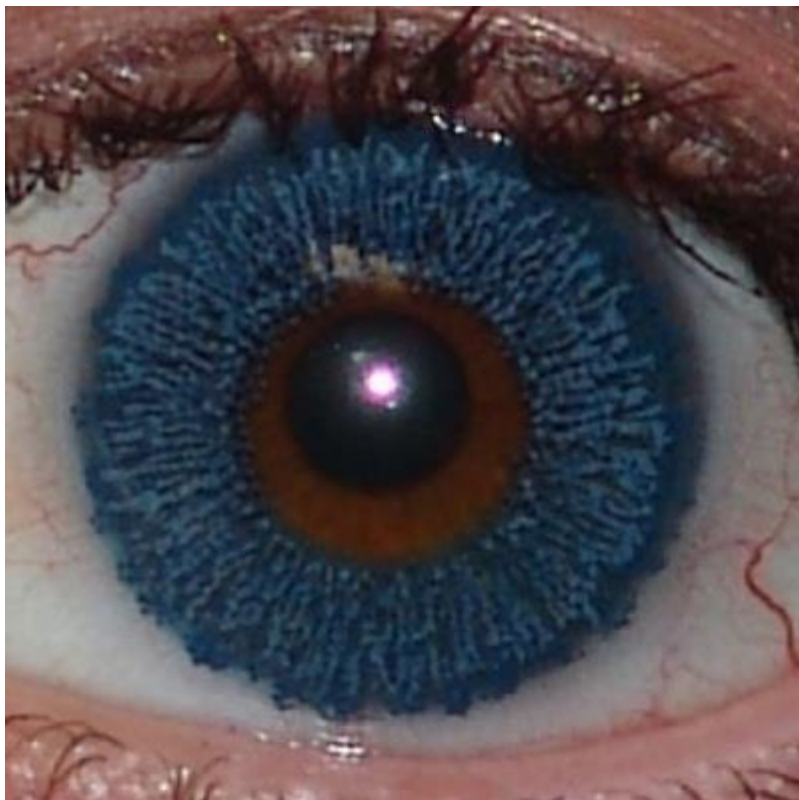


Spoof Attacks





Patterned Contact Lenses





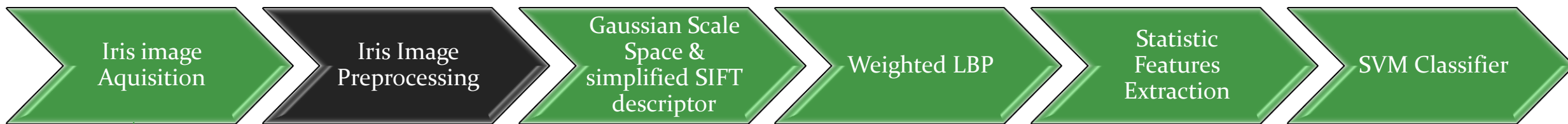
1st Method – weighted LBP

- “Contact lens detection based on weighted LBP” by Hui Zhang, Zhenan Sun and Tieniu Tan

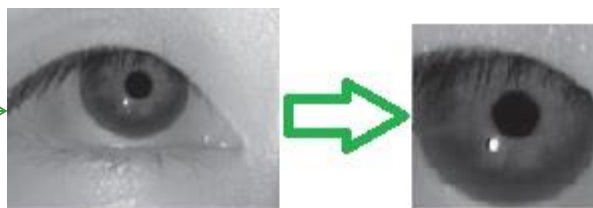


1st Method – weighted LBP

- “Contact lens detection based on weighted LBP” by Hui Zhang, Zhenan Sun and Tieniu Tan



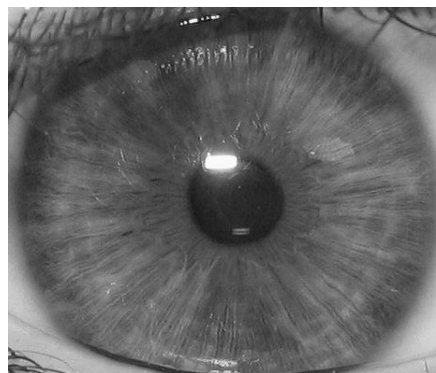
Segmentation



ROI
400 x 400

1st Method – weighted LBP

- “Contact lens detection based on weighted LBP” by Hui Zhang, Zhenan Sun and Tieniu Tan



6 levels



- . Pixel magnitude
- . Pixel orientation

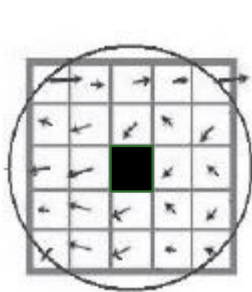


What do we want?

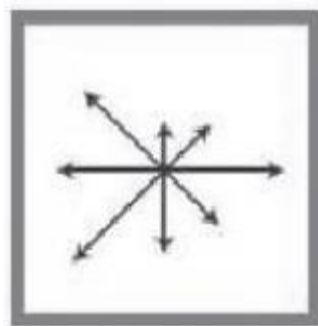
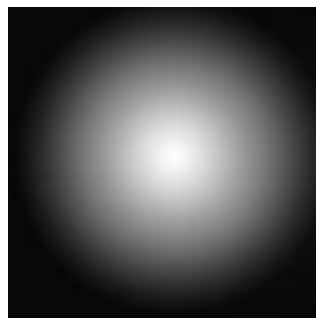
An orientation histogram for every pixel.

1st Method – weighted LBP

- “Contact lens detection based on weighted LBP” by Hui Zhang, Zhenan Sun and Tieniu Tan



Weighted Gaussian window



Orientation Histogram



1	6	2
5		4
0	3	7

Ranking

- . For every pixel
- . For every level



- . $400 \times 400 = 160000$ pixels
- . 6 level

1st Method – weighted LBP

- “Contact lens detection based on weighted LBP” by Hui Zhang, Zhenan Sun and Tieniu Tan



LBP – Local Binary Pattern

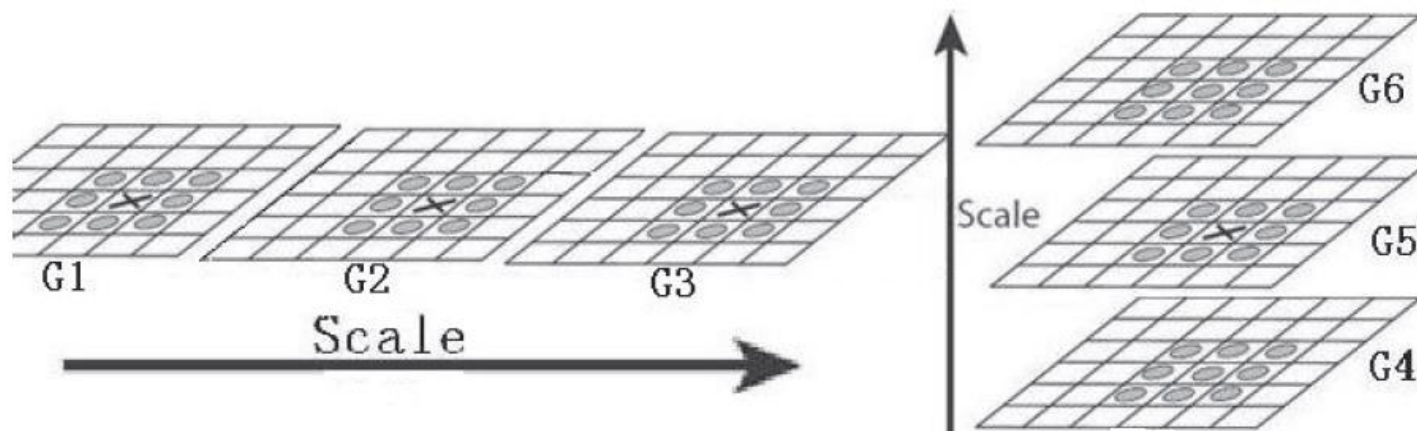


Comparison of 3x3 neighbors with center pixel

45	57	23	→	0	0	0
88	101	150		0		1
200	189	76		1	1	0

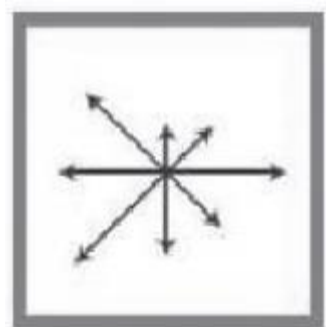
- G₁, G₂, G₃ – 3 LBP maps
- G₄, G₅, G₆ – 1 LBP map

= 4 LBP maps



1st Method – weighted LBP

- “Contact lens detection based on weighted LBP” by Hui Zhang, Zhenan Sun and Tieniu Tan



45	57	23
88	101	150
200	189	76



1	6	2
5		4
0	3	7



0	0	0
0		1
1	1	0



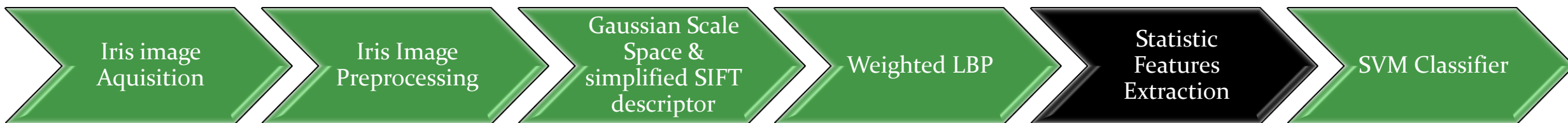
00011001 --> 25

Example of wLBP map

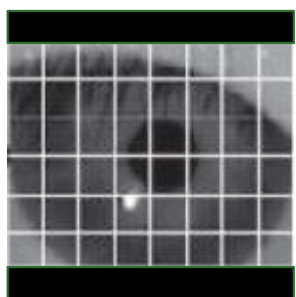
25	21	13	23
45	42	35	34
76	45	24	79
12	16	42	23

1st Method – weighted LBP

- “Contact lens detection based on weighted LBP” by Hui Zhang, Zhenan Sun and Tieniu Tan



Division of wLBP map in 8x8 partitions (each 50x50 pixels)



= 6x8 partitions

3 statistics extracted per block:

$$\bar{I}_{map} = \frac{1}{m \times n} \sum_{i,j} I_{map}(i, j)$$

$$\sigma_{map} = \sqrt{\frac{1}{m \times n} \sum_{i,j} (I_{map}(i, j) - \bar{I}_{map})^2}$$

$$\sigma_{hist} = \sqrt{\frac{1}{256} \sum_{i=0}^{255} (hist(i) - m \times n / 256)^2}$$

6x8 blocks
 x
 3 statistics
 x
 4 wLBP maps
 =
576
 dimensional
 feature

1st Method – weighted LBP

- “Contact lens detection based on weighted LBP” by Hui Zhang, Zhenan Sun and Tieniu Tan



- RBF kernel function

Preliminary Results:

Classification Error Rate		
Database	Mean	Std. Deviation
Clarkson	0.3602	0.025
NotreDame	Loading...	Loading...



2nd Method - GLCM

- “Counterfeit Iris Detection Based on Texture Analysis” by Zhuoshi Wei, Xianchao Qiu, Zhenan Sun and Tieniu Tan
- GLCM – Gray level co-occurrence matrices
- Up to 14 measures of textural features based on co-occurrence matrices
- Feature selection – 3 features !
 - Inverse difference moment
 - Sum average
 - Sum entropy

- . $p(i, j)$ is the co-occurrence matrix
- . N_g is the total grey levels

$$f_{idm} = \sum_i \sum_j \frac{1}{1 + (i - j)^2} p(i, j),$$

$$f_{sa} = \sum_{i=2}^{2N_g} i p_{x+y}(i),$$

$$f_{se} = - \sum_{i=2}^{2N_g} p_{x+y}(i) \log(p_{x+y}(i)),$$



What's next?

- Apply methods to other DBs
- Wrapper methods



Part II - Quality Assessment



Quality Assessment

- Important to broaden the applicability of Iris Recognition Systems
- Quality of image could affect the performance of the system (increase of FRR and FAR)
- Common properties:
 - Defocus blur
 - Motion blur
 - Occlusion
 - Off-Angle
 - ...



Future Work



Future work

- Choose Quality Assessment methods
- Implementation of the chosen methods
- Apply to DBs
- Analyze results and assess quality of those methods



Thank you ! Questions?