



Biometric Technologies and Behavioural Security

Tutorial 6 - Multimodal-Biometrics

Multimodal-Biometrics

Multiple
Sensors



Multiple
Biometrics



Multiple
Matcher



Multiple
Units





Multimodal-Biometrics

Pros

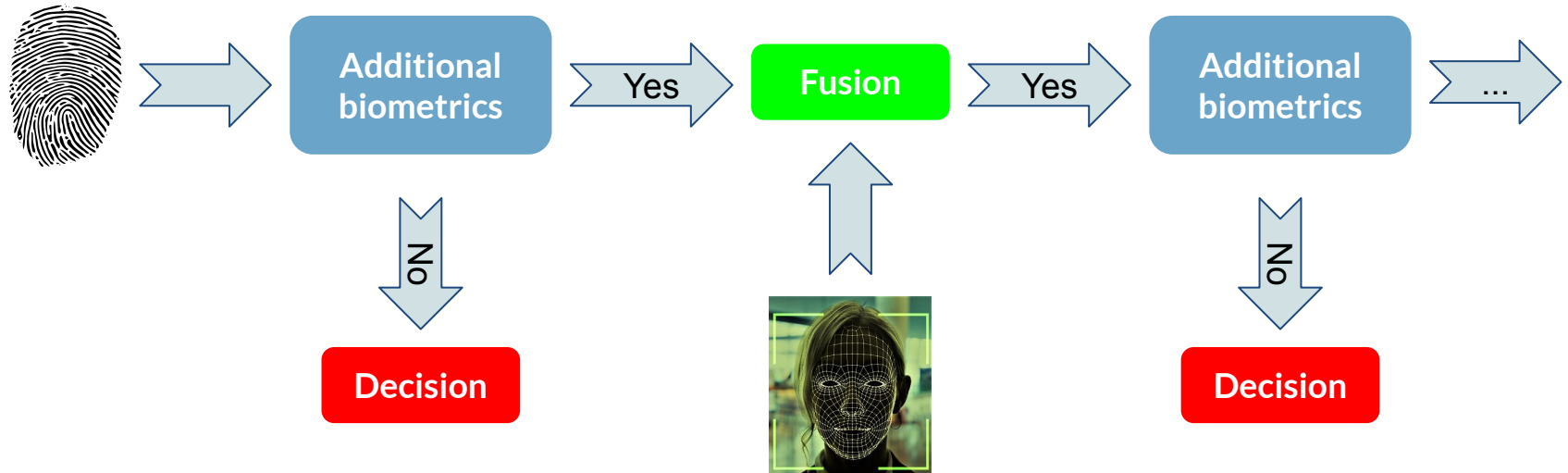
- Improve the accuracy of the biometric system
- Provide more resistance against spoofing

Cons

- Though time taken is larger than the Unimodal system
- Higher computing capacity

Multimodal-Biometrics

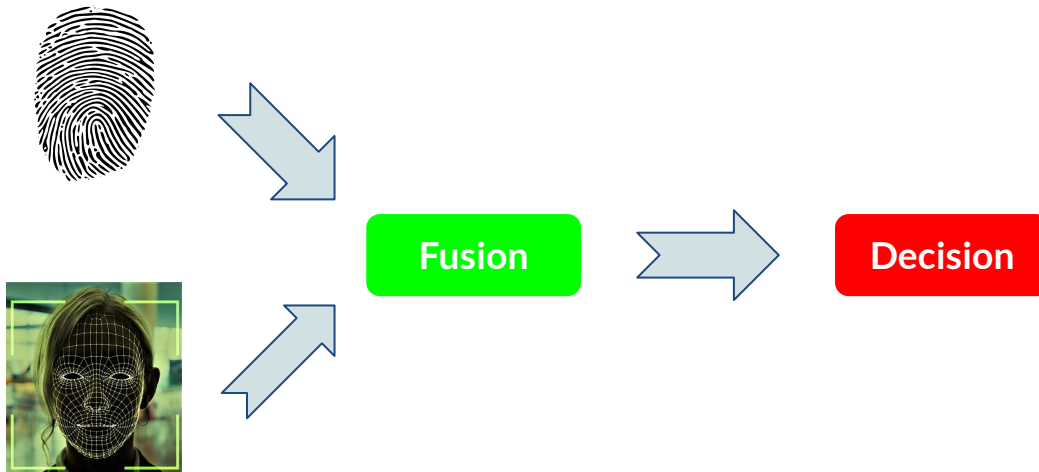
SERIAL ARCHITECTURE





Multimodal-Biometrics

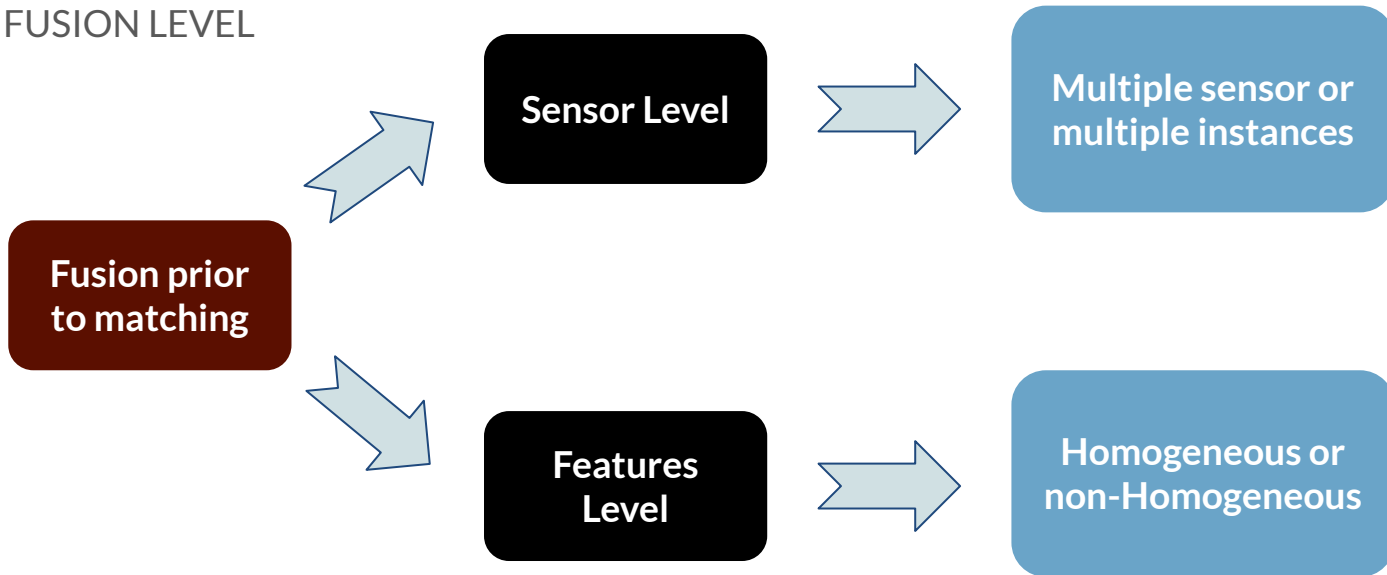
PARALLEL ARCHITECTURE





Multimodal-Biometrics

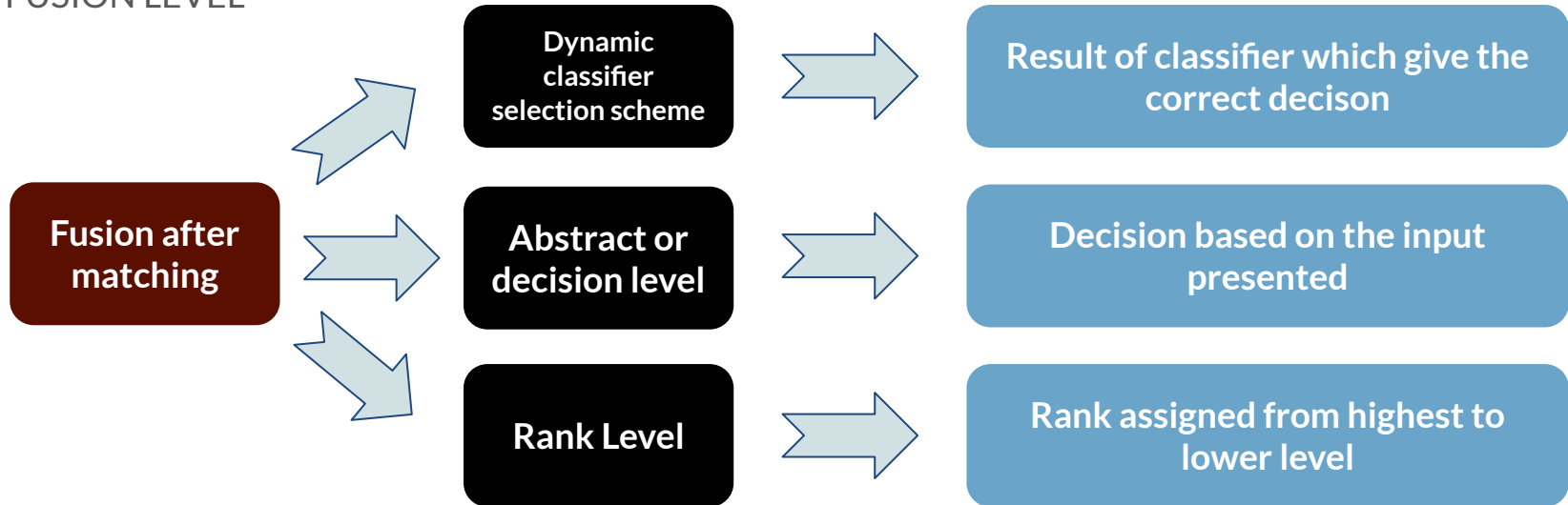
FUSION LEVEL





Multimodal-Biometrics

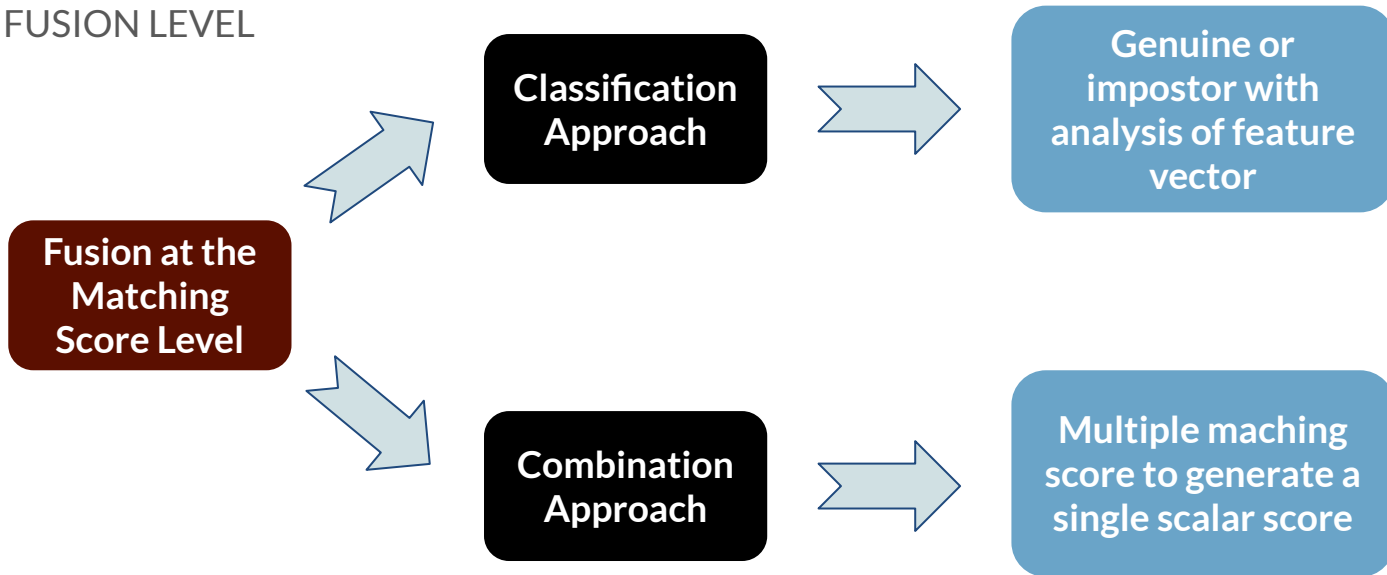
FUSION LEVEL





Multimodal-Biometrics

FUSION LEVEL





Multimodal-Biometrics - Score Normalization

Score output for individual matcher:

- Non-homogeneous: distance or similarity
- Ranges may be different
- Distribution may be different

To simplify the fusion:

- Modify the location and scale parameters of score distribution of individual matchers
- Apply transformation to scores present in the genuine-impostor overlap region

Multimodal-Biometrics -- Fusion

Simple Sum



$$f_i = \sum_{m=1}^M n_i^m, \forall i$$

Min Score



$$f_i = \min(n_i^1, n_i^2, \dots, n_i^M), \forall i$$

Max Score



$$f_i = \max(n_i^1, n_i^2, \dots, n_i^M), \forall i$$

Matcher
Weighting



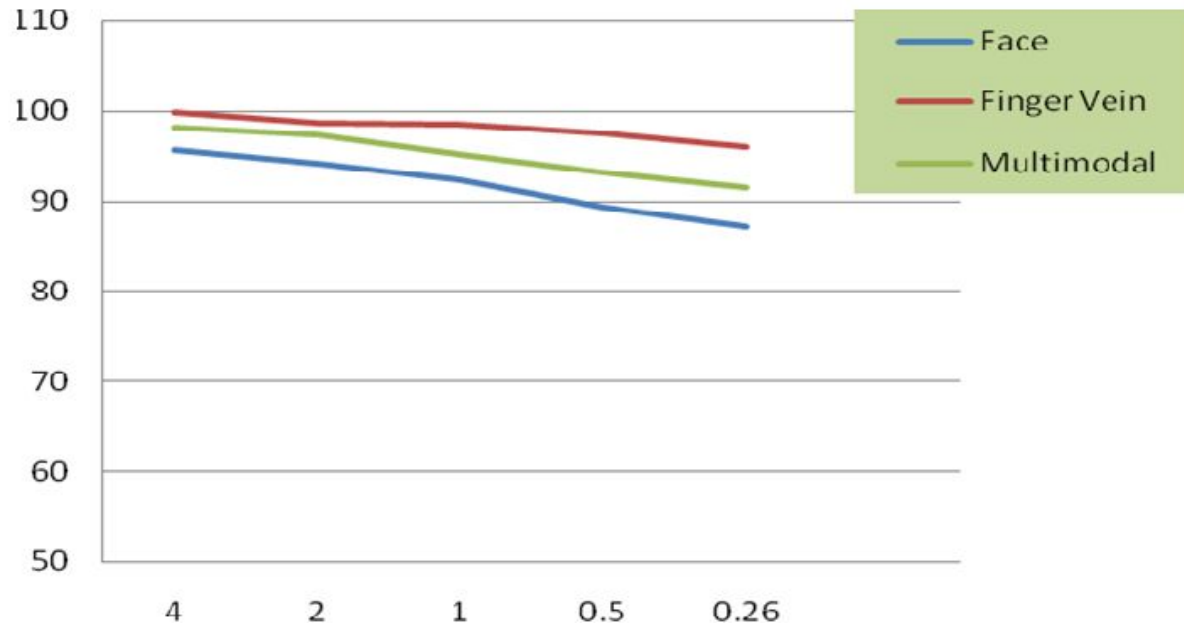
$$f_i = \sum_{m=1}^M w^m n_i^m, \forall i.$$

Multimodal-Biometrics -- Example

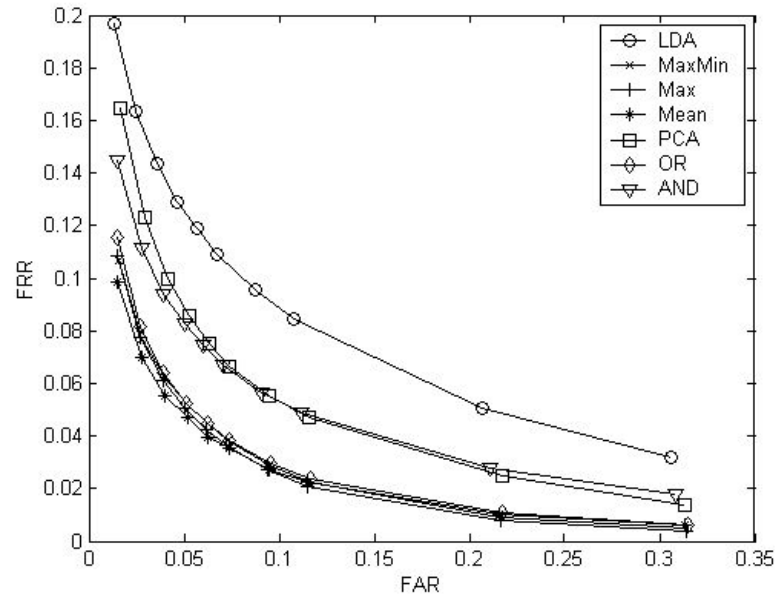




Multimodal-Biometrics -- Face vein/Face



Multimodal-Biometrics -- Results Fusion





Let's move to colab

Today tutorial: <https://bit.ly/Tutorial6 MM>

Solution : <https://bit.ly/Tutorial6Sol>