



FACULTY OF SCIENCE

ACADEMY FOR COMPUTER SCIENCE AND SOFTWARE ENGINEERING

MODULE	IT00207 BIOMETRICS
CAMPUS	AUCKLAND PARK CAMPUS (APK)
EXAM	NOVEMBER 2014

DATE 5/11/2014

SESSION 08:30-10:30

ASSESOR(S)

DR DT VAN DER HAAR

EXTERNAL MODERATOR

DR BL TAIT (UNISA)

DURATION 2 HOURS

MARKS 100

NUMBER OF PAGES: 4 PAGES

INSTRUCTIONS: ANSWER ALL THE QUESTIONS

REQUIREMENTS: AN EXAM BOOK FOR THE STUDENT

SECTION A - SHORT QUESTIONS

QUESTION 1

General Biometric Systems

- (a) With the aid of a **diagram** illustrate the components of a general **biometric** system that are required for it to function. [5]
- (b) Discuss the **difference** between a password, token and biometric characteristic when used as an **authenticator**. [3]
- (c) Provide two **benefits** that would promote the use of a biometric system. [2]

[10]

QUESTION 2

Fingerprint and Hand Geometry

- (a) Feature extraction within the context of fingerprint recognition is said to take place at three **levels**. Discuss what can be extracted at **each** of the levels in a biometric system. In your opinion, which of these levels is the most feasible for a fingerprint recognition system? [4]
- (b) Briefly describe four **types** of single finger flat **scanners** that are used in industry today. [4]

[8]

QUESTION 3

Face and Speaker Recognition

- (a) Discuss the **difference** between egocentric and ecocentric face recognition algorithms and provide one **example** for each of them. [4]
- (b) Briefly describe the three **characteristics** that **sound** exhibits. [3]
- (c) List three **advantages** that **both** speaker and face recognition-based systems share. [3]

[10]

QUESTION 4

Ocular Biometrics

Retina recognition-based biometric systems have been used in military environments for quite some time. One of the reasons behind this popularity can be attributed to the accuracy of the algorithms used to **process** captured retinal scans. Discuss the various **steps** required to capture and process a retinal scan. For each step in your discussion be sure to elaborate on the following aspects:

- A brief description of the steps followed to capture and process a sample.
- The algorithms used at each step (if necessary).
- The output of each step.

[8]

QUESTION 5

Behavioural Biometrics

- (a) Name three types of **distances** that can be used to measure between features in a keystroke dynamics system. [3]
- (b) List three **categories of gestures** that can be found in interactive gesture systems. [3]
- (c) Describe what one should consider when moving from a single authentication-based biometric system to a **continuous** biometric system. [2]

[8]

QUESTION 6

Multi-modal and Pervasive Systems

- (a) Discuss the three **types of fusion** that can be achieved in a multi-modal biometric system. [3]
- (b) Discuss five **advantages** of using **wearable** sensors/devices in a biometric system. [5]

[8]

QUESTION 7

Esoteric Biometric

- (a) Discuss **facial thermography** as a potential biometric attribute with regards to: [5]
 - 1. The sensor used
 - 2. Two advantages
 - 3. Two disadvantages
- (b) **Define** the following, along with their **role** in biometrics. [3]
 - 1. ECG
 - 2. EEG
 - 3. EMG

[8]

QUESTION 8

Large-Scale Systems

Discuss the steps one must follow when **considering** if a biometric system is viable on a **larger scale** with a bigger population.

[5]

SECTION B - LONG QUESTIONS

QUESTION 9

Vulnerabilities and Countermeasures

Draw an **attack tree** that highlights the **weaknesses** that will typically be found for a **iris** recognition system **AND** provide a discussion on two **reasons** why you would want to subvert a biometric system and two ways to **safeguard** against them.

[10]

QUESTION 10

Although there is a steady growth in biometric deployment across the world, there are still **privacy** concerns that users typically have that have been affecting the adoption of these systems. These biometric systems have also affected the **legal** and **standardisation** landscape for enabling the use of biometric systems. Discuss these 2 statements and supplement your discussion with the following:

- The privacy issues typically found in a biometric system.
- Discuss how the ECT, RICA, POPI and PAIA Acts impact biometric systems.
- Discuss the importance of standards when designing and deploying biometric systems.

[10]

QUESTION 11

A surge of wearable devices in today's market has awakened the opportunity of leveraging wearable computing within the domain of biometrics (especially in terms of liveness). Part of the challenge vendors have is to provide a robust working solution that accommodates a diverse population. Comprehensively discuss **liveness**, **user acceptance** and the **testing/evaluation** efforts that need to be realised in order for them to create an effective biometric product, by paying special attention to the following:

- The benefits of liveness in biometric systems.
- The metrics that should be used to evaluate biometric systems.
- The types of testing that would be required to ensure robustness.
- Doddington's taxonomy and user acceptance of biometric technologies.

[15]

— End of paper —