

SUMMER SCHOOL IN PEKING UNIVERSITY
SUBJECT DESCRIPTION

Subject title: Biometric Authentication: System and Application

Subject code:

Credit value: 2 credits

Pre-requisite: (Subject title and code no, if any)

Nil

Recommended background knowledge:

Nil

Mutual exclusions: Nil

Learning approach:

Lecture	28 hours
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Assessment:

Examination	100%
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Objectives:

- To understand the problems with current security systems.
 - To introduce biometric computing knowledge and methods.
 - To learn some basic biometrics systems based on the learned techniques.
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Keyword syllabus:

PART I: OVERVIEW

Introduction to Biometrics Authentication

What is biometrics authentication? Traditional methods for personal authentication. Some definitions of biometrics authentication technologies and systems. Software and hardware biometrics systems. Image processing and pattern recognition in living body, including human head & face, the mechanism of human eye, hand & skin characteristics.

Biometrics Sensors and Data Acquisition

Biometric data acquisition and database. How to design various biometric sensors and how to evaluate their system performance?

PART II: BIOMETRICS TECHNOLOGIES

Biometrics Pre-processing

The related biometrics preprocessing technologies, including: noise removing, edge sharpening, image restoration, image segmentation, pattern extraction and classification. etc.

Biometrics Feature Extraction

Basic elements in pattern recognition system, and some basic introduction of pattern recognition systems on biometrics (such as fingerprint, palm-print, finger, hand, face, iris, and face, as well as dental, DNA, and retina recognition).

Features Matching and Decision Making

Various matching methods, including PCA and LDA. Introduce decision theory and their examples.

PART III: TRADITIONAL BIOMETRICS

Design and Implementation of Biometric Systems

Basic approaches of automated biometrics identification and verification systems. Various performance comparison and their analysis for large population authentication, accuracy and reliability of authentication in an *e*-world. Various biometrics (Fingerprint, Face, Iris, Palmprint, Signature, Voice, etc.) and their fusion technologies are introduced in detail.

PART IV: ADVANCED BIOMETRICS

3D Biometrics and Multispectral Biometrics

Biometrics Fusion and Palmprint Recognition

Biometric Authentication Applications

Except various security applications, including access control, immigration and naturalization, military identification, banking, etc., some new applications, like medical biometrics and aesthetics biometrics, are also explored.

Indicative reading list and references:

- B. Zhang, Q. Zhao and D. Zhang, 2018, *Facial Multi-Characteristics and Applications*, 411pp, ISBN 978-981-3234-57-4, World Scientific/Higher Education Press.
- D. Zhang, G. Lu and L. Zhang, 2018, *Advanced Biometrics*, 335pp, ISBN 978-3-319-61544-8, Springer, Singapore.
- D. Zhang, Y. Xu and W. Zuo, 2016, *Discriminative Learning in Biometrics*, 266pp, ISBN 978-981-10-2055-1, Springer, Singapore.
- D. Zhang, F. Chen and Y. Xu, 2016, *Computer Models for Facial Beauty Analysis*, 268pp, ISBN 978-3-319-32596-5, Springer, USA.
- D. Zhang, Z. Guo and Y. Gong, 2015, *Multispectral Biometrics- Systems & Applications*, 229pp, ISBN 978-3-319-22484-8, Springer, UK.
- D. Zhang, W. Zuo and N. Li, 2015, *Medical Biometrics-Computerized TCM Data Analysis*, 363pp, ISBN 978-7-04-042883-4, World Scientific/Higher Education Press.
- D. Zhang and G. Lu 2014, *3D Biometrics- Technologies and Systems*, 290pp, ISBN 978-1-4614-7400-5. Springer, USA.
- D. Zhang, F. Song, Y. Xu and Z. Liang, 2008, *Advanced Pattern Recognition Technologies with Applications to Biometrics*, IGI Global, USA, 369pp, ISBN 978-1-60566.
- D. Zhang, X. Jing and J. Yang, 2005, *Biometric Images Discrimination (BID) Technologies*, IRM Press, USA, 357pp, ISBN 1-59140-831-8.
- D. Zhang, 2004, *Palmprint Authentication*, Kluwer Academic Publishers, USA, 241pp, ISBN 1-4020-8096-4.
- D. Zhang, 2000, *Automated Biometrics: Technologies & Systems*, Kluwer Academic Publishers, USA, 331pp, ISBN 0-7923-7856-3.