TÉCNICO LISBOA

Learning-based Multimedia Processing

Presentation

Prof. Paulo Lobato Correia

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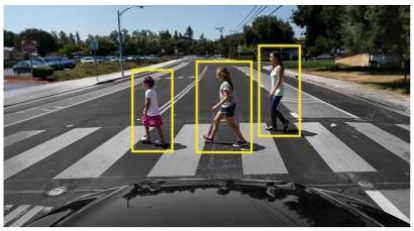
Outline

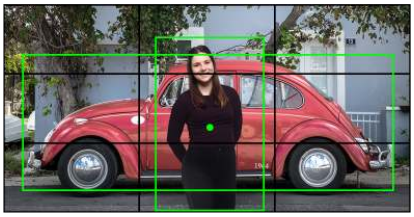
Presentation of
"Learning-based Multimedia Processing"

- Context;
- Focus on applications related to biometrics;

Planning:

- Classes;
- Lab;
- Bibliography;
- Evaluation;





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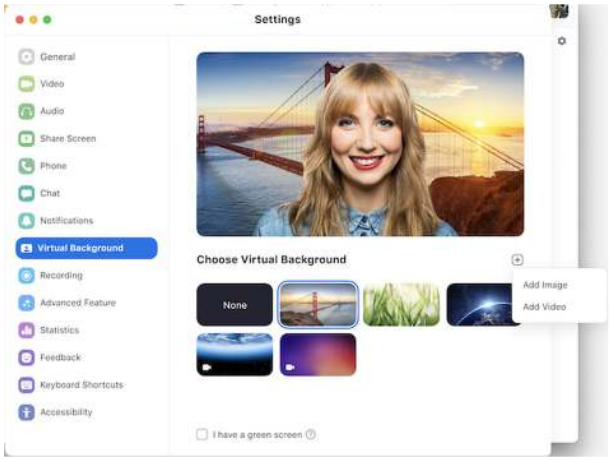
Context

Many applications and services use multimedia contents to increase their value and usefulness. Examples:

- Communications



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Context

Many applications and services use multimedia contents to increase their value and usefulness. Examples:

- Entertainment

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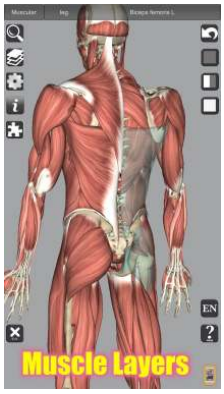
Context

Many applications and services use multimedia contents to increase their value and usefulness. Examples:

- Education



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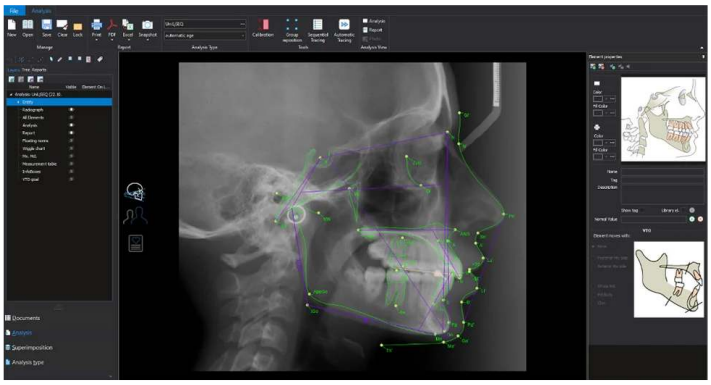
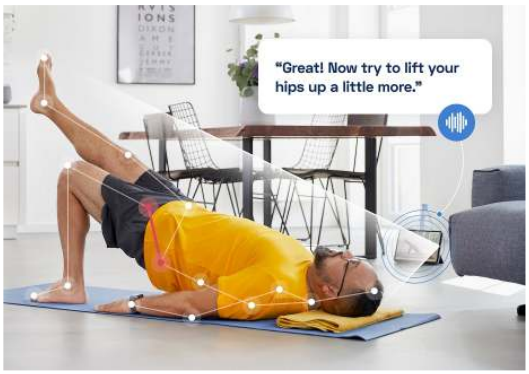
Context

Many applications and services use multimedia contents to increase their value and usefulness. Examples:

- Healthcare





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Context

Many applications and services use multimedia contents to increase their value and usefulness. Examples:

- Healthcare

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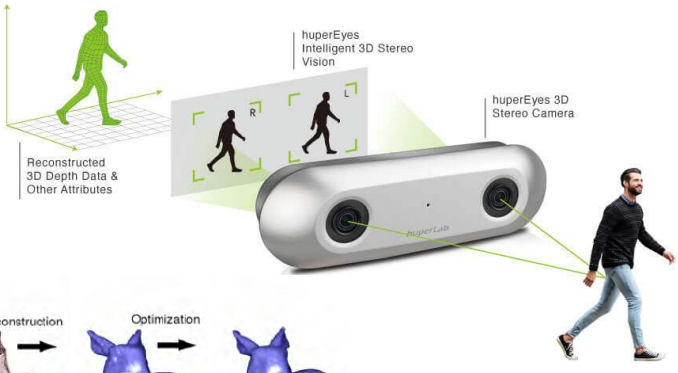
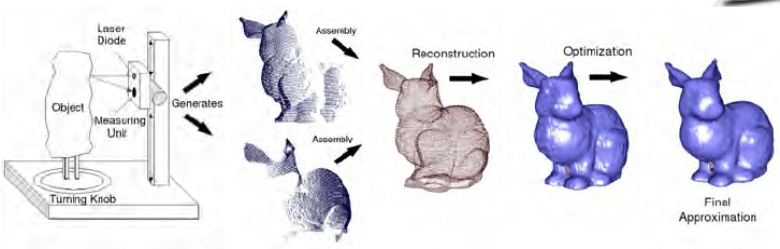
Context

Many applications and services use multimedia contents to increase their value and usefulness.

- 3D from stereo:



- Point cloud acquisition:



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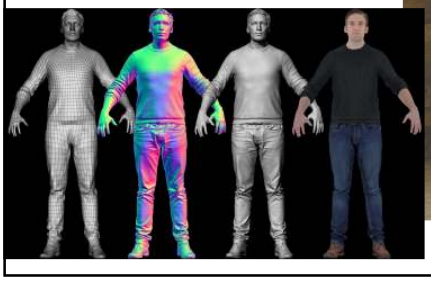
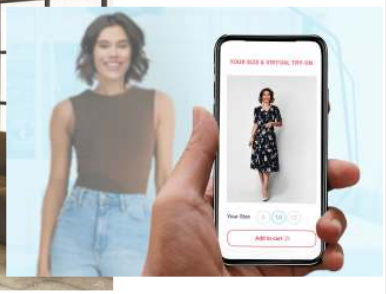
Context

Many applications and services use multimedia contents to increase their value and usefulness. Examples:

- Business





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LBMP – Who?

Student background

- MECD, MEEC, MEIC, MEFT, Erasmus, …
  - Machine learning? Deep learning?
  - Image, speech, … processing? Digital signal processing?

Expectations?

- Multimedia
  - Video, image, speech, audio, text
- Biometrics
  - Face, fingerprint, speech, …
- …

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Class Schedule

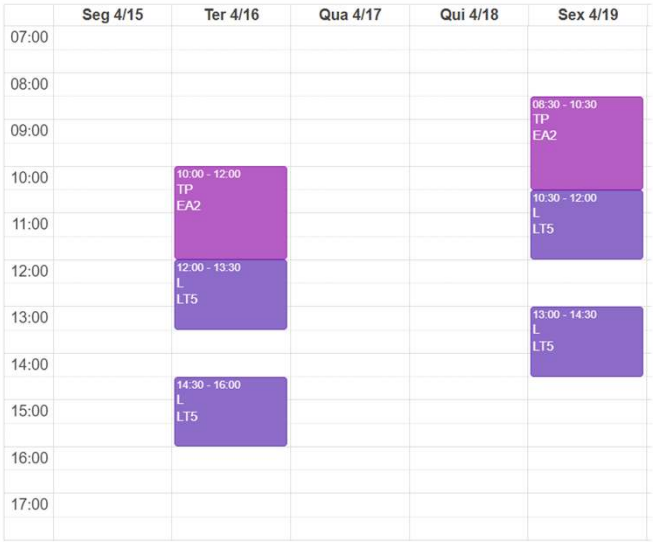
Theoretical-Practical (EA2 – North Tower):

- Tuesday 10:00-12:00
- Friday 8:30-10:30

(50+50 minutes each class)

Laboratorial (LT5 – North Tower):

- L1 – Tuesday 12:00-13:30
  Friday 10:30-12:00
- L2 – Tuesday 14:30-16:00
  Friday 13:00-14:30



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Syllabus

1. Introduction to Multimedia and to Biometrics (2 lectures)
2. Multimedia Processing (3 lectures)
3. Learning Basics and Tools (3 lectures)
4. Biometric Recognition (2 lectures)
5. Trust in Multimedia and Biometrics (1 lecture)
6. Other Biometric Applications, Challenges and Future trends (1 lecture)

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Lab Classes

Weekly planning:

1. Creation of groups; Environment setup;
   Python and OpenCV examples; **Project topic selection**
2. Project; Image representation and processing
3. Image processing tools; **Initial project presentation**
4. Project; Multimedia processing; Machine learning
5. Project; Deep learning
6. Project
7. **Project presentation and debate**

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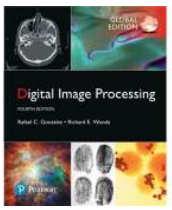
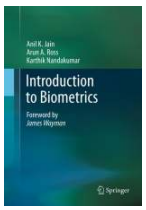
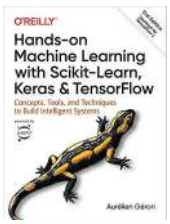
Bibliography

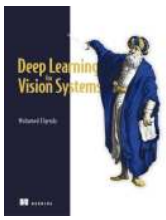
Books:

- [MC] *Multimedia Computing*, Gerald Friedland and Ramesh Jain, 2014. Cambridge University Press
- [DIP] ***Digital Image Processing***: Gonzalez and Woods", 4th Ed., 2018, Pearson
- [IB] ***Introduction to Biometrics***, Anil Jain, Arun A. Ross, Karthik Nandakumar, 2011. Springer.
- [ML] ***Hands-On Machine Learning*** *with Scikit-Learn, Keras, and TensorFlow*, Aurélien Géron, 2nd Edition, 2019, O'Reilly Media, Inc.
- [DL] ***Deep Learning for Vision Systems***, Mohamed Elgendy, 2020, Manning Publications
- [Py] *Python Data Science Handbook*, Jake Vanderplas, https://jakevdp.github.io/PythonDataScienceHandbook/







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Bibliography

1. Introduction to Multimedia and to Biometrics [MC, IB] (2 lectures)
2. Multimedia Processing [DIP] (3 lectures)
3. Learning Basics and Tools [ML, DL , Py] (3 lectures)
4. Biometric Recognition [IB] (2 lectures)
5. Trust in Multimedia and Biometrics (1 lecture)
6. Other Biometric Applications, Challenges and Future trends (1 lecture)



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Continuous Evaluation

Grading of students includes the following components:

- Continuous assessment in class (35%) – individual
  - 4 x 20 minutes short questionnaires – **in class** (foreseen for: 26/4, 7/5, 17/5, 24/5)
- Laboratory sessions (15%) – individual
  - 2 x short questionnaires, following the lab class work – **in class** (foreseen for: 30/4, 10/5)
- Project (50%) – group + individual
  - Topic selected by the students; includes presentations about the selected topic and the adopted strategy for implementation of a demo (presentations + code). Includes a peer evaluation component.

16/04/2024	
19/04/2024	
23/04/2024	
26/04/2024	Quiz
30/04/2024	Lab eval
03/05/2024	1st presentation
07/05/2024	Quiz
10/05/2024	Lab eval
14/05/2024	
17/05/2024	Quiz
21/05/2024	
24/05/2024	Quiz
28/05/2024	
31/05/2024	Presentation

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Exam Evaluation

Grading of students includes the following components:

- Exam (50%)
  - June 17, 2024, 10:30, 2 hours
- Project (50%)
  - Partly developed in class
  - Presented and discussed in class

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Project

- Group constitution (3 students): today's lab class (lab 1)
- **Selection of topic**: **April 19** (lab 2)
- **Initial presentation** (5 + 5 min): **May 3** (lab 6)
  - Send text + powerpoint by e-mail (paulo.lobato.correia@tecnico.ulisboa.pt) until **May 1**, 23:59
  - Text (PDF) – 2 page description
    (Title; Problem description; Why is the problem important; How is the problem addressed;
    System architecture and main modules; References)
    Template: https://www.ieee.org/conferences/publishing/templates.html
  - Powerpoint slides – 5 minute presentation
- **Final presentation** (10+3 + 10 min): May 31 (**last week**)
  - Send text, code, powerpoint + video (or links), by e-mail, until **May 27**, 23:59
  - Text (PDF) – 4 page description (include description of what was implemented)
  - Powerpoint slides – 10 minute presentation
  - 3 minute video
  - Peer evaluation (≥ 2 questions proposed - send by e-mail until **May 29**, 17:00)

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Project

Examples of possible project topics (check e.g.; https://keras.io/examples/):

- Audio, speech, touch, smell
- Image retrieval
- Gesture recognition
- Behaviour recognition
- Gait recognition, People Re-ID, Face detection and recognition, …
- Explainable biometric recogniton
- Face swapping and reenactment
- Face Beneath the Ink: Synthetic Data and Tattoo Removal with Application to Face Recognition
- Liveness detection
- Morphing attack detection
- Remote photoplethysmography for recognition
- Deep fake detection
- …

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Project

Project topics in 2021/2022:

- Detection and classification of fish
- Gesture recognition
- Face recognition explainability
- Document analysis
- Object detection and classification for sports
- Video-based stroke recovery assessment

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Project

Project topics in 2022/2023:

- Detecting Parkinson Disease Through Drawing Movements
- VisionGuide: Computer Vision for Path Planning in Assisting the Visually Impaired
- Lung Disease Detection using X-Ray Images
- Portuguese Sign Language Translation
- Detection and Ripeness Classification of Bananas Using Deep Learning Methods
- Learning-based Video Analysis for Optimizing Exercise Posture
- Combining Spectral Features and 2D CNNs for More Accurate Deepfake Detection
- Automated Diagnosis of Dental Diseases using AI
- Deep Learning for blood cells classification
- The Special One - Object Detection of Football Players to Enhance Performance Analysis

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Contacts

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