2SC7910 – 2D-3D image and sound analysis

Instructors: Catherine Soladie
Department: CAMPUS DE RENNES
Language of instruction: ANGLAIS
Campus: CAMPUS DE RENNES
Workload (HEE): 60
On-site hours (HPE): 34,50

Description

Sight, hearing, touch, smell and taste. It is through our 5 senses that we apprehend our environment and interact with it. In recent years, living beings are no longer the only ones who interact and understand the world around them. More and more powerful automatic image and sound analysis tools are created every day. Whether for autonomous driving, space, medical, the fields of application are multiple. And more recently, these techniques have gained new momentum with Deep Learning and generative models. It is now difficult to recognize a true picture of a fake picture And it becomes easy to make artificially but effectively say whatever you want to whoever you want.
In this module, you will discover an overview of analysis and synthesis techniques for 2D and 3D image and sound, through precise use cases. You will be the actors of the understanding and the artificial modification of your environment!

Quarter number

ST7

Prerequisites (in terms of CS courses)

Statistics et machine learning.
Signal processing
Computer science :

- Algorithms
- Programming langages

Syllabus

Background (5%)

- Introduction to the subject
- Historical context.
- Link with the subjects of the program.

Image Analysis (35%)

- Filtering: low-cut filter, high-pass filter, Canny filter
- Segmentation: waterShed, Split & merge, region growing

- Feature extraction: LBP, SIFT, HOG

Sound analysis (35%)

- Audio signals and time-frequency representation
- Speech production and modeling
- Spatial audio

Synthesis of image and sound (10%)

- 3D image synthesis: from basics to animation
- Stereoscopy

Personal study (15%)

- Choosing a subject
- Exploration and presentation

Class components (lecture, labs, etc.)

- Applied course : mixing theory and practice : 50% (30 HEE)
- Evaluation : 10% (6 HEE)
- Applied course reports, and personal study : 40% (24 HEE)

Grading

MCQ of theoretical knowledge: 1/3 of the note
Defense of the project of realization of an applied course : 1/3 of the note
Applied course content and justification: 1/3 of the note

Course support, bibliography

For audio, videos available online: https://www.animations.physics.unsw.edu.au/waves-sound/oscillations/index.html
For image synthesis: OpenGL Programming Guide

Resources

Teaching team:

- Catherine SOLADIE
- Renaud SEGUIER
- Simon LEGLAIVE
- PhD Students of AIMAC research team
- Externals

Software tools and number of licenses needed:

- Python libraries
- Anaconda and Jupyter Notebooks
- OpenGL

Learning outcomes covered on the course

By the end of the course, you will be able to :

- Cite many techniques for extracting audio and video characteristics (C2.1)
- Choose the relevant treatment for the analysis, understanding and synthesis of audio and video data (C6.1)
- Design, implement and validate a complete audio and / or video processing system (C2.1 et C6.1)
- Understand and explain new algorithms in image and sound processing (C7.4)

Description of the skills acquired at the end of the course

- C2 Jalon 2
  - C2.1 **Approfondissement** : Approfondir l'ensemble de ses connaissances sur un domaine choisi, via les enseignements de 2A
- C6 Jalon 2
  - C6.1 **Numérique :** Résoudre numériquement un problème
- C7 Jalon 2
  - C7.4 **Convaincre sur les techniques de communications** : Déployer avec succès des techniques de communication adaptées à la situation spécifique, parmi lesquelles : rhétorique, storytelling, langage corporel, occupation d'espace, respiration, mémoire, supports visuels, outils vidéos, distanciel, etc…