Audio and Visual Analytics

Academic Year: (2019 / 2020)   **Review date: 17/05/2019 14:43:14**

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: DIAZ DE MARIA, FERNANDO

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

OBJECTIVES

The main goal of this course is to provide the students with the theoretical and methodological knowledge about algorithms and methods for multimedia information indexing and retrieval.

At the end of the course the students are expected to have acquired (or progress in the acquisition -for transversal competences-) the following competences:

1. TRANSVERSAL/GENERAL COMPETENCES:
1.1 Personal work abilities.
1.2 Analysis and Synthesis abilities.
1.3 Abilities for applying theoretical concepts to practical uses.
1.4 Abilities related to team work and collaboration.
1.5 Abilities related to oral and written presentations.

2. SPECIFIC COMPETENCES:
2.1 To understand the fundamentals of audio-visual data analytics and its applications.
2.2 To understand the basics of speech, audio, image and video description and representation.
2.3 To understand audio-visual analytics methods and technologies.
2.4 To understand, design and implement multimedia indexing, retrieval, filtering and recommendation.

CB1, CB2
CG3, CG11
ETEGITT9, ETEGITT3

DESCRIPTION OF CONTENTS: PROGRAMME

The modern information overload problem caused by the availability of enormous amounts of information through internet makes it necessary to design systems that allow us to find the information we search and filter or personalize the information according to our needs. For that matter it is fundamental to be able to automatically index not only textual contents but also audio (music, speech, etc.) image or video, using methods based on the content or even collaborative tagging as the one taking place in social networks. Examples of these multimedia management systems are Google search (and all its variants as Google Image, Google Goggles, etc.), recommender systems and user profilers like those available in Amazon.

0. Overview of audio & visual analytics.
1. Speech, audio, image & video descriptors
2. Methods for audio & visual analytics
3. Multimedia Information Retrieval and Recommendation

LEARNING ACTIVITIES AND METHODOLOGY

Several types of learning activities are proposed: theoretical and practical lessons, lab assignments and final project.

Several methodologies will be adopted: theoretical lessons and problem-based learning (with different levels of supervision and guidance).

THEORETICAL LESSONS (2.5 ECTS)
Theoretical lessons provide an overview of the main theoretical and mathematical concepts together with explanations about the analytical tools employed for analysis of audio, imagen and video.

GUIDED LAB ASSIGNMENTS (1.75 ECTS)
Several guided lab assignments have been designed with the purpose of allowing the students to put into practice the mathematical tools explained in the theoretical lessons. The students will learn to use different audio and image analysis methods, such as audio clustering, face recognition and textual indexing, and learn to make sense of the results obtained.

FINAL PROJECT (1.75 ECTS)
The students will develop a simple image or audio (their choice) analysis system.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	30
% of continuous assessment (assigments, laboratory, practicals…):	70

The assessment will be composed of three parts:

30% Final Examination
30% Guided lab assignments: the students will fill in a questionnaire after each of the lab assignments.
40% Final Project: both the oral presentation and the materials provided will be assessed

BASIC BIBLIOGRAPHY

 - C. D. Manning, P. Raghavan and H. Schultze Introduction to Information Retrieval, MIT press, 2008

 - N. Morgan and B. Gold Speech and Audio Signal Processing: Processing and Perception of Speech and Music, John Wiley & Sons, Inc. New York, NY, USA, 1999

 - Rafael C. González and Richard E. Woods Digital Image Processing, Fourth Edition, Pearson, 2018

ADDITIONAL BIBLIOGRAPHY

 - Ricardo Baeza-Yates, Berthier Ribeiro-Neto Modern Information Retrieval: the concepts and technology behind search, 2nd Edition, Pearson, 2011

 - S. Theodoridis and K. Koutroumbas Pattern Recognition, 4th ed., Academic Press, 2008

 - Wilhelm Burger and Mark J. Burge Principles of Digital Image Processing: Fundamental Techniques, Springer-Verlag, 2009