Universidad Zaragoza

Academic Year/course: 2021/22

69724 - Scientific visualization and representation techniques

Syllabus Information

Academic Year: 2021/22
Subject: 69724 - Técnicas de visualización y representación científica
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 633 -
ECTS: 3.0
Year: 2 and 1
Semester: Second semester
Subject Type: Optional
Module:

1. General information

1.1. Aims of the course

The course has an strong applied character, and focuses on understanding of scientific foundations of Computer Graphics applied to the particular field of Scientific Data Visualization.

The problem of Scientific Data Visualization focuses on the transformation from magnitudes to images, in order to use the most powerful sense the human being has: vision.

The course and its intended results are based on the following approacches:

- Defining what is Data Visualization about.
- Introduce some needed bases of Conputer Graphics.
- Analyze the different structures of data representations, at topological and geometrical levels.
- Describe widely and with several examples the algorithmic bases of visualization.
- Apply those algorithms and techiques to multiple cases in the world of Biomedicine.

After passing the course, the student will be able to:

- Have a general view of the field of Data Visualization.
- Comprehend the mathematical models and algorithms implied in the process.
- Count on knowledge on both tools and methodologies.
- Choose or design software solutions to solve a given visualization problem.
- Transmit to any kind of public the acquired knowledge.

1.2. Context and importance of this course in the degree

There is no requirements on previous matters in the Master, that should be needed to follow this course.

2. Learning goals

2.2. Learning goals

After passing the course, the student will demonstrate the following results:

- Understand the logical structure of the information visualization techiniques from Computer Graphics
- Distinguish the most suitable solutions to visualize data of assorted types: scalar, vectorial, tensorial, etc.
- State adequate solutions to visualization problems for meshes with attributes of multiple types over space.
- Some experience on work in small groups, starting from an scenary (usually supplied by the teacher), modifying and adapting it to its own needs, with capacity to solve data visualization problems in Biomedicine.

2.3. Importance of learning goals

Nowadays, development of any Biomedicine related activity requires the use of software tools that allow visualizing data, either as results of an experimental analysis or as the outcomo of a computer simulation.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

Students should prove they have achived the planned learning objectives by means of the following evaluation activities:

E1: Final exam (30%)

Written exam, common for all students in the course. The test will consist of some theorical and practical questions.

E2: Lab work (30%)

Evaluation of the work will be based on the work itself, lab results and reports generated about the exercises in lab sessions, either at the lab or later.

E3: Tutored application work (40%)

Application work done by students as homework along the course. Evaluation of the work will be based on the work itself, results achieved, and proposed solution.

In order to pass the course, the students will need to have a minimum weighted average of 5/10, and at least a grade of 4/10 on each of the evaluation activities. If the grade of any of the activities is below 4, the maximum grade will be 4/10.

Any student that chooses not to to follow this evaluation procedure, or fails to pass those tests along the course time frame, o even that would like to ehance its marks on any activity, will be able to access a final global exam on each examinations convocatory available in the course.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives.

A wide range of teaching and learning tasks are implemented, such as lectures, student participation, computer lab sessions for data visualization, autonomous and continuous work, practical tasks and research assignments, usually related with the student's PhD work.

4.2. Learning tasks

The course includes the following learning tasks:

- **Lectures** (20h): The main course contents are presented and discussed, always using example problems related to Bio-Engineering. Student participation is encouraged.
- **Computer lab sessions** (10h): Lab sessions are carried out in between lectures, in the same classroom. The students develop the theoretical concepts with the use of computer applications specifically designed for data visualization. Students use their own computers/laptops with software supplied by the theacher. Only free or public sofware is used.
- **Practical assignment** (15h): Development of a practical assignment, more complex than the ones done lab sessions that students can solve individually or in pairs. It requires a written report and a public presentation.
- **Tutorials and personalized attention** (5h)**:** Students may ask any questions they have about unclear contents of the course, lab sessions or assignments.
- **Assessment tests** (5h)**:** The students will take an exam, and submit several reports derived from the computer lab sessions and from the practical assignment.
- **Self study and autonomous work** (20h): both for grounding of theoretical concepts as for preparation and final solving of lab session problems, if extra time is required.

4.3. Syllabus

The course will address the following blocks and topics:

Theory

- General intro to the problem of Scientific Data Visualization.
- Principles of Computer Graphics
- Basic data representation and modelling.

- Fundamental Data Visualization algorithms.
- Specialized data representation and advanced algorithms.
- Special needs for visualization in Biomedic Engineering.

Practice

- Three-dimensional data processing
- Interactive applications for scientific data visualization: Paraview
- Interactive applications for medical data visualization: 3DSlicer
- Intro to specific application development: VTK

4.4. Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the Master website (http://www.masterib.es).

Dates for submission and tracking of practical work will be detailed with enough anticipation both in lectures and on the course web page at the Unizar ADD, https://moodle.unizar.es/.

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=69724&Identificador=C73933