ACADEMIC PROGRAM

DATA VISUALIZATION

B.F.A. IN **COMPUTER SCIENCE**

MODALITY: ON CAMPUS

ACADEMIC YEAR: 2023-2024

Name of the course:	Data Visualization
Degree :	Computer Science
Location:	Centro Universitario de Tecnología y Arte Digital
Area:	Data Engineering
Year:	4º
Teaching period:	2
Type:	OBM
ECTS credits:	3
Teaching modality:	On campus
Language:	English
Lecturer / Email	-
Web page:	http://www.u-tad.com/

SUBJECT DESCRIPTION

Area description

The contents of the subject allow students to understand the flow of searching, ingesting, storing, processing and analyzing data information and brings students closer to the techniques and technologies necessary for managing large amounts of data.

Subject description

Visualization is an area of multidisciplinary knowledge between the field of communication, design and information processing, aimed at obtaining the greatest efficiency and effectiveness in the transmission of messages through images and requiring visual thinking and communication skills. computing resource management

Goals:

• That students know how to possess and understand the corresponding knowledge of the visual representation of data in a clear and functional way. That they know the references of data visualization and good practices.

• That students acquire skills in using tools in different technologies. That they learn to search for, reuse or improve open source solutions generated by others.

• That students develop a critical spirit by analyzing visualization works to highlight both their positive and negative aspects.

• That students learn to express themselves through visualization.

• That students know how to apply this knowledge to their activities in an effective, productive and professional way.

• That students conceive this knowledge as an initial base with a long learning journey, always seeking continuous improvement.

Learning will be carried out with examples using different tools and different approaches that allow comparing solutions.

COMPETENCIES AND LEARNING OUTCOMES

Competencies

BASIC AND GENERAL SKILLS

CG1 - Ability to understand, schedule and solve problems trough software development

CG3 - Knowledge of the scientific fundamentals applicable to the resolution of computer problems

CG4 - Ability to simplify and optimize computer systems by understanding their complexity

CG9 - Ability to learn, modify and develop new software solutions

CG10 -Use of creative techniques to carry out computer projects

CG11 - Ability to search, analyze and manage information for insights capture

BC1: Students should demonstrate knowledge in an area of study that builds upon the foundation of general secondary education and goest beyond at a level that, while supported by advanced textbooks, also encompasses certain aspects derived from the cutting edge of their field of study.

BC2: Students should be able to apply their knowledge to their work or vocation in a professional manner, and they should possess the competencies typically demonstrated through the development and defence of arguments as well as problem-solving within their field of study.

BC3: Students must possess the ability to gather and interpret relevant data (usually within their field of study) in order to make judgments that involve reflection on socially, scientifically, or ethically significant issues.

BC4: Students should be capable of conveying information, ideas, problems, and solutions to both specialized and non-specialized audiences.

BC5: Students should have developed the learning skills necessary to pursue further studies with a high degree of autonomy.

TRANSVERSAL SKILLS

CT1 - Knowledge of the definition, scope and implementation of the fundamentals of project management methodologies for technology projects

CT2 - Knowledge of the main sectorial players and the life cycle of a digital content development and commercialization project

CT4 -Ability to update the knowledge acquired in the management of digital tools and technologies according to the current state of affairs of the sector and the technological solution

CT5 -Development of the basic skills for digital entrepreneurship.

SPECIFIC SKILLS

CE3 - Knowledge of relational algebra and querying in procedural languages for the design of standardized database schemas based on entity-relationship models

CE10 - Ability to work with a release manager and generate application documentation automatically.

Learning outcomes

Upon completion of the degree, the graduate will be able to:

- To know and develop storage procedures and data management in distributed environments.

- To know and apply supervised, unsupervised and semisupervised learning techniques.

- To know and apply Deep Learning techniques

- To be able to retrieve information using web scraping or standard APIs

- To know and understand Natural Language Processing techniques

- To be able to analyze social networks contents.

- To understand the nature and representation of digital images.

- To know the applications of neural networks to the analysis and generation of sound, static images and video.

- To develop software solutions for computer vision.

- To develop a fully-fledged data project applying iterative methodology from design to delivery.

CONTENTS

Multidimensional data representation

Data labelling and visualization

Interactive graphs, algorithms for the analysis of agglomerates

SUBJECT SYLLABUS

• T1: Visualization theory

o M1.1: Visualization and state of the art.

 Brief history of visualization

 Use of visualization in international and national media

 Blogs, events and visualization projects

- Visualization gurus
- visualization tools

o M1.2: Introduction to visualization

- Types of visualizations
- Visualization process
- Good practices
- Bad practices
- Viewing environments

• T2: The color

o M2.1: Color theory

- Color definition
- Additive and subtractive synthesis
- Color classification
- The color wheel
- Color harmony
- Color schemes
- Gradients

o M2.2: Color and Data Display

- Psychology of color and cultural connotations
- Criteria in the use of color and Data Visualization
- Color management tools
- Color palettes for graphics.
- Vision alterations and color management tools
- Errors in the use of color
- Practical case: Excel-Google Sheets.

• T3: Visualize with R

o M3.1: R Fundamentals

- Introduction to R using the tidyverse suite (ggplot2)
- Data management in visualization

o M3.2: Tabulated data visualizations

o M3.3: Map visualizations / various API type sources

• T4: Visualize with Python

or M4.1. Python Fundamentals

 Introduction to Python using Pandas

 Data management in visualization

o M4.2: Tabulated data visualizations

 Matplotlib

 Pandas-Matplotlib integration

 Other libraries: Seaborn, Bokeh, Ploty, Dash

TRAINING ACTIVITIES AND TEACHING METHODOLOGIES

TRAINING ACTIVITIES

LEARNING ACTIVITIES	Total hours	Hours of presence
Theoretical / Expository classes	14,69	14,69
Practical classes	11,63	11,63
Tutorials	2,00	1,00
Independent study and autonomous work of the student	25,00	0,00
Elaboration of work (group or individual)	15,94	0,00
Evaluation Activities	2,63	2,63
Project Follow-Up	3,13	3,13
TOTAL	75	33,08

Teaching methodologies

Expository method or master lesson

Case learning

Learning based on problem solving

Project based learning

Cooperative or collaborative learning

inquiry learning

Flipped classroom methodology

Gamification

Just in time Teaching (JITT) or classroom on time

Expository method or master lesson

Case method

Learning based on problem solving

Project based learning

Cooperative or collaborative learning

inquiry learning

Flipped classroom methodology

Gamification

TEMPORAL DEVELOPMENT

719 / 5.000

Resultados de traducción

Resultado de traducción

DIDACTIC UNITS / TOPICS TIME PERIOD

T.1. Visualization theory

M1.1: Visualization and state of the art

M1.2: Introduction to visualization

Week 1 introduction Week 2 and 3

T2: The color

M2.1: Color theory

M2.2: Color and Data Display

Color Task (March)

Weeks 4 and 5

T3: Visualize with R

M3.1: R Fundamentals

M3.2: Tabulated data visualizations

M3.3: Map visualizations

Session to work in practice

Task R (April)

Weeks 6,7,8,9

Easter

April 3 to 10

T4: Visualize with Python

M4.1. Python Fundamentals

M4.2: Tabulated data visualizations

Session to work in practice

Task 4 (May)

Weeks 10,11,12,13,14

Review, practices and doubts

Week 15

EVALUATION SYSTEM

ASSESSMENT SYSTEM	MINIMUM SCORE RESPECT TO THE FINAL ASSESSMENT (%)	MAXIMUM SCORE RESPECT TO THE FINAL ASSESSMENT (%)
Assessment of participation in class, exercises or projects of the course	10	30
Assessment of assignments, projects, reports, memos	40	80
Objective test	10	60

GRADING CRITERIA

ASSESSMENT SYSTEM	ORDINARY EVALUATION	EXTRAORDINARY EVALUATION

Assessment of participation in class, exercises or projects of the course	10	10
Assessment of assignments, projects, reports, memos	50	50
Objective test	40	40

General comments on the evaluations/assessments

Participation (10%)

Assistance and questions to the teacher will be valued

Color Practice (10%)

Correct assimilation of the concepts seen in class.

Attractive infographic approach in relation to color and Data Visualization.

Interest and originality of the topic.

Correct use of graphics.

The execution of graphics will be highly valued in relation to possible problems in color visualization, for example, a type of color blindness.

R Practices (20%)

The choice of graphics, the use of color, attention to detail, clarity and visual communication will be valued.

Python practices (20%)

The choice of graphics, the use of color, attention to detail, clarity and visual communication will be valued.

Final exam (40%)

The choice of graphics, the use of color, attention to detail, clarity and visual communication will be valued.

• The qualification will be based on two types of deliveries or activities:

• Continuous evaluation tasks, structured in two blocks: one in the R environment and the other in Python

• Final exam that will consist of solving four visualization problems

• To pass the subject in the ordinary call, it is essential that both the grade of the activities to be delivered and that of the final exam be at least 5.0 (out of 10).

• If the student does not pass the ordinary session, he or she may take the extraordinary session in July, where they will take a new exam that will represent 100% of their grade in said session.

LIST OF REFERENCES (BOOKS, PUBLICATIONS, WEBSITES):

Basic Bibliography:

Cleveland, W. S. (1985). The elements of graphing data (Vol. 2). Monterey, CA: Wadsworth Advanced Books and Software.

Tufte, E. (1990). Envisioning information. Cheshire, CT: Graphics Press.

Tufte, E. (2001). The visual display of quantitative information, second edition. Cheshire, CT: Graphics Press

Wadsworth Advanced Books and Software.

Tufte, E. (1990). Envisioning information. Cheshire, CT: Graphics Press.

Tufte, E. (2001). The visual display of quantitative information, second edition. Cheshire, CT: Graphics Press

Books-Manuals R

• [in] R for Data Science

• [en] R for data science

• Data Visualization with R, Rob Kabacoff

• https://clauswilke.com/

• beautiful-plotting-in-r-a-ggplot2

• quick-reference color

• Dealing with colors in ggplot2

• Animate annotation layers with gganimat

• Highlight lines-1

• Highlight lines-2

Python manual books

• https://matplotlib.org/

• https://claudiovz.github.io/scipy-lecture-notes-ES/intro/matplotlib/matplotlib.html

• https://pandas.pydata.org/docs/user_guide/index.html

• https://seaborn.pydata.org/

Another resources

Blogs about visualization:

• https://datavisualization.ch/

• https://flowingdata.com/

REQUIRED MATERIALS, SOFTWARE AND TOOLS

Type of classroom

Theory classroom

Board and projection system

Materials:

Personal Computer

Software:

R 4.0 https://cran.r-project.org/

RStudio https://rstudio.com/products/rstudio/download/

Entorno Google colab https://colab.research.google.com/