

ISA

Geographic Information Systems 2026/2027

Lesson 01 - Welcome! Introduction.

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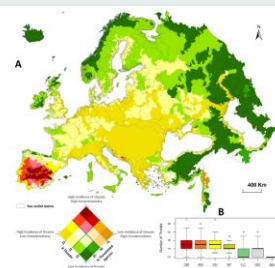
UNIVERSIDADE
DE LISBOA

INSTITUTO
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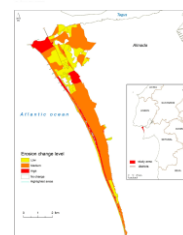
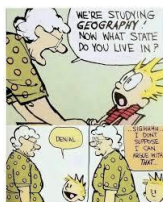
Who are we?



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Office hours for student support



Gonçalo Duarte

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Monday, 10h45am to 11h45am

- In person (Forestry Building, room 2.13) or via Zoom (link)
- Necessary to book in advance via email

Angeliki Peponi

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To be determined

- In person at the Forestry Building, room 2.13
- Necessary to book in advance via email

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Who are you?



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What is GIS?

A Geographic Information System (GIS) is a computer-based system to **aid in the collection, maintenance, storage, analysis, output and distribution of spatial data and information.**

Geographic Information Systems are composed of

 hardware, software and procedures,

created for

 storage, management, processing, analysis, modelling and visualization of data located in space

in order to solve complex problems which require **spatial operations.**

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Goals of the course

Learn how spatial data collection, geographic reality modelling and spatial data analysis is done.

Main goals:

- Understand the basic principles of Geographic Information Science using a GIS tool;
- Become familiar with the use of GIS software
- Prepare yourself to solve problems using GIS.

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Overview of the course



1. Data storage

- a. Non spatial data
 - i. Structure – geographic themes
 - ii. Implementation – relational database design and query
- b. Spatial data
 - i. Coordinate Reference Systems
 - ii. Vector data structures
 - iii. Raster data structures
- c. Digital maps and visualisation

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Overview of the course



2. Spatial problem solving

- a. Modelling
 - i. Process modelling – communication and documentation
 - ii. Spatial data modelling (2D and 3D)
- b. Spatial Analysis
 - i. Vector data analysis
 - ii. Raster data analysis
 - iii. Vector to raster and raster to vector conversion

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Overview of the course



3. Editing data

4. Spatial data sources

References:

- class slides
- Paul Longley, Michael Goodchild, David Maguire and David Rhind, Geographic Information Systems and Science, 4th edition (2015)Wiley.

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Overview of the course



Visit the [course page](#) at ISA website for more information

Continuously updated to provide all the contents

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Evaluation

Practical component (45%):

- 2 Individual assignments (5% + 5%)
- 1 Group Assignment (2 people) (35%)
 - GIS project
 - Report
 - Pdf files with diagrams
 - Minimum grade: 10

Mandatory

Theoretical component (55%):

- Test
- OR Minimum grade: 8
- Exam

Questions?

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What is GIS?

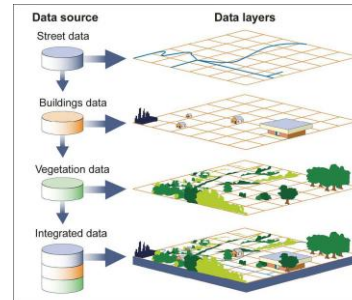
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Ask chat GPT

Go to <https://chat.openai.com/chat>
and ask what is a GIS

Or go to National Geographic and
see examples

<https://education.nationalgeographic.org/resource/geographic-information-system-gis/>



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What is GIS?

GEOGRAPHIC INFORMATION SYSTEMS COMPONENTS AND APPLICATIONS

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Components

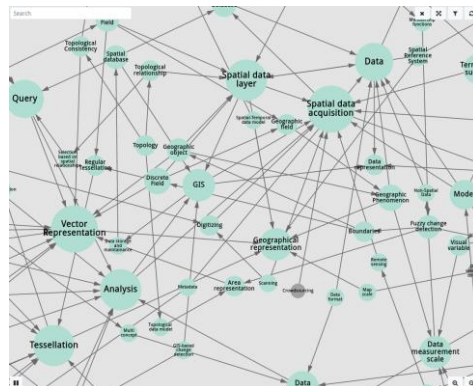
- Multidisciplinary
- Technology
- Applications
- Data
- Human resources

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Concept map

Representation of concepts and relationships

<https://ltb.itc.utwente.nl/page/498/dashboard>



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MULTIDISCIPLINARY

- Geography
- Geodesy
- Topography
- Geographic Engineering
- Geometry
- Mathematics
- Software Engineering
- Photogrammetry
- Remote Sensing
- Geostatistics
- Networks and Graphs
- Optimization
- Agronomic Engineering
- Forest Engineering
- Civil Engineering
- Territory Planning and Management
- Environment Control
- Mining Engineering
- Oceanography
- ...

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TECHNOLOGY

Presently, technology allows

- efficiency
 - prototyping
 - local and regional GIS developed to support well-defined problems
 - organizational GIS developed to support all activities carried out by different institutions

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TECHNOLOGY

Presently, technology allows

- efficiency
 - prototyping
 - local and regional GIS developed to support well-defined problems
 - organizational GIS developed to support all activities carried out by different institutions
- all scales
- solving problems concerning regions of any dimension
- the integration of unlimited geographic themes
- different computer architectures (different operating systems, networks, cloud, ...)
- users with different backgrounds

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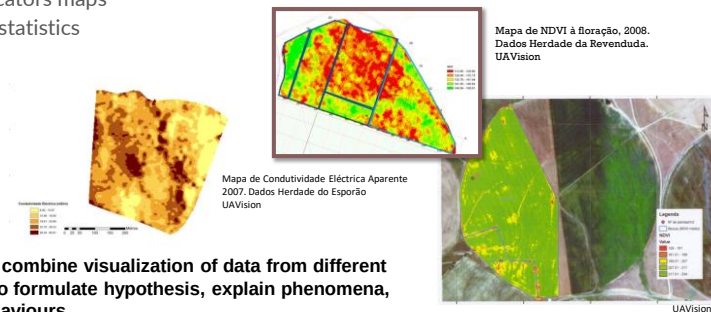
APPLICATIONS: DATA REPOSITORIES

- Property, agriculture, forest cadastres
- Hydrology
- Climate
- Soils
- Biodiversity
- Environmental indicators
- Oceanography
- ...

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APPLICATIONS: DECISION SUPPORT

- Monitorization with field sensors
- Remote sensing (airplanes and satellites)
- Indicators maps
- Geostatistics

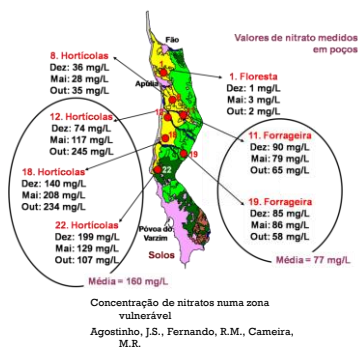


Integration and combine visualization of data from different sources allow to formulate hypothesis, explain phenomena, and predict behaviours

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APPLICATIONS: MODELS

- Water Management
- Automatic watering
- Forest management
- Environmental control
- Diagnosis
- Prediction
- ...



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PRIMARY DATA

Official sources

- Topographic data
- Hydrological data
- Statistical data
- Roads network
- Climatic data
- ...

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DATA COLLECTION

- Fieldwork
 - using GPS or classic methods
 - laboratory analysis
 - observation
 - ...
- Advanced methods
 - Field sensors
 - Aerial imagery
 - Radars
 - Satellites
 - Lidar - Light Detection and Ranging

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HUMAN RESOURCES



Different levels of competence

- short/medium courses
- professional courses
- subjects in undergraduate and graduate courses
- postgraduate studies
- masters

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Credits



The structure and content of the course, including most of the slides and exercises were developed by Professor Graça Abrantes (SIG 2021_2022) and Professor Rui Figueira (SIG 2023_2024)

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