Department of Geography
at the University of Wisconsin – Madison

USGS
science for a changing world

UN-GGIM
GEOSPATIAL SOCIETIES

IGU
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UNIL | Université de Lausanne
Faculté des géosciences
et de l'environnement

GEO-AI Working Group 4 – BoK

Body of Knowledge

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Issues in defining a Body of knowledge in GEO-AI

In parallel with the Syllabus on GEO-AI (Working groups 1 to 3)

Supporting the GEO-AI initiative trainings

- Corresponding vocabulary
- Adapted to different levels and pathways

Up to date vocabulary

Online system enabling easy contributions and access

Main issues

⇒ **Knowledge area**

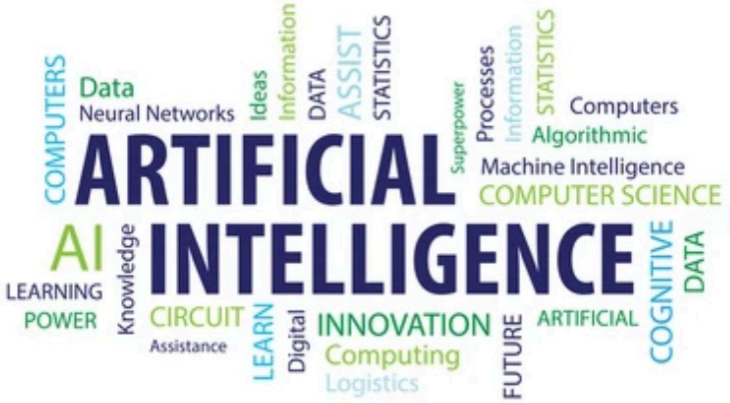
⇒ **Coordination** with existing BoK on Geographic Information Science

⇒ **Practical tools** to support users (trainers, trainees, private sector)

GEO-AI - Knowledge Area

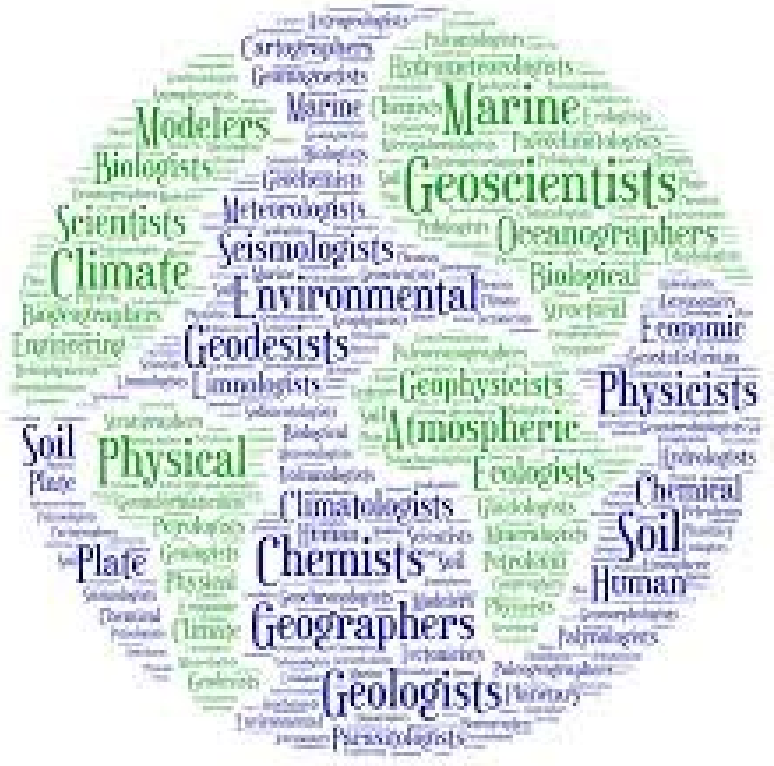
At the intersection between

- Geoscience & GIS
- AI



Main categories

- Geospatial Machine Learning and Deep Learning
- Generative GEO-AI Models
- Geospatial Knowledge Graphs
- Geospatial Data and ML Stewardship



GEO-AI - Knowledge Area

Geospatial ML & DL

- Spatially Explicit ML Models
- Spatial Neural Network Regression
- Geographically and Temporally Weighted Neural Networks
- Multi-Modal Spatial Contrastive Representation Learning
- …

Geo-Knowledge Graphs

- Geo-Knowledge Graphs
- KG-Based Spatial Reasoning
- Uni- Multi-partite Graphs
- Multiplex Graphs (multi-modal)
- …

Generative GEO-AI

- Generative Pre-trained Transformers
- Diffusion Models for Maps and Satellite Imagery Generation
- Geo-Foundation Models
- Geo-Prompt Engineering
- …

Stewardship

- FAIR Geodata and codes
- Open Geodata and codes
- Ethics for Geodata and codes
- Understanding and developing trust
- …

To coordinate with existing GIS BoKs?

Coordination with existing BoK projects

1. GIS & T Body of Knowledge : USA University Consortium for Geographic Information Science - UCGIS
https://gistbok-topics.ucgis.org/UCGIS

USA consortium contacts
Diana Sinton, UCGIS

UCGIS (1994-…): First edition 2006
- Professional hub for the academic GIS community in the United States
- full collection of 350+ Topics appears in its hierarchical structure

2. EO4GEO to SPACE4GEO Body of Knowledge : European consortium to empower space data users
https://bok.eo4geo.eu/GIST

EO4GEO (2018-2022): EU supporting Erasmus+ action for Sector Skills Alliance
- 25 partners and 50 associates from 22 countries.
- set of tools based on a shared ontology, a training and education offer
- bridge the skills gap between the supply and demand of education and training in the space geoinformation sectors

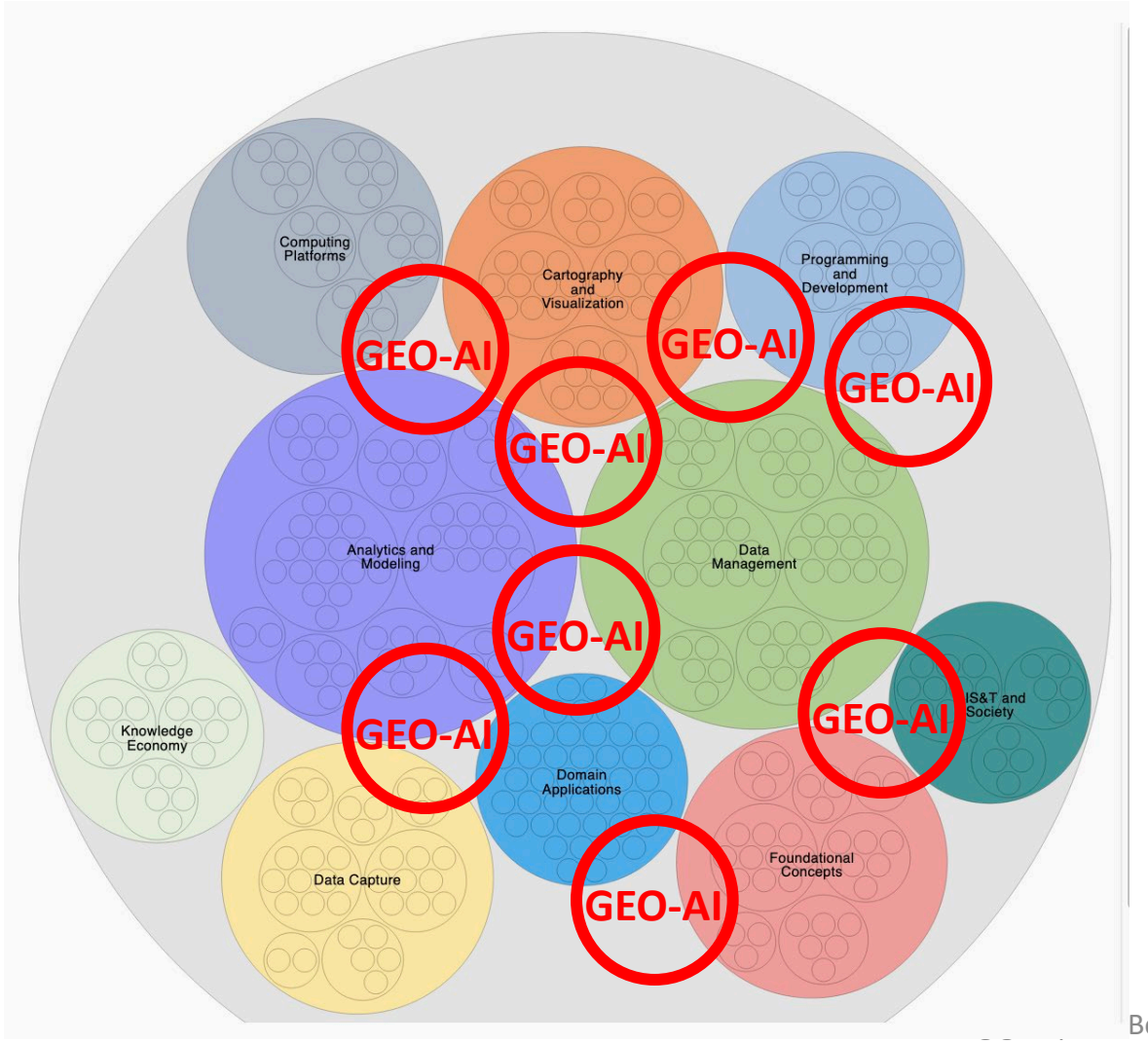
SPACE4GEO Alliance (2023-…) European Union Commission DG EMPL and DG DEFIS
- Leveraging on the results of EO4GE
- large-scale Skills Partnership for space data, services and applications

European consortium contacts
Sven Casteleyn (Spain, Univ. Castellon)
Rob Lemmens (Netherlands, Univ. Twente)

Nested structure (RDF - SKOS)

UC-GIS project GIS & T Body of Knowledge

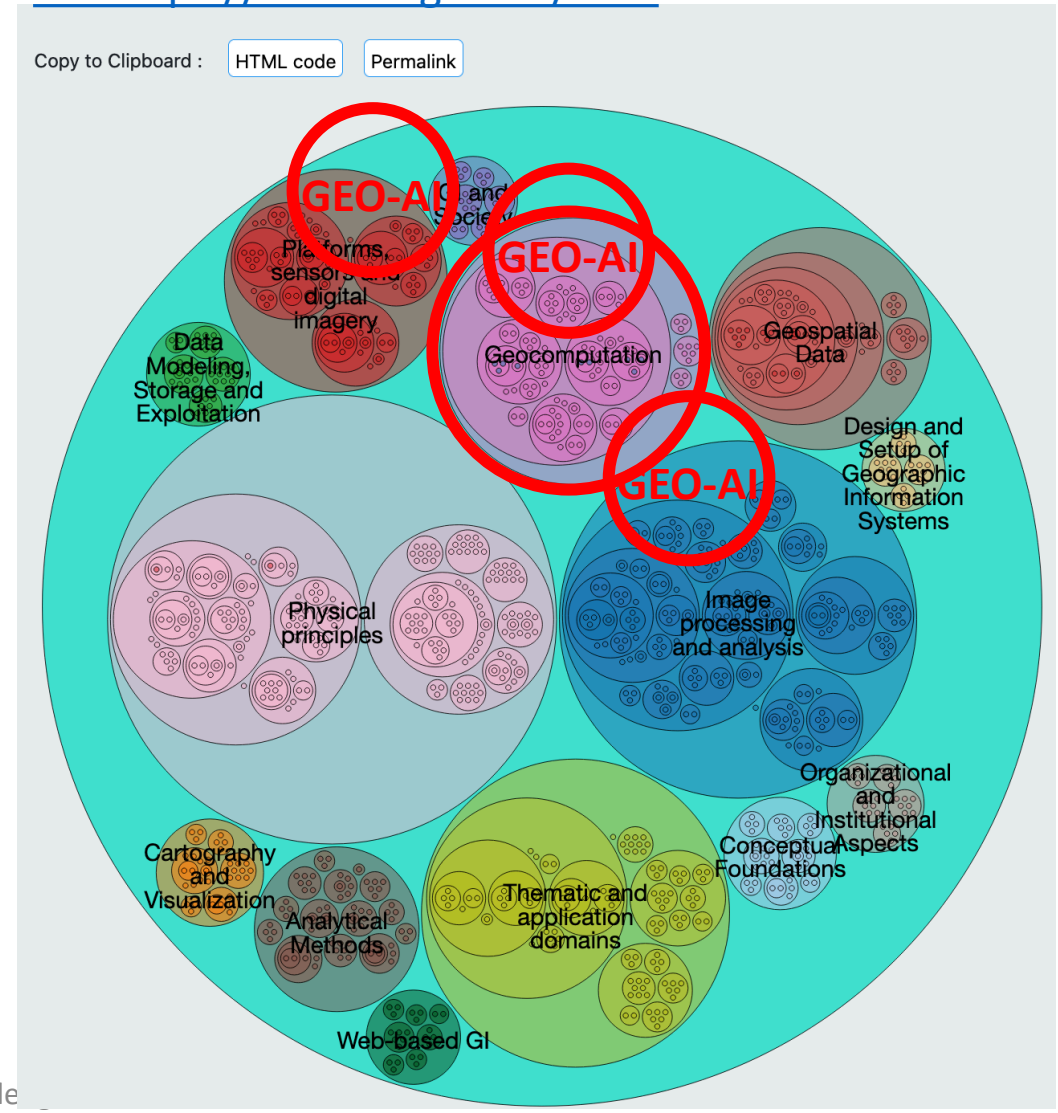
https://gistbok-topics.ucgis.org/UCGIS



Body of Knowle

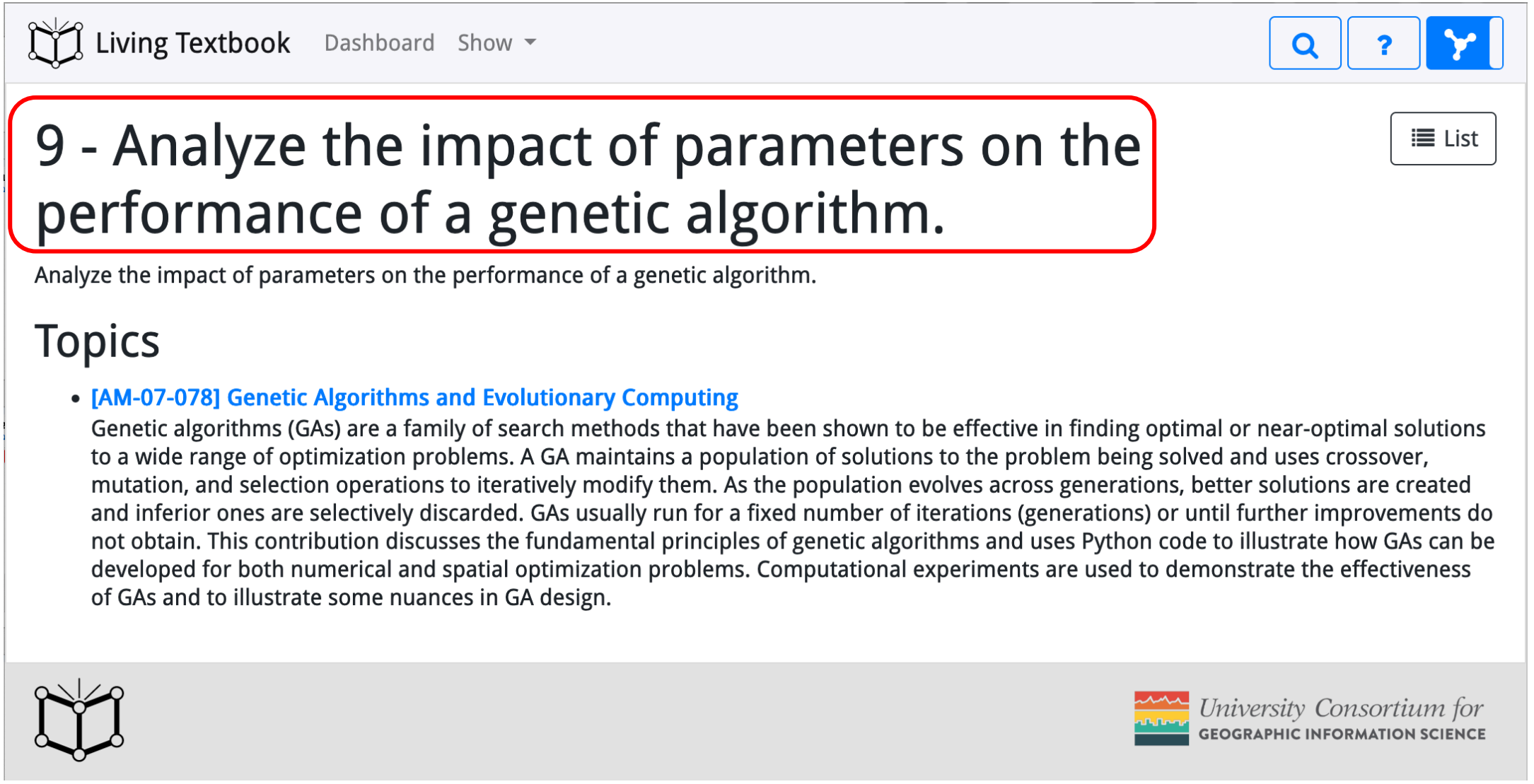
SPACE4GEO Body of Knowledge :

EU: https://bok.eo4geo.eu/GIST



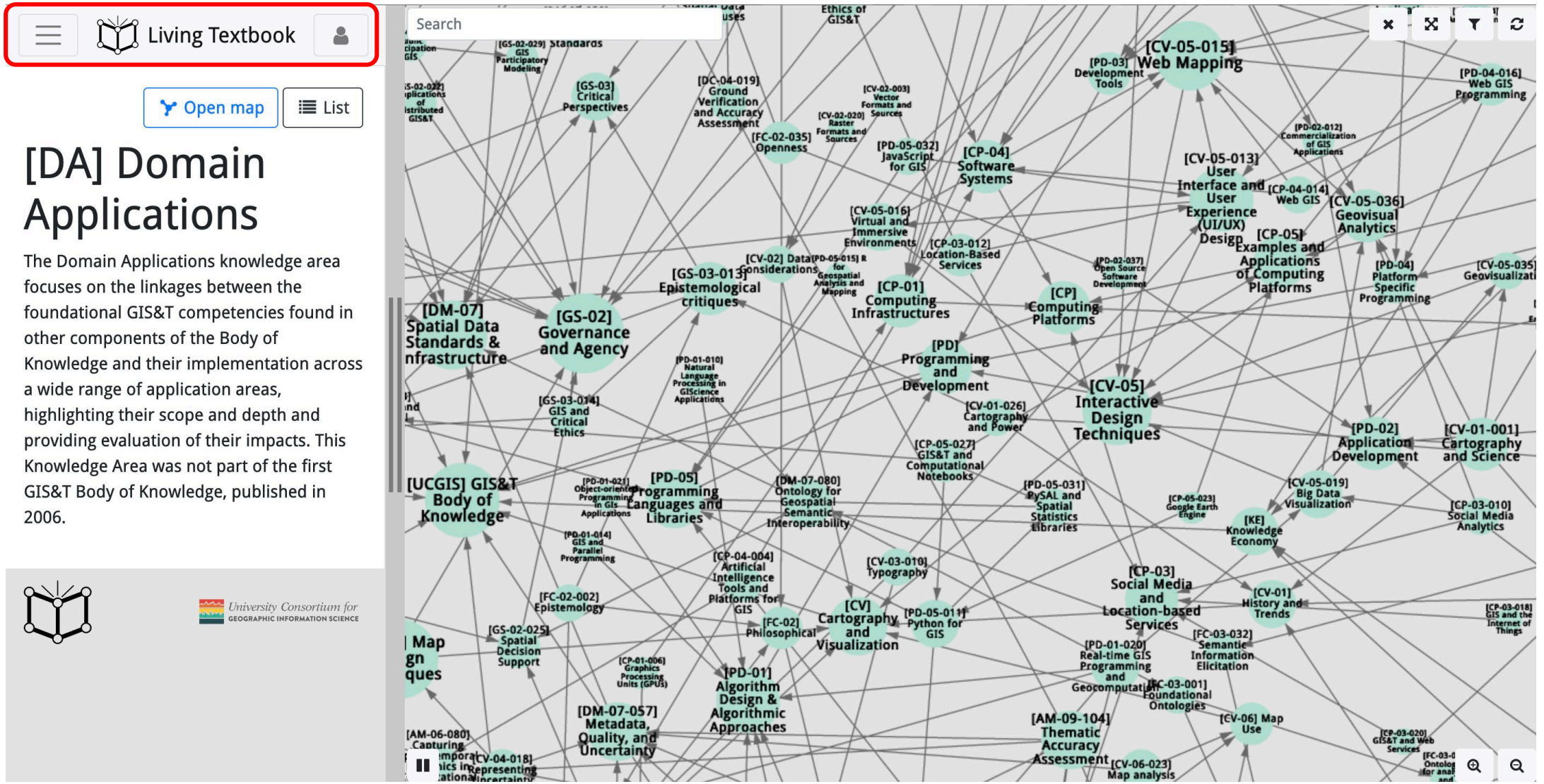
1.2 Tool of UC-GIS project GIS & T – Learning outcomes

https://gistbok-ltb.ucgis.org/



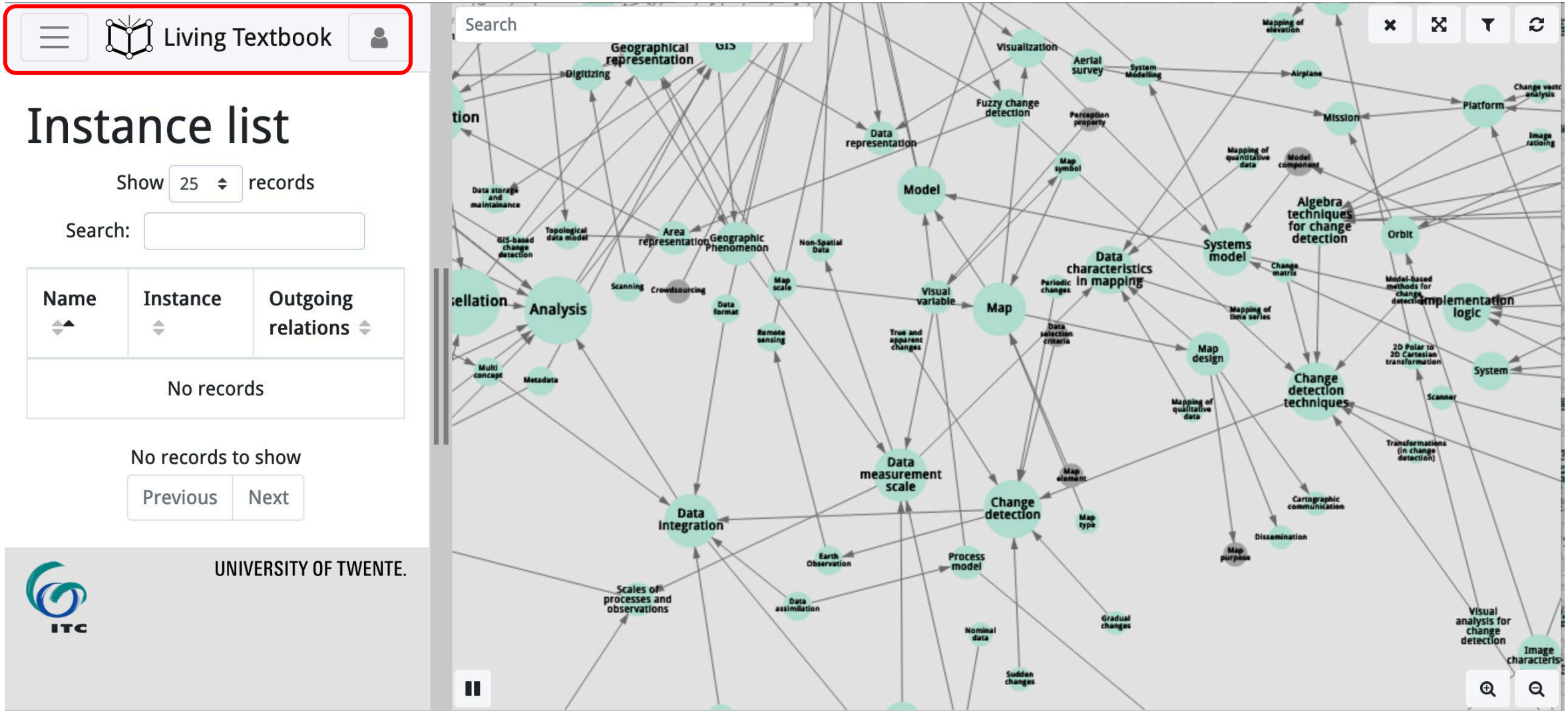
1.1 Tool of UC-GIS project GIS & T – Living Textbook: Transversal links between competencies

https://gistbok-ltb.ucgis.org/



2.2 Tool of SPACE4GEO – Living Textbook: Transversal links between competencies

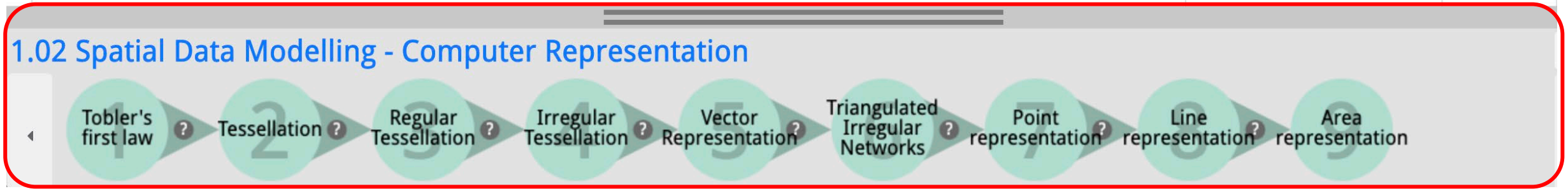
https://gistbok-ltb.ucgis.org/



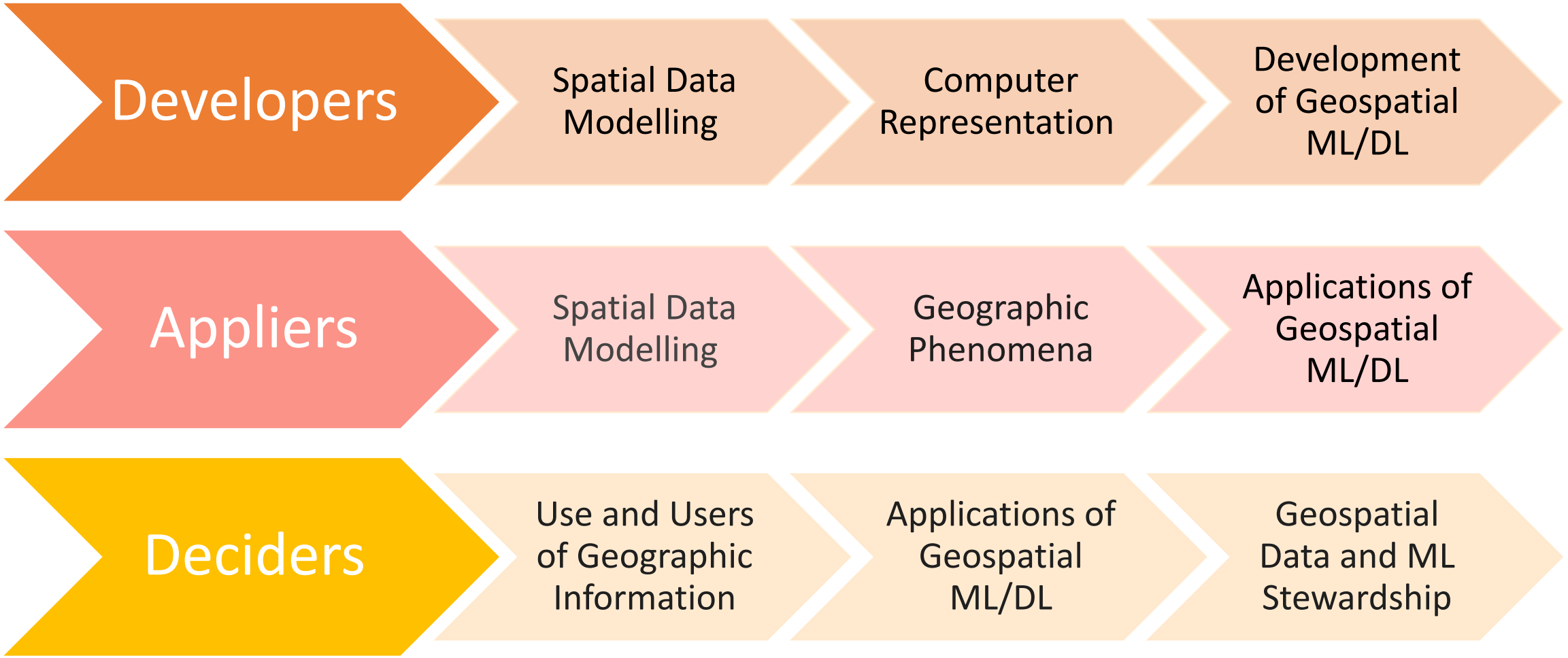
2.3 Tool of SPACE4GEO – Learning path: chains of complementary competences

https://ltb.itc.utwente.nl/page/498/learningpath/list

Name	Follow path	Actions
1. 01 Spatial Data Modelling - Geographic Phenomena	Follow path	View
1.02 Spatial Data Modelling - Computer Representation	Follow path	View
1.02.1 Spatial Data Modelling - Topology and Time	Follow path	View
1.03 Exploring Geospatial Data	Follow path	View
1.03.1 Data Management : GIS and Database	Follow path	View
1.03.2 Data Management : Relational Data Model	Follow path	View
1.04 Spatial Referencing: Coordinate Systems and Map Projections	Follow path	View



2.4 GeoAI Learning paths: chains of complementary competences

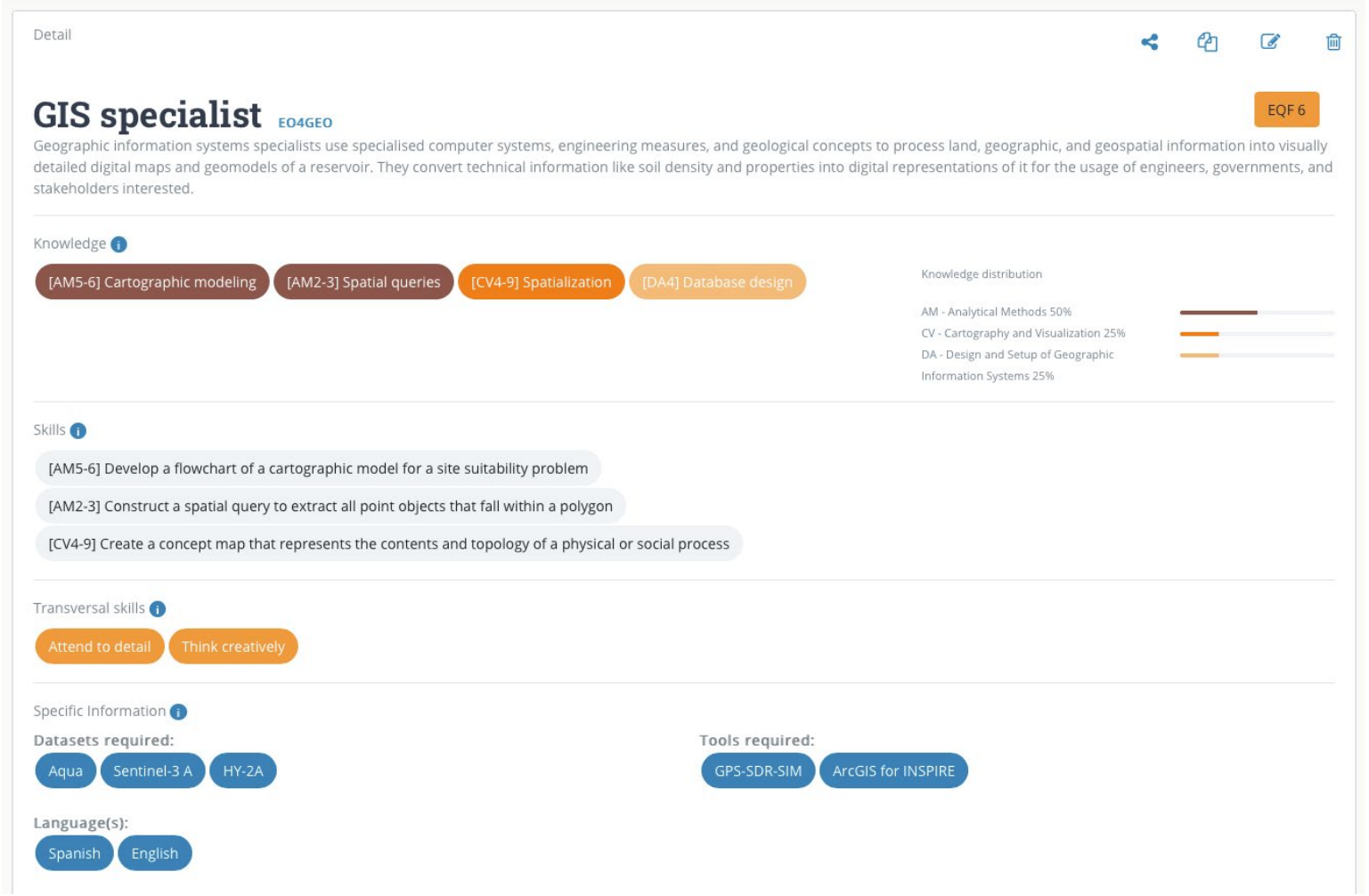


⇒Coordination with Syllabus of WG1—WG3

2.6 Tool linked to SPACE4GEO – Job offer tools

http://www.eo4geo.eu/tools/job-offer-tool/

- CURRICULUM DESIGN TOOL
- OCCUPATIONAL PROFILE TOOL
- JOB OFFER TOOL
- BOK VISUALIZATION AND SEARCH
- BOK ANNOTATION TOOL
- BOK MATCHING TOOL
- DATA EXPLORATION AND ANALYSIS TOOLS



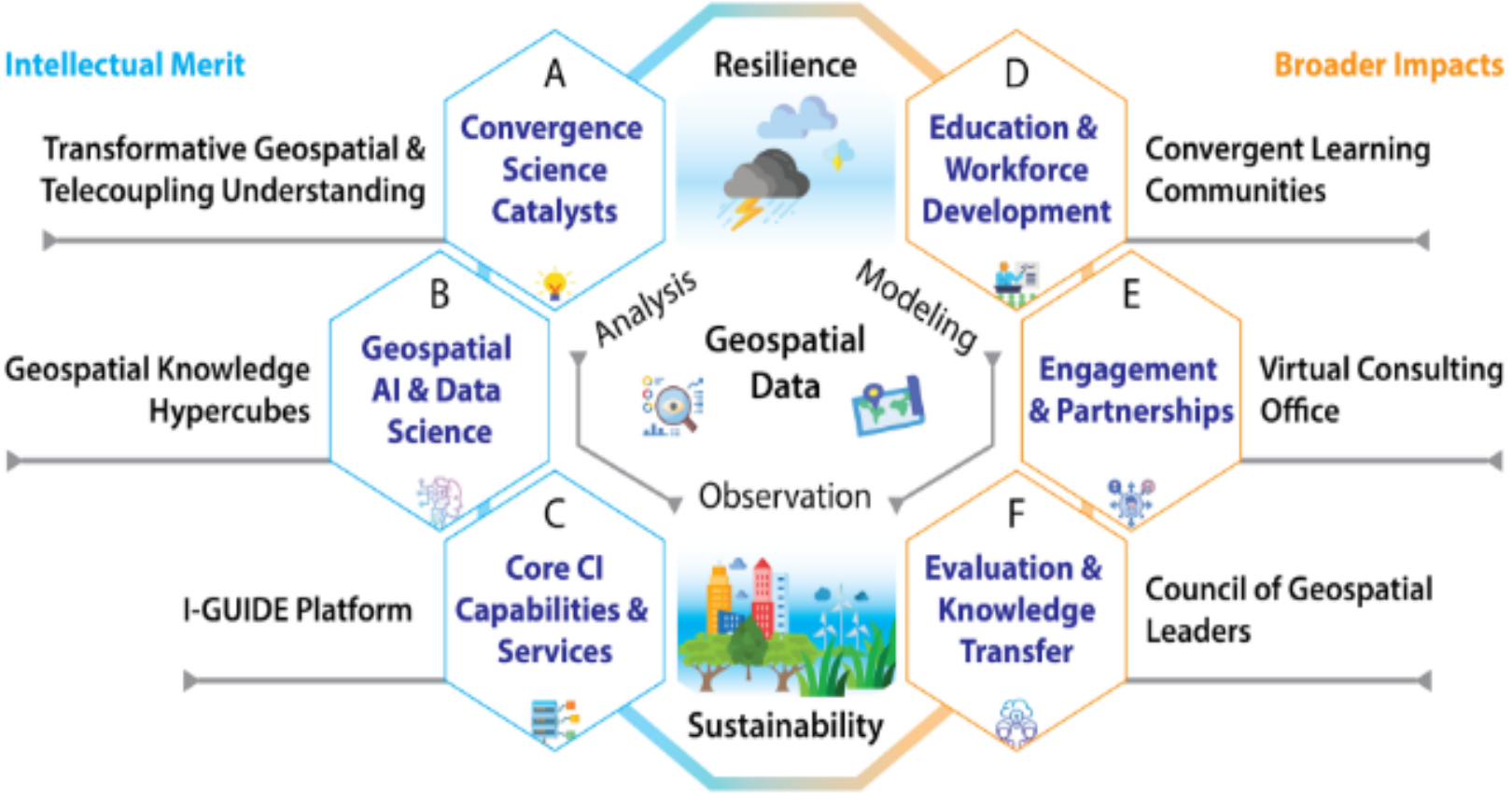
3. Other US projects: I-GUIDE

NSF Institute for Geospatial Understanding through an Integrative Discovery Environment

https://i-guide.io/platform/

Led by the **University of Illinois, Urbana-Champaign** + **11 US universities**:

- Columbia University
- the Consortium of Universities for the Advancement of Hydrologic Science Inc. (CUAHSI)
- Florida International University
- Michigan State University
- Purdue University
- the Open Geospatial Consortium (OGC)
- University Consortium for Geographic Information Science (UCGIS)
- University Corporation for Atmospheric Research (UCAR)
- University of Minnesota, Twin Cities
- Utah State University



GEO-AI for good BoK

- Geospatial Machine Learning and Deep Learning
- Generative GEO-AI Models
- Geospatial Knowledge Graphs
- Geospatial Data and ML Stewardship

⇒ **To be completed by the 3 working groups of Syllabus**

Coordination with both BoK existing projects

- USA: GIS & T Body of Knowledge
- Europe: EO4GEO to SPACE4GEO Body of Knowledge

⇒**GEO-AI for good BoK in the GEO-AI Ecosystem information**

WORKING GROUP: *Song Gao, Céline Rozenblat, Diana Sinton, Samantha T. Arundel, Eva Malinverni et al.*

Thank you for your attention

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GEO-AI
Training centers Survey

Prof. Céline Rozenblat

Chair 2023-2024 of the UN-GGIM Geospatial Societies

Vice president of the International Geographical Union (IGU)

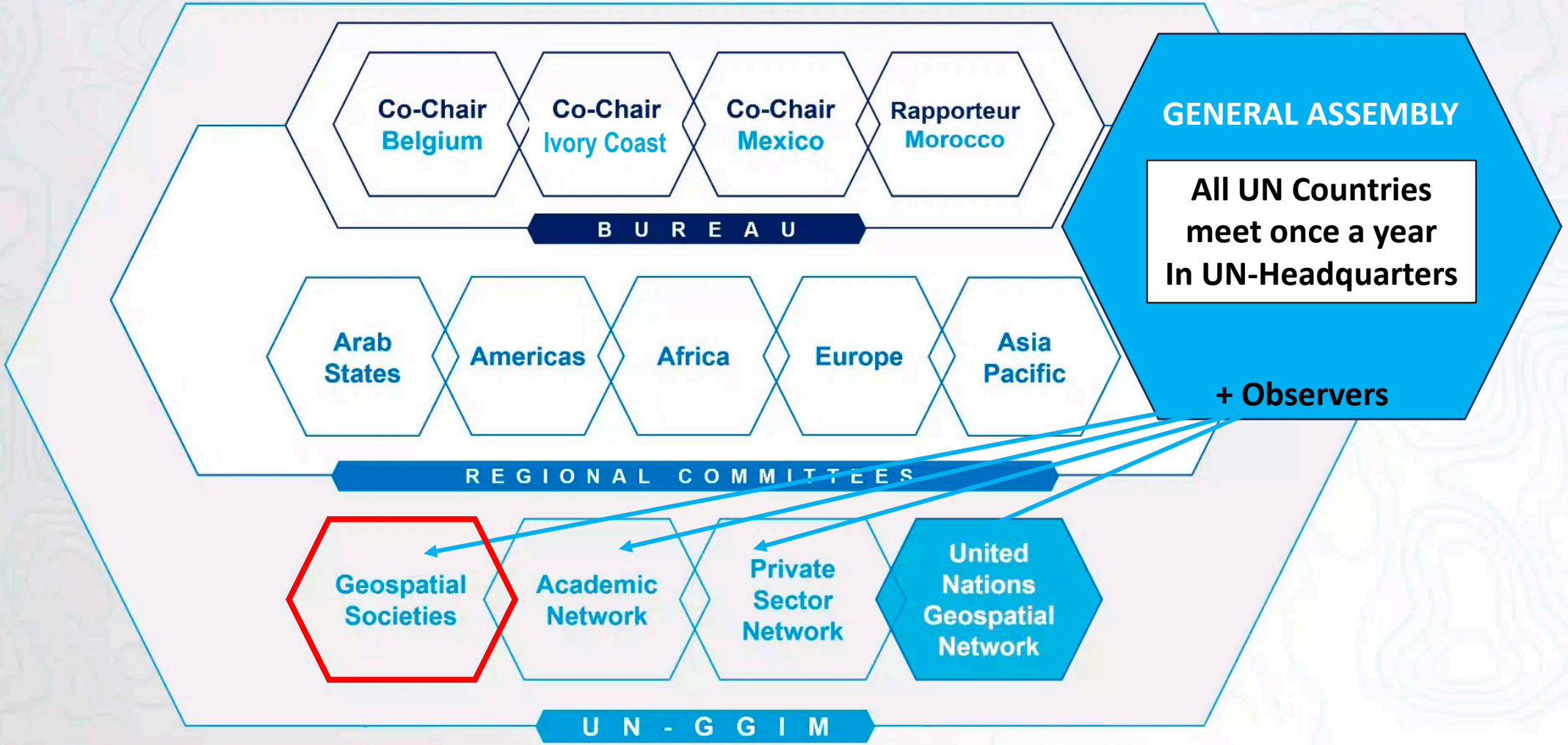
Institute of Geography and Sustainability

Faculty of Geoscience and Environment

University of Lausanne - Switzerland

UN-GGIM
GEOSPATIAL SOCIETIES

OUR ROLE IN UN-GGIM ARCHITECTURE



UN GEOSPATIAL NETWORK
UNITED NATIONS COMMITTEE OF EXPERTS ON GLOBAL GEOSPATIAL INFORMATION MANAGEMENT

11 UN-GGIM Geospatial societies in 2024

IIEE	•IEEE Geoscience and Remote Sensing Society (GRSS)
IAG	•International Association of Geodesy (IAG)
ICA	•International Cartographic Association (ICA)
FIG	•International Federation of Surveyors (FIG)
IGU	•International Geographical Union (IGU)
IMIA	•International Map Industry Association (IMIA)
ISDE	•International Society for Digital Earth (ISDE)
ISPRS	•International Society for Photogrammetry and Remote Sensing (ISPRS)
IUGG	•International Union of Geodesy and Geophysics (IUGG)
OS-GEO	•The Open Source Geospatial Foundation
ISC-CODATA	• International Science council (ISC) - CODATA

CARTOGRAPHY

GEOLOGY

REMOTE SENSING

GEOPHYSICS

GEODESY

PHYSICAL & HUMAN GEOGRAPHY

DIGITAL GEODATA

PERMANENT WORKING GROUPS AND ACTIONS

WORKING GROUPS

1. One Situation Room
2. **UN-IGIF**
3. **Inter-Agencies and Expert Group on SDGs**
4. **Geodesy**
5. Integration of Statistical and Geospatial Information
6. **Land Administration and management**
7. **Geospatial Information and Services for Disasters**
8. **Marine Geospatial Information**
9. **Policy and Legal Frameworks**
10. **Role of Standards**
11. **Toponymy**

REGIONAL COMMITTEES

- **Asia-Pacific**
- **Americas**
- **Arab States**
- **Europe**
- **Africa**

CENTERS

- Bonn (2021): **UN Global Geodetic Centre of Excellence**
- Daqing (2023): **UN Global Geospatial Knowledge and Innovation Centre**
- Riyadh (2024): **United Nations Global Geospatial Ecosystem Centre**

Geo AI Issues of training centers

Survey 2024 on training centers on GEO-AI

To support the Academic networks' GEO-AI initiative Syllabi & Body of Knowledge

Coordinating with existing training centers of Geo-AI

⇒ What exists? What do they teach?

⇒ Where? To whom? Cost and equity ?

Making a showcase of training centers on GEO-AI

To make a showcase / webpage with links to the training centers

An online questionnaire send via the Geospatial Societies

⇒1st round (March 2024): 68 filled questionnaires

⇒2nd round with a map of the first answers (June 2024): 54 new filled questionnaires

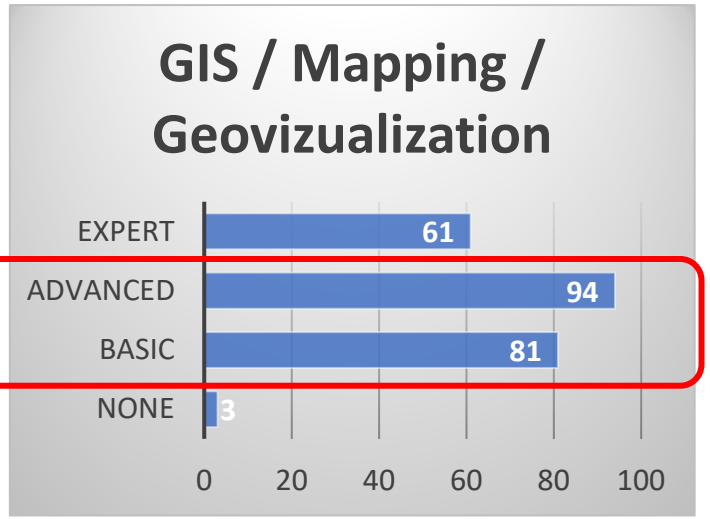
⇒**TOTAL: 122**

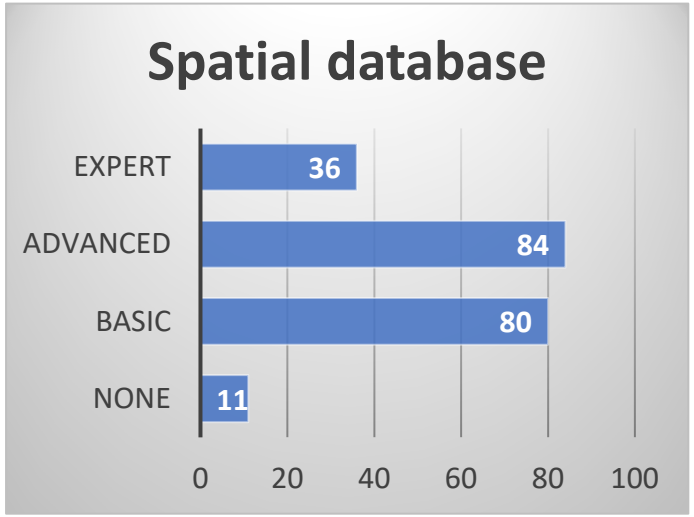
2024 - SURVEY ON GEOSPATIAL & AI TRAININGS

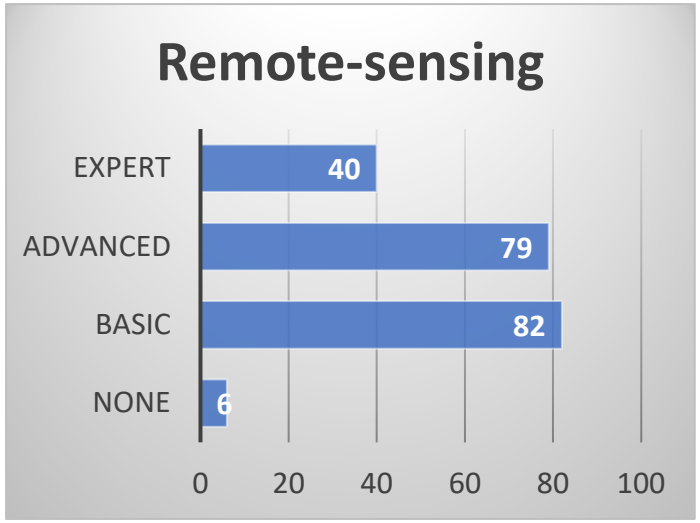
122 Centers (167 trainings)

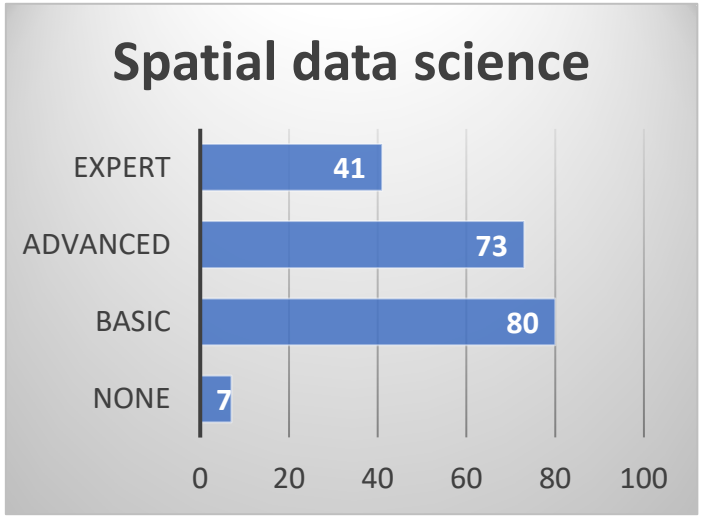
2024 - SURVEY ON GEOSPATIAL & AI TRAININGS

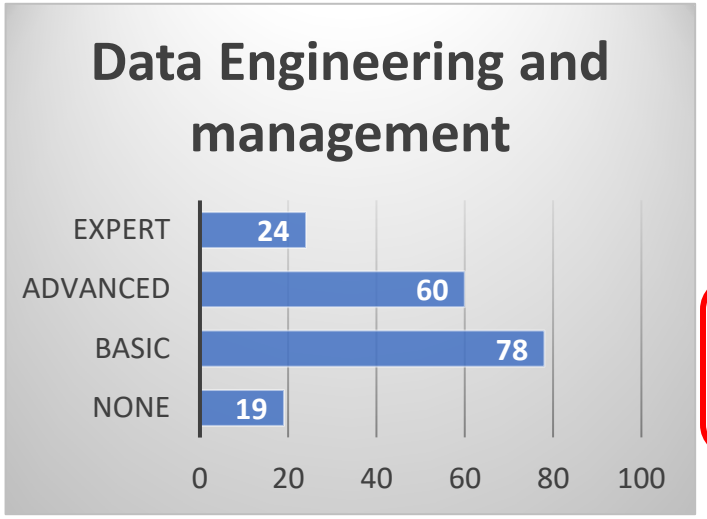
TEACHED DOMAINS (1/3)

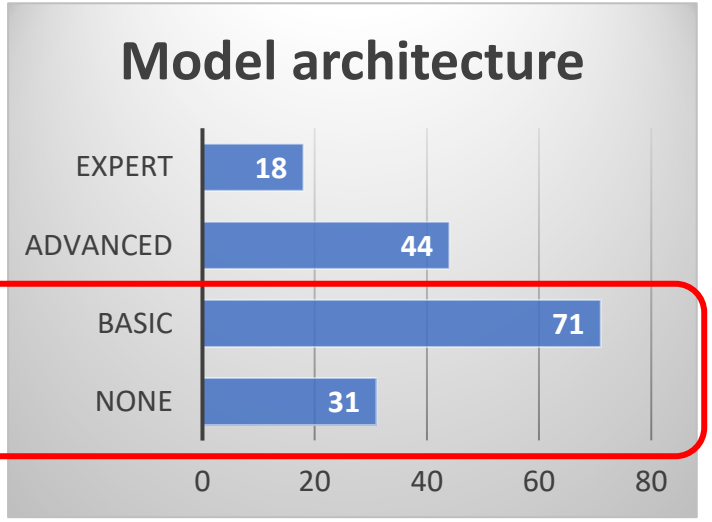






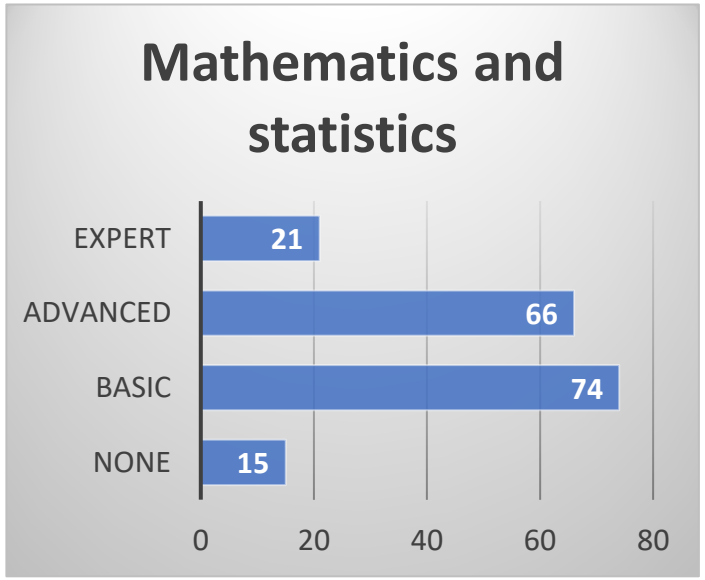


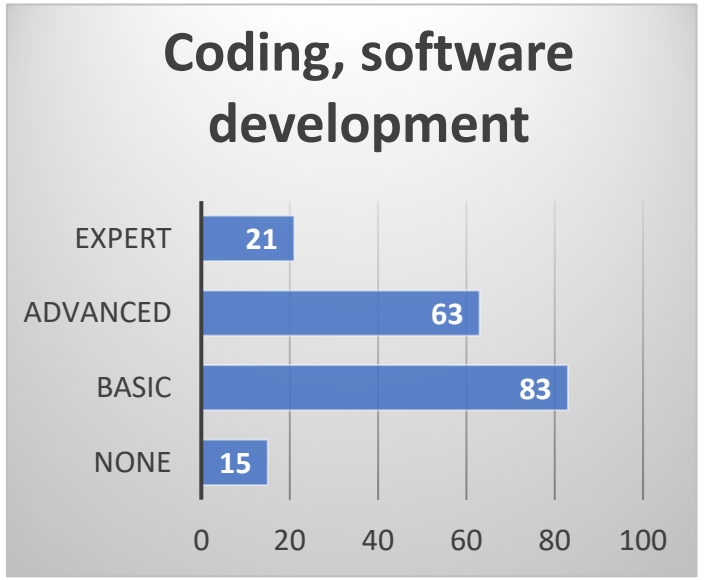


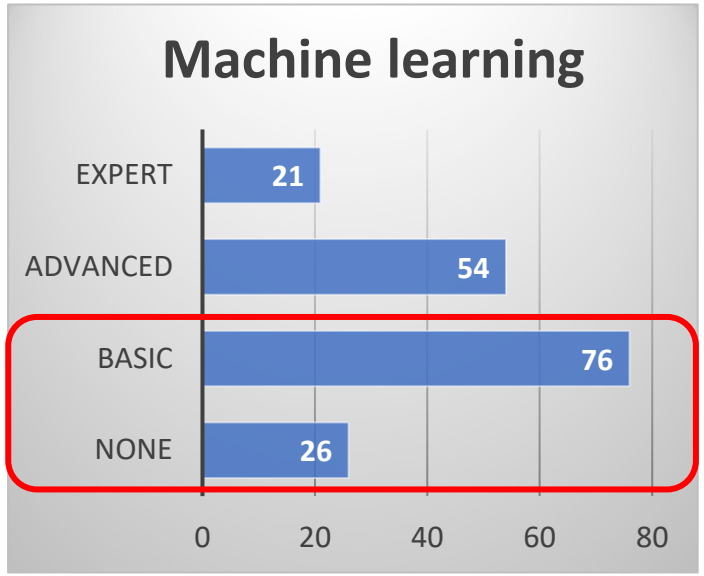


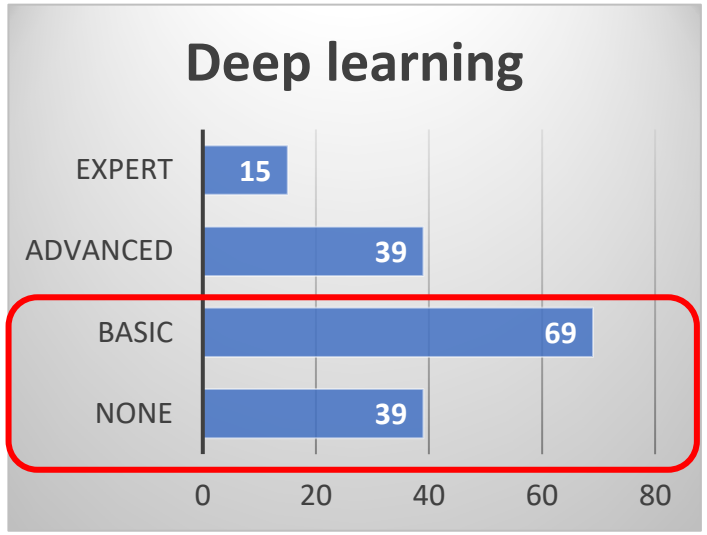
2024 - SURVEY ON GEOSPATIAL & AI TRAININGS

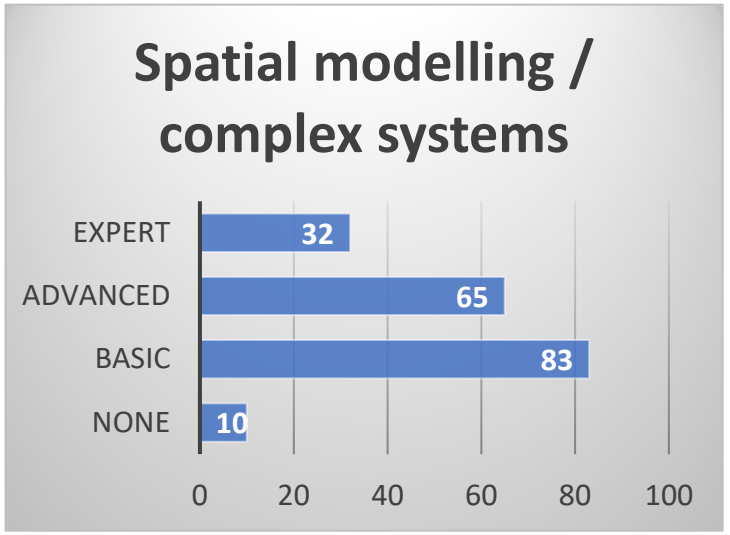
TEACHED DOMAINS (2/3)

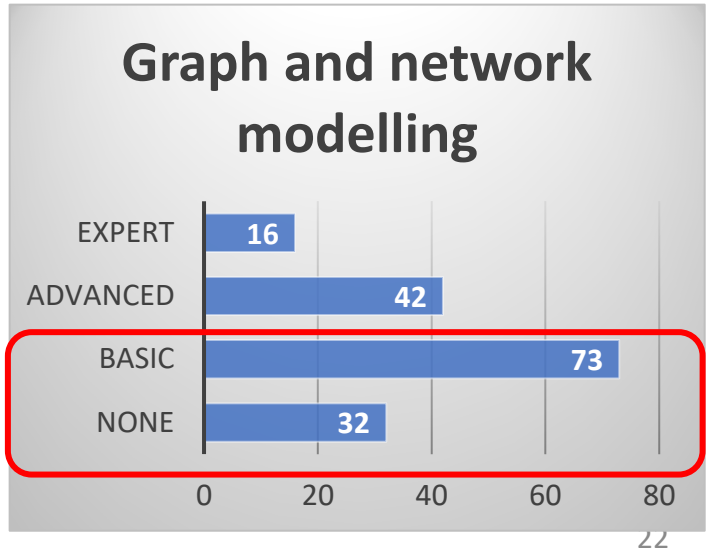






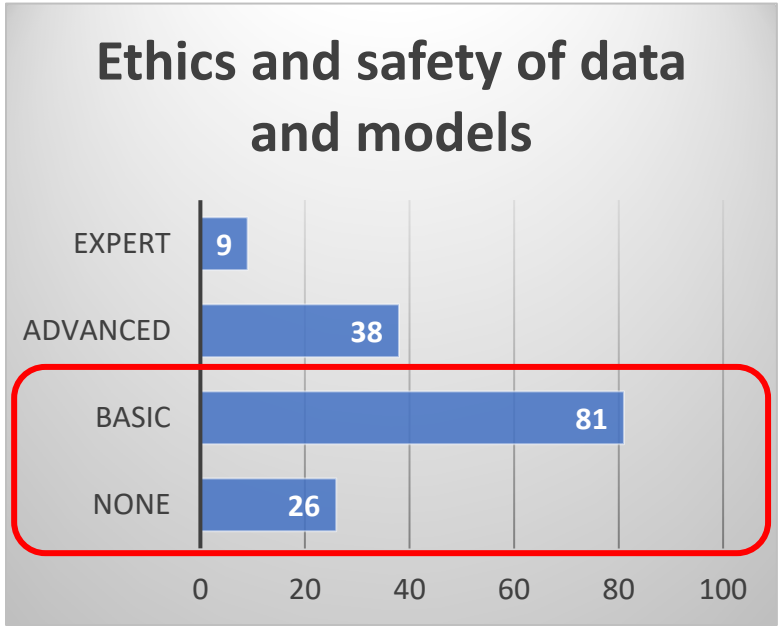


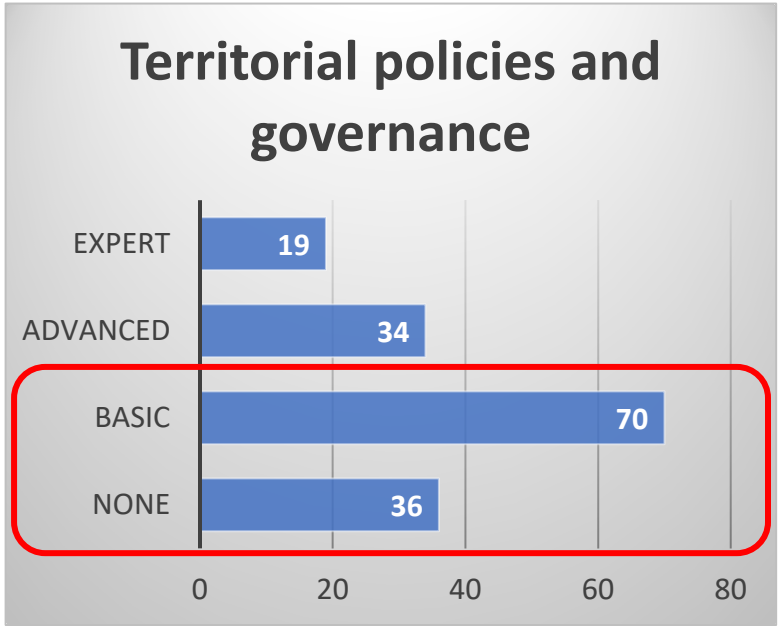




2024 - SURVEY ON GEOSPATIAL & AI TRAININGS

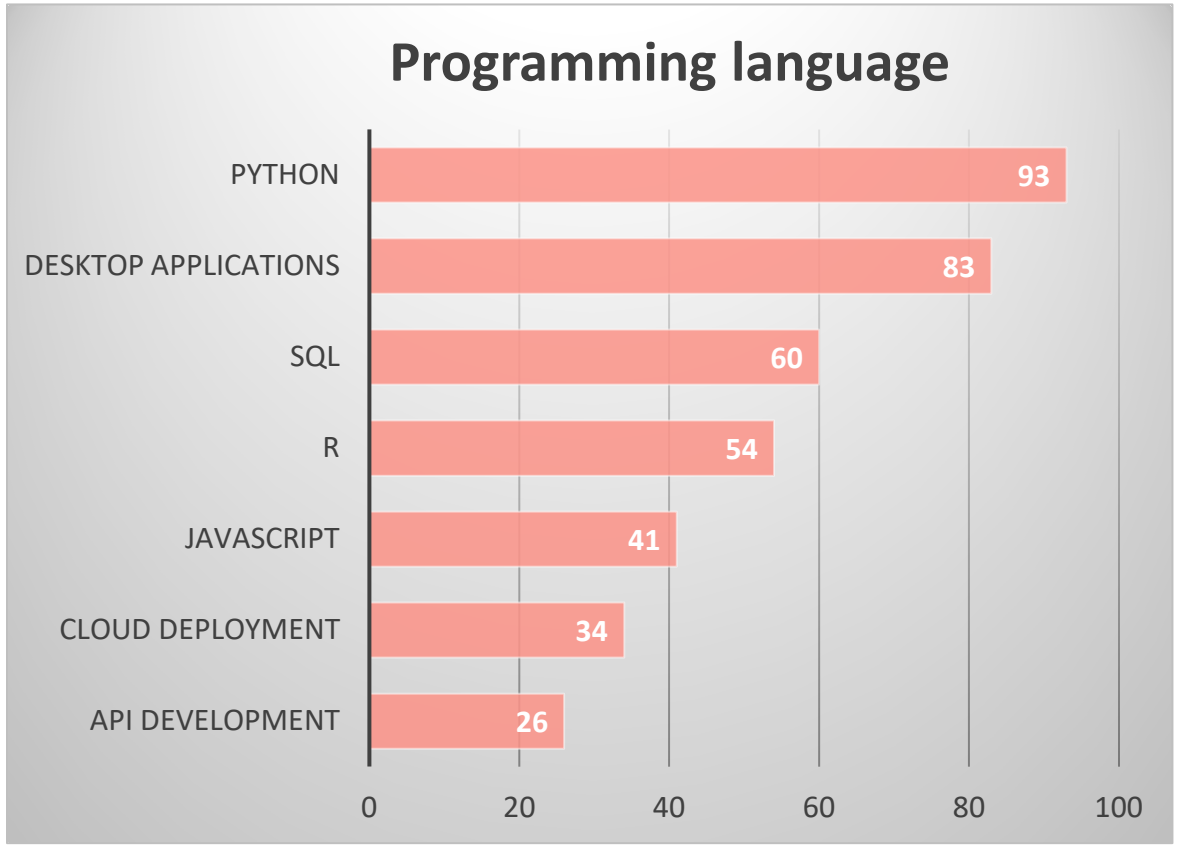
TEACHED DOMAINS (3/3)

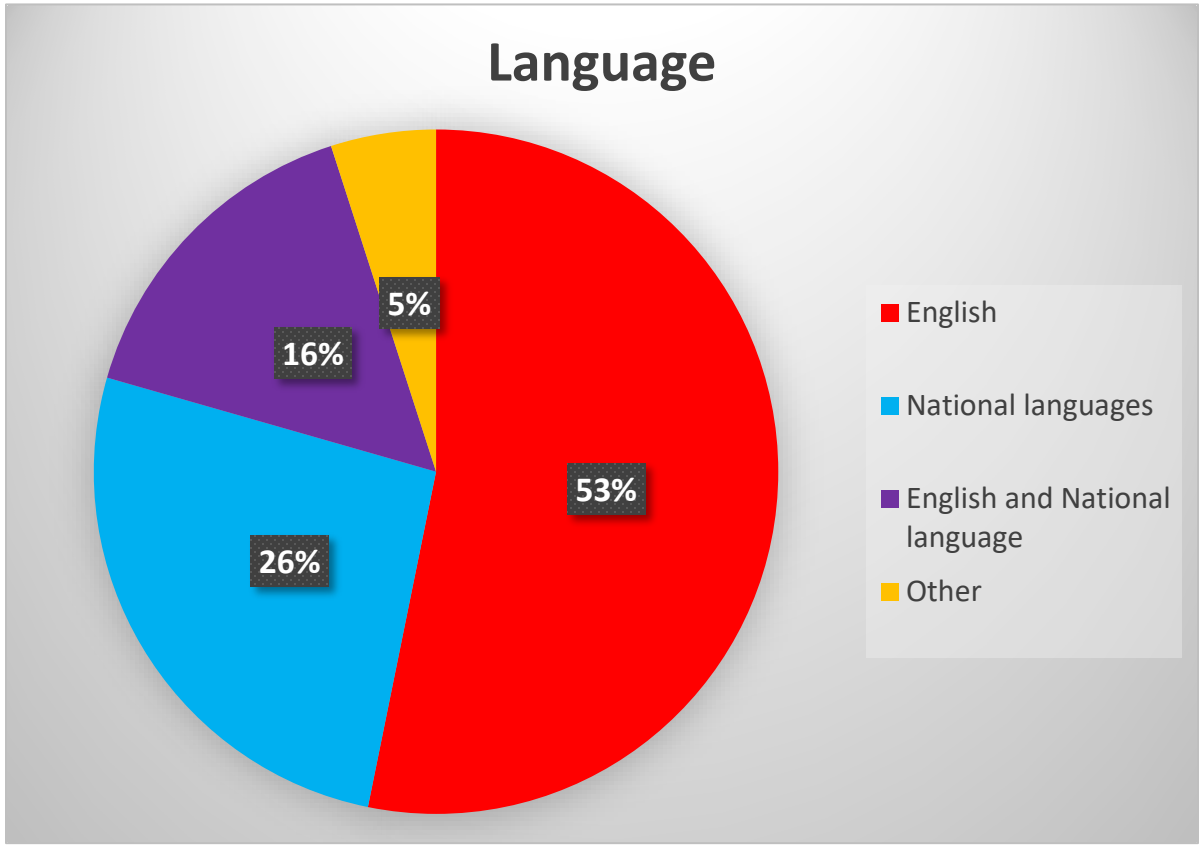




2024 - SURVEY ON GEOSPATIAL & AI TRAININGS

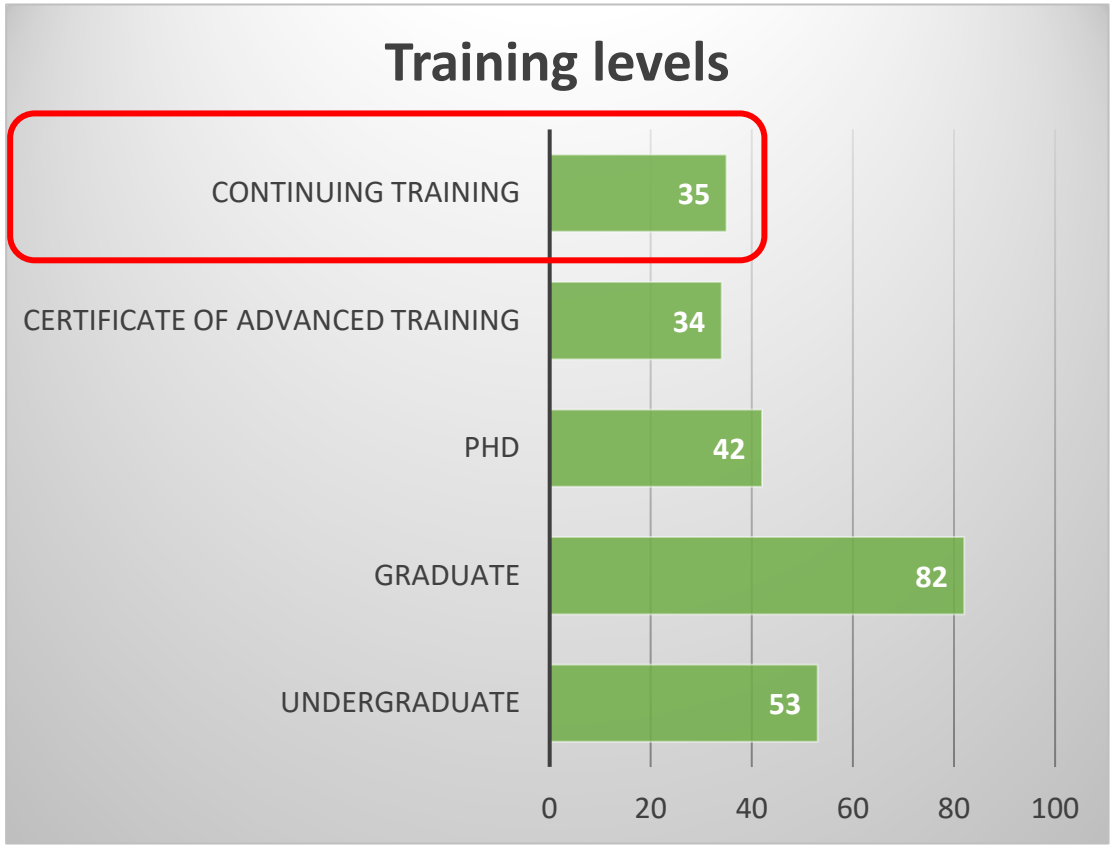
LANGUAGES

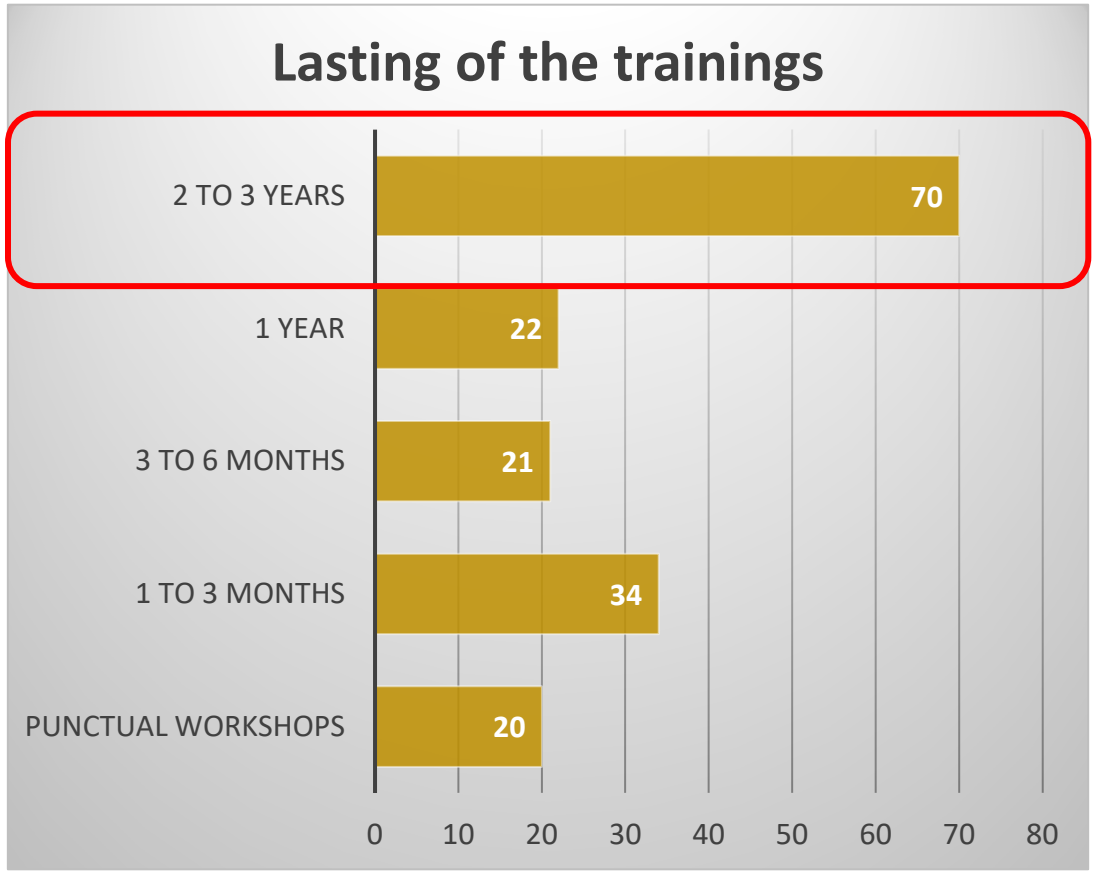




2024 - SURVEY ON GEOSPATIAL & AI TRAININGS

TYPES OF TRAINING





INCLUSIVITY

Students' gender

Women: 40%

Students' nationality

Foreigners: 28% (from 1% to 100%)

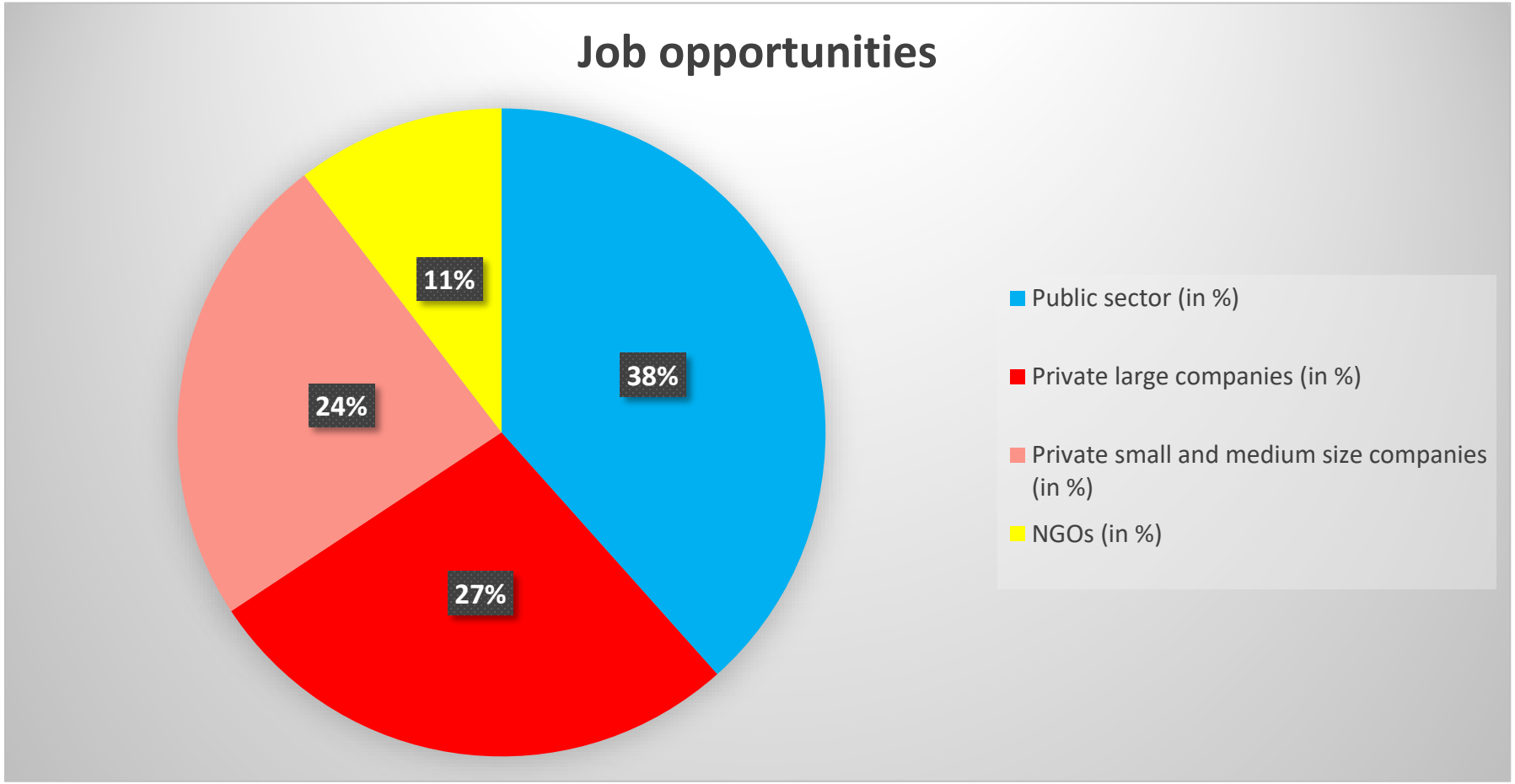
Cost of the training for 1 semester

Average: 3,000 US $

Min: Free

Max: 16,000 US $ (School of Engineering / Aalto University – Espoo for foreigners)

FUTURE CAREER



PERSPECTIVES

Representativeness

- Leadership?

Building an online platform

- Interactive map
- Directory of training centers

⇒ Issue of updating?

⇒ Open systems (VIVO – LYRASIS) + development (resources)

Sustain a worldwide community (around the UN-GGIM)

Thank you for your attention