Name of the course: Spatial Databases and Data Mining in Geoinformatics	Total credits: **6**

Code:

Type: **practice**

Total hours of per semester: **1.5 hour/week. 15 week.**

lecture:

practice: **100%**

consultation:

Other:

Type of testing: practice mark

Other:

Semester: **2. or 4.**

Description

According to the student's skills and preknowledge in geoinformatics, the following topics are possible. The course stand from two parts: In the first one, the students are going to get to know how to handle spatial data in a database management system (PostgreSQL+PostGIS).

Spatial Databases:

- Working with vector data: data types, spatial indexing methods, handling map projections
- Getting familiar with built in fuctions of spatial extension in the database: measurements, geometry and geoprocessing functions
- Data import and export
- Topology
- Raster Data
- Development of websites with spatial data extensions
- Other topic suggested by students

In the second part of the semester, data mining methods in geoinformatics are going to be explained.

- Getting data from the OpenStreetMapDatabase
- Working with vector and raster data in Python modules (GDAL/OGR, Shapely, GeoPy etc.)
- GTFS format: the General Transit Feed Specification. Importing into a database.
- Other data format's (e.g. text file) conversion into a geoinformatics one, like geoJSON/KML. Visualization of the geoinformatics formats
- Other topic suggested by students

Literature

Compulsory

- PostGIS Documentation: https://postgis.net/documentation/
- Nagy G.: Spatial databases online lecture notes 1-6. chapters.
  - https://regi.tankonyvtar.hu/hu/tartalom/tamop425/0027_SDO1/index.html
  - https://regi.tankonyvtar.hu/hu/tartalom/tamop425/0027_SDO2/index.html
  - https://regi.tankonyvtar.hu/hu/tartalom/tamop425/0027_SDO3/index.html
  - https://regi.tankonyvtar.hu/hu/tartalom/tamop425/0027_SDO4/index.html
  - https://regi.tankonyvtar.hu/hu/tartalom/tamop425/0027_SDO5/index.html
  - https://regi.tankonyvtar.hu/hu/tartalom/tamop425/0027_SDO6/index.html
- Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining. Pearson Education Inc., 2019 ISBN: 9780133128901, 0133128903

- https://www-users.cs.umn.edu/~kumar001/dmbook/index.php#chapters
- OpenStreetMap WIKI: https://wiki.openstreetmap.org/wiki/Main_Page, 2020

Recommended

- PostgreSQL Documentation: https://www.postgresql.org/docs/
- Obe.E Regina: PostGIS in Action. Shelter Island, Manning, 2015. ISBN: 9781935182269
- Arsanjani, Zipf, Mooney, Helbich (eds.): OpenStreetMap in GIScience: Experiences, Research, and Applications. Springer, 2015. ISBN: 9783319142807
- Ian H. Witten, Eibe Frank, Mark A. Hall, Christopher J. Pal: Data mining. Practical Machine Learning Tools and Techniques. ELSEVIER SCIENCE & TECHNOLOGY. 2017. ISBN 9780128042915 https://www.cs.waikato.ac.nz/~ml/weka/book.html

Competencies

Knowledge

- The student knows geospatial technologies including geographic information systems (GIS), remote sensing, global positioning systems (GPS), and spatial statistics.
- His/her knowledge can be used in various fields, such as environmental management, urban planning, natural resource management, disaster management, agriculture, transportation, and health. It allows researchers and professionals to collect, analyze, and visualize spatial data to make informed decisions and solve complex problems.

Competencies

Key competences in data mining are: Understanding of data mining principles, image processing, interpretation of spatial data, integration of digital data with other geospatial data, knowledge of data base applications, technical skills.

Attitude

- Attention to Detail: Data mining involves analyzing large volumes of data, often at very high resolutions. An attention to detail is essential for identifying patterns, anomalies, and other features in the data.
- Curiosity: A curious attitude can lead to asking questions that lead to a deeper understanding of the data and the Earth's surface. This can lead to new discoveries and insights.
- Flexibility: Data mining often involves working with data that can be incomplete, noisy, or difficult to interpret. A flexible attitude can help in adapting to these challenges and finding creative solutions.

Autonomy and responsibility

- Ethical Use of Data: Spatial data can have implications for privacy, security, and other ethical considerations. It is important to use data mining data responsibly and with consideration for ethical principles.
- Accuracy and Quality of Data: Spatial data base data must be accurate and of high quality to be useful. It is important to ensure that the data is collected, processed, and analyzed with a high degree of accuracy and quality control.
- Environmental Responsibility: Data mining data can have significant implications for the environment. It is important to consider the environmental impact of spatial data manipulation and take steps to minimize any negative impact.