Tárgy neve: Geospatial algorithms P

Tárgyfelelős neve: Dr. Gede Mátyás
Tárgyfelelős tudományos fokozata: PhD
Tárgyfelelős MAB szerinti akkreditációs státusza: AT

Az oktatás célja:
a, knowledge
- Knowledge of the current theories, models and literature of geoinformatics based on scientific results. He/she is aware of the possible development directions and limits of the field of geoinformatics.
- Comprehensive knowledge and understanding of the key relationships and concepts in the field of geoinformatics, in particular in the following areas: geovisualization, geoinformatics programming and application development, vector and raster geoinformatics, digital image processing.
b, abilities
- Ability to interpret complex professional problems in the field of geoinformatics, to explore the necessary theoretical and practical background and to solve problems.
- Ability to recognize and apply new problem-solving methods and procedures in his/her field and apply what he/she has learnt in a diverse, multidisciplinary environment.
- Ability to use the professional vocabulary of geoinformatics in his/her mother tongue and English.
c, attitude
- Accepts and adheres to the ethical principles of work and organizational culture, especially with regard to the copyright related to geoinformatics.
- Committed to adhering to and making others adhere to quality requirements.
d, autonomy and responsibility
- Independence regarding the thorough examination and elaboration of professional issues and processes.
- Feels responsible for meeting and making others meet the deadlines. He/she is responsible for his/her work and for his/her co-workers' work in projects.
- With his/her knowledge and skills of geoinformatics, he/she cooperates responsibly with professionals in other fields.

Az oktatás tartalma:
The course introduces students to fundamental algorithms and data structures in computer science, which are also widely used in geoinformatics. The second half of the course focuses on the geospatial field and takes an outlook on well-known geospatial algorithms and data structures.
- Introduction to Python. Literals and variables, data types, User input management. Control structures (sequences, conditional executions, iterations). Exception handling (try & except).
- Functions: built-in functions, function definition, arguments & parameters, return value.
- Collection data structures in Python: lists, dictionaries, tuples, sets.
- Basic algorithms: summation, counting, maximum selection, conditional variants, linear search, logarithmic search.
- Sorting: bubble sort, insertion sort, maximum sort, quicksort, merge sort, complexity analysis.
- Tabular data processing (CSV, Excel files), pandas library. Plotting and diagram visualization of scalar data (matplotlib library).
- Spatial data management: vector formats (geopandas library), raster formats (rasterio library)
- Graph representation (adjacency matrix, edge list). Graph traversal (BFS, DFS).
- Minimum cost path graph algorithms (Dijkstra, Bellman-Ford). Priority queue, heap data structure.
- Minimum spanning trees (Red-Blue rules, Prim algorithm, Kruskal algorithm)
- Scalar indexing: binary tree, search tree, AVL-tree, B (2-3) tree
- Spatial indexing: grid index, kd-tree, adaptive kd-tree, quadtree, R-tree
- Topological algorithms: Crossing Number, Shamos-Hoey, Bentley-Ottman, Greiner-Hormann.
- Topological data structures: winged-edge, half-edge.
- Convex hull algorithms: Jarvis's march, Graham's scan, Quickhull, Chan's algorithm
- Clustering and classification: K-means, ISODATAA

A számonkérés és értékelés rendszere: practical course mark based on course work.

Kötelező irodalom:
- T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein: Introduction to Algorithms, The MIT Press, 2009, ISBN: 9780262033848
- H. Samet: The Design and Analysis of Spatial Data Structures, Addison-Wesley, 1994, ISBN: 9780201502558

Ajánlott irodalom
- P. Rigaux, M. O. Scholl, A. Voisard: Spatial Databases: With Application to GIS, Morgan Kaufmannn, 2001, ISBN: 9781558605886
- M. de Berg, O. Cheong, M. van Kreveld, M. Overmars: Computational Geometry, Springer, 2008, ISBN: 9783540779735
- E. Matthes: Python Crash Course, No Starch Press, 2015, ISBN: 9781593279288