

Proposals for master thesis' topics
Field of study: Informatics,
Specialization: Geoinformatic and Mobile Technologies
2018 r.

In English

1.

Master Thesis Subject (Polish)	Przetwarzanie i analiza informacji ech z sonaru wielowiązkowego w celu badania środowiska morskiego
Master Thesis Subject (English)	Multibeam sonar echoes processing and analysis for sea environment investigation
Supervisor	dr hab. inż. Zbigniew Łubniewski
Consultant	
Aim	In the thesis student should propose, implement and test on selected datasets the algorithms for sonar echoes processing for: 1) seafloor characterisation and classification – here, it is suggested to calculate the defined set of parameters for particular echoes (beams) and to investigate the dependence of parameter values on the beam angle, for several seabed types, 2) detecting of objects (e.g. fish swarms) in a water column.
Tasks	1. State of the art analysis in using multibeam sonars in investigation of marine environment 2. Development and implementation of algorithms 3. Testing of algorithms, analysis and discussion of the results
Literature	1. Scientific publications and other materials at the supervisor's disposal
Number of contractors	1
Comments	-

2.

Master Thesis Subject (Polish)	Wykorzystanie danych z ze skanowania laserowego budowy uproszczonego modelu trójwymiarowego terenu
Master Thesis Subject (English)	Using laser scanning data for construction of 3D terrain model
Supervisor	dr hab. inż. Zbigniew Łubniewski
Consultant	
Aim	Development, implementation and testing of algorithms for processing of point cloud data from ground or airborne laser scanning in 3D space, for real objects shape modelling and reconstruction, by detection and synthesis of higher order space structures – edges, facets, in order to simplify the terrain and objects model and data size reduction. Possible further processing of the obtained data may be various, e.g. visualisation; different phenomena modelling using terrain topography spatial data.
Tasks	<ol style="list-style-type: none"> 1. State of the art analysis in processing and utilisation of laser scanning data 2. Development and implementation of algorithms 3. Testing of algorithms, analysis and discussion of the results
Literature	<ol style="list-style-type: none"> 1. P. A. Longley, M. F. Goodchild, D. J. Maguire, D. W. Rhind, Geographic information systems and science. Wiley, 2004 2. Scientific publications and other materials at the supervisor's disposal
Number of contractors	1
Comments	-

3.

Master Thesis Subject (Polish)	Weryfikacja wyników numerycznego prognozowania pogody
Master Thesis Subject (English)	Verification of numerical weather prediction results
Supervisor	dr hab. inż. Zbigniew Łubniewski
Consultant	
Aim	Comparison of the results being obtained from numerical weather prediction (NWP) systems with archival real meteorological data, in order to detection and identification of systematic errors, like, e.g., daily max air temperature underestimation, fall zone moving speed underestimation. Attempts to identification of the conditions where such error occur, in order to improve the accuracy of the NWP
Tasks	<ol style="list-style-type: none"> 1. Getting familiar with the basics of the NWP systems 2. Preparing the data for analysis 3. Development and implementation of algorithms 4. Performing the analyses and discussion of the results
Literature	<ol style="list-style-type: none"> 1. ECMWF Data Assimilation Lecture notes (https://software.ecmwf.int/wiki/display/OPTR/Data+Assimilation+Lecture+Notes) 2. Materials at the supervisor's disposal
Number of contractors	1
Comments	-

4.

Master Thesis Subject (Polish)	System do wizualizacji przestrzennej satelitarnego obrazowania Ziemi
Master Thesis Subject (English)	System for visualisation of satellite EO data collecting
Supervisor	dr hab. inż. Zbigniew Łubniewski
Consultant	
Aim	The aim of the thesis is: 1. Development of the IT system, using the appropriately designed database, processing and delivering the information on particular satellite Earth observation systems characteristics, e.g. orbit parameters, spectral bands, spatial resolution, revisit time, scene size, typical applications of a given systems (keywords). The software should also provide the output in a graphic form – 2D or 3D visualisations of satellite/scene locations. 2. Performing the analyses on satellite Earth observation data accessibility (of a given revisit time for instance) for a given locations on the Earth.
Tasks	<ol style="list-style-type: none"> 1. Getting familiar with the satellite Earth observation, examples of systems and their characteristics 2. Definition of system requirements 3. Software implementation and testing 4. Performing of the analyses and discussion of the results
Literature	<ol style="list-style-type: none"> 1. P. A. Longley, M. F. Goodchild, D. J. Maguire, D. W. Rhind, Geographic information systems and science. Wiley, 2004 2. Materials at the supervisor's disposal, Internet resources on satellite Earth observation and imaging systems
Number of contractors	1
Comments	-

5.

Master Thesis Subject (Polish)	Marszrutyzacja pojazdów dostarczających towary
Master Thesis Subject (English)	Routing problem solving for vehicles delivering goods
Supervisor	dr hab. inż. Zbigniew Łubniewski
Consultant	
Aim	The aim of the thesis is development and verification of sample algorithms solving the Vehicle Routing Problem (VRP) for a group of vehicles delivering goods to the defined set of locations, e.g. shops, wholesales etc. The input data, for a given working day, contain: destination locations (in a form of spatial point data), requested goods amounts for particular locations, road network data (e.g. from Google Maps / Google Directions), the fleet of vehicles, their capacities, and limits, etc. The task for the algorithm is to find routes for particular vehicles, i.e. the ordered list of destinations which should be visited by each of them. In the course of the thesis implementation, it is possible to use and adopt the existing VRP solving algorithms. The initial assumptions for the problems to be solved will be in more detail discussed and agreed between the student and the supervisor at the beginning of the thesis implementation. They may contain the specification of delivered goods (e.g., whether the good is single and uniform or not), how big is the max number of destinations, is the vehicle's capacity equal or not, are any limitations of vehicle use defined or not, are the time windows applied, etc.
Tasks	<ol style="list-style-type: none"> 1. Analysis of the problem and formulation of the algorithms specification 2. Software implementation 3. Analysis of the VRP solving algorithms performance
Literature	<ol style="list-style-type: none"> 1. Vehicle Routing Problem (http://neo.lcc.uma.es/vrp/) 2. P. A. Longley, M. F. Goodchild, D. J. Maguire, D. W. Rhind, Geographic information systems and science. Wiley, 2004 3. Scientific publications and other materials at the supervisor's disposal
Number of contractors	1-2
Comments	-

6.

Master Thesis Subject (Polish)	Analiza treści z mediów społecznościowych w celu badania nastrojów społecznych
Master Thesis Subject (English)	Social media contents analysis for social moods evaluation
Supervisor	dr hab. inż. Zbigniew Łubniewski
Consultant	
Aim	Development and implementation of algorithms for processing of social media contents, e.g. from Twitter, and sample analysis performing. The task for the algorithm will be to evaluate to what extent the tweets express positive or negative opinions on a given issue. Sample proposed strategy is to filter the tweets with respect to a given time (and place) using the defined set of keywords, and then try to assess if a given tweet express the positive or negative opinion.
Tasks	<ol style="list-style-type: none"> 1. State of the art analysis in automatic extraction of information from social media 2. Development, implementation and testing of algorithms 3. Results analysis and discussion
Literature	Materials at the supervisor's disposal
Number of contractors	1
Comments	-

7.

Master Thesis Subject (Polish)	Globalnej analiza zmian w środowisku ziemi przy wykorzystaniu narzędzi HPC
Master Thesis Subject (English)	Analysis of global environmental change using HPC tools
Supervisor	dr inż. Tomasz Berezowski
Consultant	
Aim	A comparison of various HPC techniques, such as CPU, GPU or cloud to increase the efficiency of global scale processing of long time series of raster data in high resolution.
Tasks	<ol style="list-style-type: none"> 1. Selection of HPC techniques for comparison 2. The choice of data sources is the processing and analysis to carry out 3. Implementation of techniques under the account of the use of raster data 4. Analysis of the results of comparisons, presentation of the results of changes studied in the environment 5. Discussion and conclusions
Literature	1. Durbha, Surya S., Kuldeep R. Kurte, and Ujwala Bhangale. "Semantics and High Performance Computing Driven Approaches for Enhanced Exploitation of Earth Observation (EO) Data: State of the Art." Proceedings of the National Academy of Sciences, India Section A: Physical Sciences 87.4 (2017): 519-539.
Number of contractors	1
Comments	

8.

Master Thesis Subject (Polish)	Mobilne narzędzie do zbierania, wizualizacji wyników i sugestii lokalizacji przestrzennych danych pomiarowych
Master Thesis Subject (English)	A mobile tool for collecting, visualizing results and suggestions for spatial location of measurement data
Supervisor	dr inż. Tomasz Berezowski
Consultant	
Aim	Development and testing of a dedicated tool for mobile devices supporting field measurements. The tool should use the artificial intelligence algorithm to forecast successive measurement points based on previous results or given criteria.
Tasks	<ol style="list-style-type: none"> 1. Analysis of the issues 2. Development of the data collection module (measurement result + location) 3. Development of a visualization module for results in real time 4. Development of a suggestion module for subsequent locations 5. Field tests 6. Discussion and conclusions
Literature	1. Android Application Development. 2009. Rogers Rick et al.
Number of contractors	1
Comments	Research financed from the National Science Center grant

9.

Master Thesis Subject (Polish)	Wykorzystanie danych z sensorów satelitarnych SAR i zaawansowanych technik obliczeniowych do kartowania zasięgu powodzi
Master Thesis Subject (English)	The use of data from SAR satellite sensors and advanced computational techniques for mapping the extent of floods
Supervisor	dr inż. Tomasz Berezowski
Consultant	
Aim	Development and testing of an algorithm that allows effective mapping of flood extent. Operation verification for the 2002-2019 data set
Tasks	<ol style="list-style-type: none"> 1. Analysis of the issues 2. Tests and selection of the best algorithm, in particular the emphasis is on polarimetric techniques 3. Implementation of the algorithm for data strings 2002-2019 4. Discussion and conclusions
Literature	<ol style="list-style-type: none"> 1. Martinis, S.; Kersten, J. & Twele, A. 2015 A fully automated TerraSAR-X based flood service . <i>ISPRS Journal of Photogrammetry and Remote Sensing</i>, 104, 203 – 212 2. Martinis, S. & Rieke, C. 2015 Backscatter Analysis Using Multi-Temporal and Multi-Frequency, SAR Data in the Context of Flood Mapping at River Saale, Germany. <i>Remote Sensing</i>, 7, 7732
Number of contractors	1
Comments	Research financed from the National Science Center grant, the possibility of conducting field research, new SAR images will be obtained