Internship 1.

Title of internship: ***„Inventory of Architectural Barriers at Tram Stops and Pedestrian Access Routes"***

Supervisor: Dr. Izabela Wilczyńska, e-mail: izabela.wilczynska@upwr.edu.pl

Duration: three months

What is the research problem the intern will resolve:

The summer internship consists of a month-long pilot study focused on the inventory of architectural barriers at tram stops and pedestrian access routes in the city of Wrocław. The project aims to identify and document infrastructure elements that may hinder the use of public transport for persons with reduced mobility (PRM), including people with disabilities, seniors, and caregivers with strollers. As part of the internship, an analysis of selected tram stops and their immediate surroundings will be conducted, covering an assessment of platform accessibility, sidewalk width and condition, curb ramps, pedestrian crossings, traffic signals, and other potential architectural obstacles. The collected data will be processed and presented as a comprehensive list of identified issues, along with recommendations for improving the accessibility of public spaces. A key output of the work will be a map showcasing the locations of the analyzed stops and the identified barriers.

What is the expected outcome:

The objective of the internship is to conduct pilot field research and develop digital accessibility maps in a GIS environment for selected transport nodes.

Requirements:

Proficiency in GIS Software, fundamentals of Transport Engineering, fieldwork skills.

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Internship 2.

Title of internship: ***„Inventory of Architectural Barriers at Tram Stops and Pedestrian Access Routes"***

Supervisor: Dr. Małgorzata Jarząbek-Rychard, e-mail: malgorzata.jarzabek-rychard@upwr.edu.pl

Duration: three months

What is the research problem the intern will resolve:

The internship is linked to research conducted at the Institute of Geodesy and Geoinformatics, focusing on the use of modern artificial intelligence methods for the automatic analysis of geospatial data.

The classification of aerial remote sensing data - both photogrammetric images and laser scanning point clouds - constitutes a key stage in geospatial information processing. It enables the automatic recognition of objects and structures in urban environments and supports their subsequent use in spatial modeling and analysis.

Conventional machine learning approaches rely on large, manually annotated datasets, which are costly to prepare and limited to predefined object classes. In practice, this restricts their ability to generalize and scale, and prevents their application to new, previously unseen categories.

An alternative to these approaches is provided by Vision-Language Models (VLMs), which have been rapidly developed in recent years. These models combine image understanding with natural language processing and enable so-called open-vocabulary classification, i.e., recognizing objects based on textual descriptions (prompts) without the need for prior training on specific classes.

Scope of the internship:

- conducting a literature review on the topic,
- implementing a solution based on existing models,
- performing experiments,
- results analysis,
- preparing a final report.

What is the expected outcome:

The objective of the internship is to develop and evaluate an approach based on Vision-Language Models for object detection and classification in aerial images, to investigate the transfer of semantic information to 3D data (LiDAR point clouds), and to compare the results with those obtained using deep learning methods for 3D point cloud processing.

Requirements:

Advance programming skills in Python, fundamental knowledge of photogrammetry and computer vision, proficiency in English.

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Internship 3.

Title of internship: ***„Profiling and diagnosing transition layers of the atmosphere using GNSS remote sensing observations"***

Supervisor: Dr. Paweł Hordyniec, e-mail: pawel.hordyniec@upwr.edu.pl

Duration: three months

What is the research problem the intern will resolve:

GNSS remote sensing observations using the radio occultation (RO) technique are a complementary source of data on the vertical distribution of the atmosphere, traditionally obtained from balloon soundings. Both of these datasets feed numerical weather prediction models, which describe meteorological conditions in a three-dimensional grid, along with their temporal variability. While common meteorological parameters include temperature and relative humidity, GNSS remote sensing observations provide geophysical profiles of non-traditional variables such as bending angle and refractivity. These parameters respond differently to changes in the vertical structure of the atmosphere and can provide new information that is not available from conventional observations. This is particularly important for meteorological conditions characterized by high dynamics and developing over remote areas, where direct observations are often unavailable. In order to address the need for targeted observables associated with summer and winter storms, dedicated aircraft reconnaissance programs are carried out over the Pacific and Atlantic oceans. The former is aimed at the acquisition of weather data during atmospheric river events on the West Coast under the Atmospheric River Reconnaissance (AR Recon) campaign. The latter focuses on capturing tropical cyclones in the western Atlantic and Gulf of Mexico. The reconnaissance campaigns are unique not only by allowing observation of extreme weather events but also by giving rise to innovative measurement approaches. The primarily weather data collected with dropsonde instruments are complemented with atmospheric soundings from airborne GNSS RO technique that allows to significantly increase number of profiles for studying the development of storms. The potential of collecting atmospheric limb soundings from aerial platform has been further expanded to high-altitude balloon-borne occultations in the French-US Strateole-2 campaign sensing the equatorial band of the Earth's atmosphere. As a part of separate campaigns taking place over the course of 5 years between 2019 and 2024, a number of balloons were deployed from the launch site in Seychelles to be then carried by wind, eventually encircling the equator at the drifting altitude of 18-20 km providing various measurements describing the properties of the atmosphere. While neither airborne nor balloon-borne occultations are mature enough to achieve operational capability, both constitute promising next-generation measurement concepts that open vast opportunities for addressing key science questions. The proposed analyses will focus on investigating two key layers of the atmosphere: its lowest part, the so-called planetary boundary layer, and the tropopause, which separates the troposphere from the 'free' atmosphere. A range of diagnostic parameters will be applied to enable the identification of both layers, based on both conventional definitions and geophysical variables typical of GNSS observations. The extension of existing meteorological datasets with new, independent observations will allow for the determination of optimal representations of atmospheric transition layers, with particular emphasis on regions lacking direct observational coverage.

The internship is linked with the National Science Centre, Poland grant entitled „Synergistic use of GNSS radio occultations and synthetic data for detecting transition layers in the moist troposphere". The funding is provided from the respective project 2024/55/D/ST10/00661.

This activity can be continued and extended beyond the internship as part of a master thesis in accordance with the proposed topics for the current or future academic year.

What is the expected outcome:

Processing GNSS remote sensing observations to determine diagnostic parameters describing atmospheric inversion layers of the Earth (tropopause, planetary boundary layer). Determination of diagnostic parameters from numerical weather prediction models. Analysis of parameter consistency. Quality assessment of GNSS observations. Utilization and development of the Radio Occultation Processing Package (ROPP), including testing and optimization of algorithms based on various scenarios.

Requirements:

Programming skills in preferred language, data visualization, familiarity with command line in Unix\Linux systems, proficiency in English sufficient to understand technical documentation and scientific publications.

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Internship 4.

Title of internship: *„Global PGV (Peak Ground Velocity) database for strong and weak seismic events as a source of information for seismic early warning systems*”

Supervisor: A/Prof. Jan Kapłon, email: jan.kaplon@upwr.edu.pl

Duration: three months

What is the research problem the intern will resolve:

Information on PGV for seismic and GNSS stations is scattered across various online repositories (e.g. EPOS Orfeus, Zenodo), with separate data sets for strong-motion and weak-motion events. In order to derive a universal scaling law for PGV as a function of earthquake magnitude and distance from the hypocentre, enabling the calculation of earthquake magnitudes in near-real time for the purposes of seismic early warning systems, it is necessary to construct a database containing observations of: PGV, local magnitude (Mw), hypocentral distance (R) and data on the location of the measuring station (type of geological formations).

What is the expected outcome:

To build and filter the PGV/Mw/R database for as many earthquakes and measuring stations (seismic and GNSS) as possible, including its validation (Mw calculation), as well as to develop tools for automatically populating the database with new data.

The plan includes:

- searching for data sources and downloading datasets,
- unifying datasets,
- filtering data,
- creating the final database,
- validating the database for its ability to determine Mw,
- developing tools for automatically populating the database with new observations.

Requirements:

Programming in Python, basic knowledge of operating system command-line operations. Basic knowledge of database solutions. Knowledge of GNSS positioning.

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