

## PHD PROJECT DESCRIPTION

(4000 characters max., including the aims and work plan to be published online)

### Project title:

#### 1.1. Project goals

Determination of road network passability for land military mobility, taking into account environmental factors in selected coastal zones, using GIS and GeoAI tools.

Specific objectives:

- development of an integrated road and environmental database,
- identification and classification of roads with regard to land military mobility,
- determination of environmental constraints affecting the movement of military vehicles,
- development of a passability model for different vehicle load classes,
- assessment of the suitability of GeoAI methods for the automated extraction and updating of road data.

#### 1.2. Outline

The project focuses on the application of GIS tools, GeoAI methods, and remote sensing, environmental and topographic data to assess military mobility and terrain passability in selected areas of the coastal zone. The aim is to develop an integrated method for analysing the road network and environmental constraints (including superficial geological structure—lithology, terrain morphology, soils, hydrography and hydrology, land use and land cover) for the purposes of land-based military mobility. The research will be based on openly available geospatial data, including satellite imagery. This will enable the identification of road networks with differentiated levels of passability and the delineation of zones and corridors that are critical from the perspective of military mobility. The developed methodology will be universal and comparative in nature, allowing it to be applied beyond the specific case study areas.

#### 1.3. Work plan

- review of scientific literature, including studies related to GeoAI,
- acquisition, harmonisation and standardisation of road, environmental and satellite imagery data,
- acquisition and preliminary processing of high-resolution remote sensing data and selected open-access vector databases,
- development of analytical tools (software plugins/scripts and code repositories) for route planning that account for the road network and environmental constraints,
- testing of basic GeoAI models in selected test areas,
- application of the developed model in selected test areas,
- development of a procedural methodology and scientific elaboration of the project results.

#### 1.4. Literature (max. 7 listed as a suggestion for a PhD candidate preliminary study)

- Dawid, W., & Pokonieczny, K. 2021. Methodology of Using Terrain Passability Maps for Planning the Movement of Troops and Navigation of Unmanned Ground Vehicles. *Sensors*, 21(14), 4682.
- Dukicin-Vuckovic S., Dordevic J., Milankovic-Jovanov J., Ivanovic-Bibic L., Protic B., Dordevic T., Ivkov M., 2018. The development of transport infrastructure and attitudes of the local population: A case study from the Republic of Serbia. *Geografisk Tidsskrift*, Vol. 118 (1), s. 101–113. DOI: <https://doi.org/10.1080/00167223.2017.1419369>
- Ewing, J., Oommen, T., Thomas, J., Kasaragod, A., Dobson, R., Brooks, C., Jayakumar, P., Cole, M., & Ersal, T. (2023). Terrain Characterization via Machine vs. Deep Learning Using Remote Sensing. *Sensors*, 23(12), 5505.
- Janowicz K., Gao S., McKenzie G., Hu Y., Bhaduri B., 2019. GeoAI: spatially explicit artificial intelligence techniques for geographic knowledge discovery and beyond. *International Journal of Geographical Information Science* 34(4).
- Wegener M., 2021. Land-use transport interaction models. W: M.M. Fischer, P. Nijkamp (red.), *Handbook of Regional Science*, Second Edition. Springer-Verlag, Berlin, s. 229–246.
- Włodarczyk A., Mesjasz-Lech A., 2019. Development of Road Transport Logistic Infrastructure and Air Pollution in the Visegrad Group Countries, *Journal of Economic and Social Development (JESD)* 6, 1, 93–103.
- Wu, Z., Zhang, H., Zhang, Z., Jiang, D., Li, S., & Sun, Y. 2026. Global Path Planning Methods Based on the Relationship Between Traversability Capability and Terrain Matching. *Sensors*, 26(5), 1472.

#### 1.5. Required initial knowledge and skills of the PhD candidate

- completed degree in natural sciences
- practical skills in remote sensing data processing
- analytical thinking ability

#### 1.6. Expected development of the PhD candidate's knowledge and skills

- ability to write scientific articles
- ability to prepare and present research findings
- creating a database
- developing self-education
- effectively using spatial and remote sensing data analysis tools and in automating the implemented processes
- ability to use ArcGIS software for spatial analysis