

MSc Eng. Kamil Choromański
(professional title, name)

Warsaw, 27.03.2026

Doctoral School
(Faculty/Unit)

Warsaw University of Technology
(University)

ABSTRACT OF THE DISSERTATION

„Assessment of the feasibility and efficiency of conducting large-scale data analyses using geospatial information cyberinfrastructure”

dissertation supervisor: DSc PhD Eng. Dariusz Gotlib, Associate Professor

assistant supervisor: PhD Eng. Bogusław Kaczałek

The dynamic development of information technologies is driving a continuous increase in spatial data volumes, whose effective analysis increasingly exceeds the capabilities of traditional GIS tools. Such datasets are referred to as spatial big data (SBD). The challenges associated with SBD analysis are addressed by geospatial cyberinfrastructures, which integrate advanced computing resources, analytical algorithms and diverse spatial data sources. However, effective use of these capabilities requires specialist knowledge, and clear guidelines are lacking regarding when the use of SBD tools is justified and how the type of spatial analysis affects their cost-effectiveness. The aim of this dissertation is to develop a methodology for the optimal selection of spatial data analysis tools, taking into account dataset size and characteristics, analysis type and implementation cost, with a particular emphasis on SBD-scale datasets. The research methodology is based on computational experiments carried out in two main stages. The entire analysis is based on the CENAGIS spatial data cyberinfrastructure. In the first stage, traditional spatial analysis methods were compared with SBD-oriented approaches. The analysis covered three most commonly used types of spatial data: vector, raster and point clouds, in order to determine differences in implementation effort and performance. The second stage of the study focused on evaluating the performance of SBD methods and the possibilities for their optimisation. Experiments were conducted on very large mobility data sets, assessing the scalability, limitations and optimisation potential of the examined tools. The objective was to determine the boundaries of this technology and identify approaches enabling SBD-scale analysis at the national level. The results of the study formed the basis for developing a tool selection methodology and strategies for analysing large spatial datasets, as well as for formulating recommendations for the further development of analysed geospatial cyberinfrastructure.


(original signature)