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# AUTOMATED SYSTEM OF MODELLING MILITARY PASSABILITY

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**ABSTRACT**

The classification of terrain in terms of passability plays a significant role in the process of military terrain assessment. It involves classifying selected terrain to specific classes (GO, SLOW-GO, NO-GO). In presented project, the problem of terrain classification to the respective category of passability was solved (among others) by applying artificial neural networks to generate (calculate) Index of Passability (IOP).

***Keywords – automation, terrain, passability***

## 1. INDRUCTION

The main methodological assumption of the conducted research was to refer the index of passability of the terrain to the primary fields of various shapes and sizes. The basis for calculating IOP are elements of land cover that exist in the given primary field. These data was inputted into two kinds in neural networks. In his analyses, the Author proposed to apply two types of artificial neural networks: a multi-layered perceptron and SOM – *Self Organizing Maps* by *Kohonen*. The results shows a comprehensive analysis of the reliability of the neural network parameters, taking into account the number of neurons, learning algorithm, activation functions and input data configuration. The studies and tests carried out have shown that a well-trained neural network can automate the process of terrain classification in terms of passability conditions (Fig. 1).

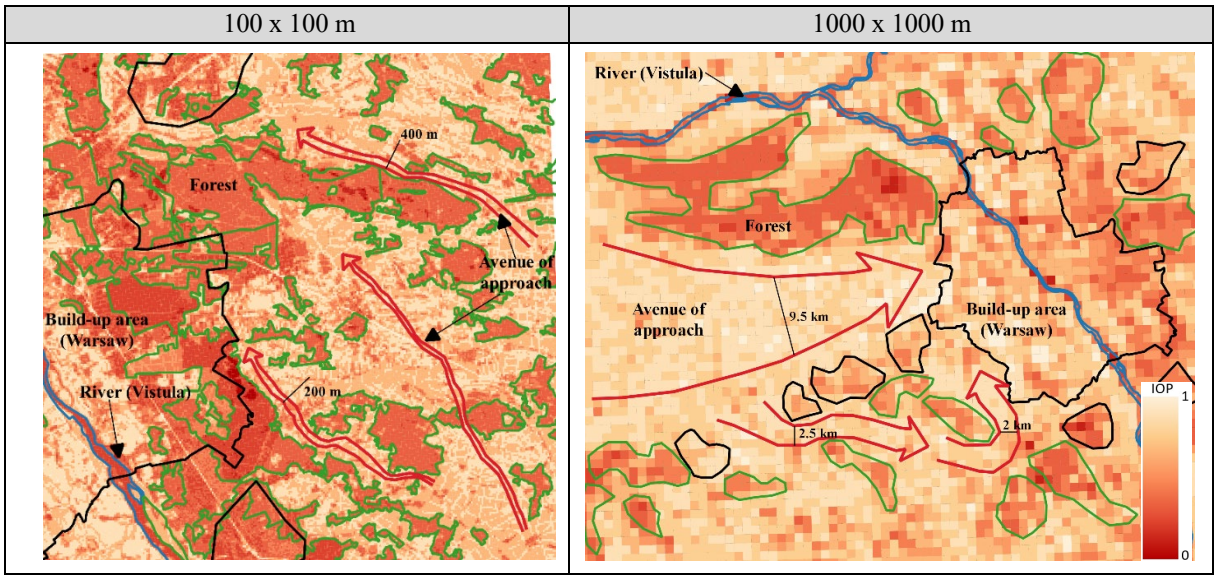


*Fig 1. Sample visualisations of indices of passability determined with use of the perceptron method for various sizes of primary fields.*

## 2. METHODOLOGY

The Author assumed that the values of indices of passability obtained with use of the algorithms may differ, even if the same methods and source data are used, depending on the type of the primary field used, i.e. its shape and size. Considering the above, the Author analysed the influence of the shape and size of the primary field on the results of automated terrain classification for the purposes of developing passability maps. The analyses of the influence of various shapes of primary fields on terrain classification results were conducted for square, triangular and hexagonal primary fields. In order to analyse the influence of the primary field size on the terrain classification results, the Author determined indices of passability for square primary fields of side lengths ranging from 25 m to 10 km (Fig. 2).

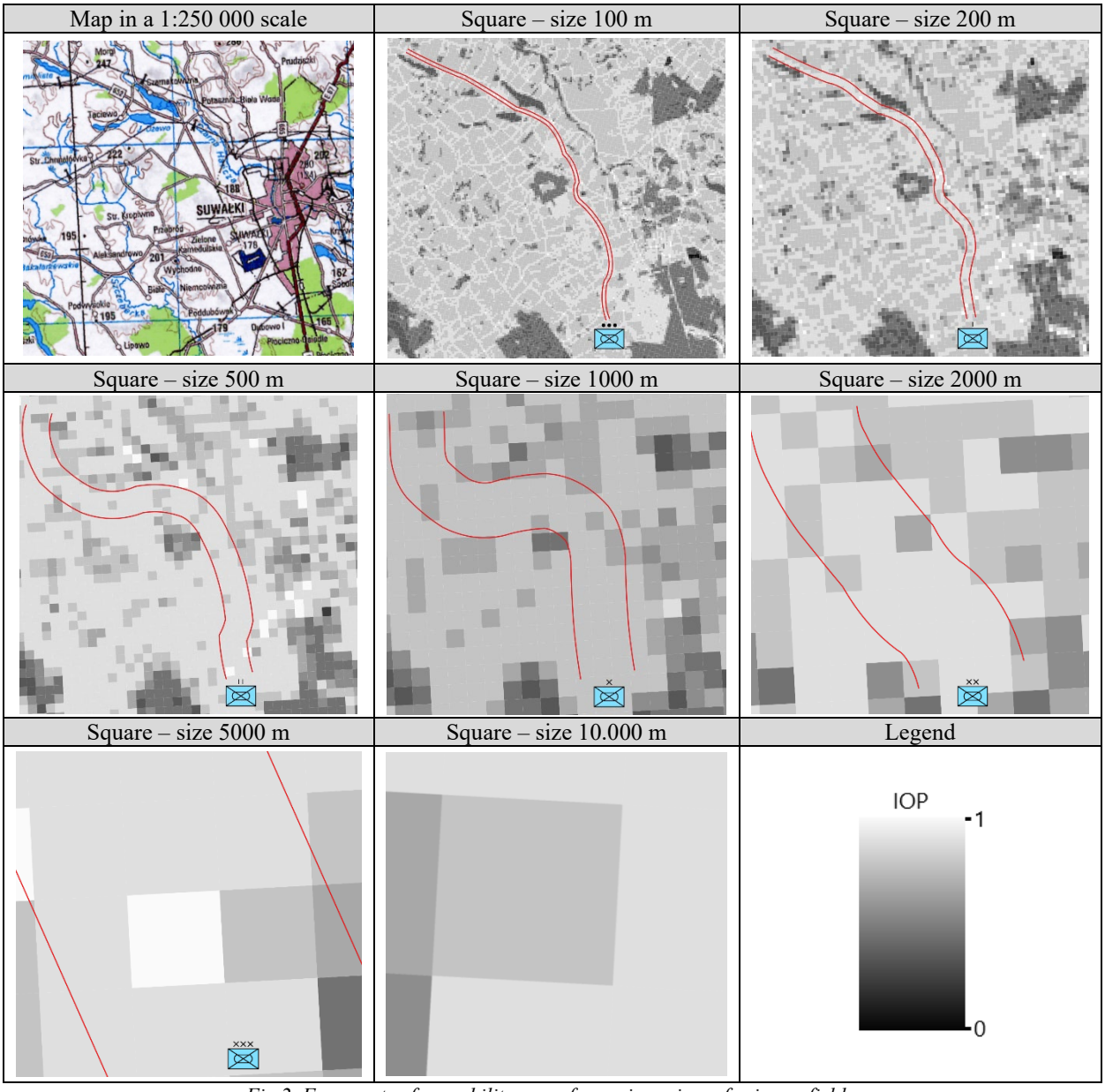


*Fig.2. Fragments of passability maps for various sizes of primary fields.*

## 3. CONCLUSION AND DISCUSSION

The Author has demonstrated that terrain classification for passability purposes may also be performed with use of not only-military data sources. So he generated maps of passability using military, public and social spatial databases (VMap Level 2, OpenStreetMap, VMap Level 1, Corine Land Cover and many others).

The presented methods of creating passability maps have been implemented in proprietary software developed by the Author. It enables full realisation and automation of all elements of cartographic modelling, from the preparation and initial processing of input spatial data, to the visualisation of the resulting map in the geoportal. Major part of the system consists of software written in the .NET programming environment. Apart from applications developed by the Author, certain modules were created with use of Open Source, generally available software (PostgreSQL databases, QGIS spatial information system). What is important, developed software will be used by Polish Directorate of Military Geography.

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