RCIN
REPOZYTORIUM CYFROWE
INSTYTUTÓW NAUKOWYCH

IBS PAN

Open Resources

# THE DIGITAL REPOSITORY OF SYSTEM RESEARCH INSTITUTE

# Digital Repository of Scientific Institutes contains 162 782 digital objects

Since 10 years a group of Polish science institutes has developed a supra-regional and multidisciplinary Digital Repository containing digitized archival materials, scientific publications, research documentation and cultural heritage manuscripts selected from their collections and libraries.

Thus, the institutes protect their current scientific achievements and enable for accessing the publications for scientists, students, etc.

The project provides new items on the Internet containing scientific content and data with a complete set of metadata, which, until now, were only available to a very limited group of researchers visiting the institutes' premises.

# The 16 Institutes Involved

Institute of Mathematics PAS – Lead Partner;
Institute of Archaeology and Ethnology PAS;
Institute of Literary Research PAS;
Systems Research Institute PAS;
Forest Research Institute;
Institute of Dendrology PAS;
Institute of Nature Conservation PAS;
Institute of Systematics and Evolution of Animals;
Nencki Institute of Experimental Biology PAS;
W. Szafer Institute of Botany PAS;
Institute of Bioorganic Chemistry PAS;
Institute of Philosophy and Sociology PAS ;
Institute of Geography and Spatial Organization PAS;
Mossakowski Medical Research Centre PAS;
Institute of Fundamental Technological Research PAS;
Museum and Institute of Zoology PAS.

# What is shared by IBS PAN?

## Research Reports unpublished

2002 – 2016

788 volumes

## Series of Books published by IBSPAN

1981 – 2017

IWIFSGN: 16 volumes of conference papers in English

BADANIA SYSTEMOWE (since 1981): 75 volumes in English and Polish

TECHNIKI INFORMACYJNE. Teoria i Zastosowania (since 1991): 18 volumes. Papers by Phd students in IBS PAN in Polish and English.

OTHER BOOKS: 13 titles in Polish and English.

IMEKO International Conference on
Metrology for Archaeology and Cultural Heritage
Lecce, Italy, October 23-25, 2017

# Multi-criteria classification of locations on the map with applications in archaeology.

Rafał Bieńkowski[12], Krzysztof Leśniewski[13], Weronika Radziszewska[1]

[1] *Systems Research Institute PAS, ul. Newelska 6 01-447 Warszawa Poland, Rafal.Bienkowski@ibspan.waw.pl, Krzysztof.Lesniewski@ibspan.waw.pl, Weronika.Radziszewska@ibspan.waw.pl*
[2] *Institute of Archaeology and Ethnology PAS, Al. Solidarności 105, 00-140 Warsaw, Poland*
[3] *Warsaw University of Technology, Faculty of Mathematics and Information Science, Pl. Politechniki 1, 00-661 Warsaw, Poland*

***Abstract* – The computer multi-criteria classification of the locations on the map can help in the predefining the areas for archaeological survey. The assumption is that settlements were located considering a number of rational criteria. The criteria considered in this paper are geographical criteria: the walking distance from drinkable water and arable areas. The method calculates the areas that are in reachable distance from each criteria then combines the data using Simple Additive Weighting method. The method was tested on real known location settlement from Venetian period in south coast Crete.**

## I. INTRODUCTION

Archaeological survey is a time consuming and labor-intensive task of searching and mapping of archaeological remains of the ground surface. One of the types of remains are traces of settlements. Predefining the interesting areas can lead to faster finding of the site of the interest. Up to now the areas to be searched were defined by archaeologists who, using their specialized knowledge, could evaluate how likely it is to find some remains of an archaeological site in the area. Although the specialized knowledge will be always necessary there might be possibility to partially automate the initial selection of areas.

The settlements are up till now created with some reasoning, like distance from other city, access to roads, climate, etc. Recognition of such criteria can help with determining what was the function of settlements and their location. There are two main types of such factors: the geographical and the anthropological. The anthropological factors are much more influential but very difficult to define, they are factors such as distance from the nearest settlement, trade route or defensible location. The geographical factors are the ones connected to the location and terrain, as e.g. short (walking) distance from water source or arable areas, difficulty of the terrain. Other of such factors is the proximity to the drinking water – the people would generally consider living near the rivers, but not too near to them if the river regularly floods the area. The arable land is the source of food, but creating the settlement on the most fertile land is wasting of farming potential. In this work we focus on geographical factors that favour the establishment of a settlement. The considered area is Crete, and the settlements that are in our example are from Venetian period. Crete is rich in archaeological material and the settlements were established not too far from each other. That gives a good test case for our algorithm and the data source for determining the parameters in our method. The next section is presenting the method of calculating the interesting areas considering each criteria. In section III the approaches to combine those data are presented. Final section concludes the paper.

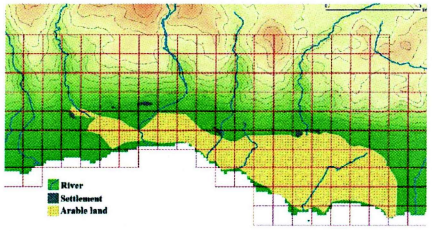


Fig 1. The sample of the data - south-west coast of Crete, Greece, in yellow are marked arable lands, grey areas indicate the known settlements, blue colour represents the rivers, different shades of green and beige represent the height over the sea level.



# Example 1

Multi-criteria classification of locations on the map with applications in archaeology. (Research Report 2017-17)

**By Rafał Bienkowski, Krzysztof Leśniewski and Weronika Radziszewska**

Abstract- The computer multi-criteria classification of the locations on the map can help in the predefining the areas for archaeological survey. The assumption is that settlements were located considering a number of rational criteria. The criteria considered in this paper are geographical criteria: the walking distance from drinkable water and arable areas. The method calculates the areas that are in reachable distance from each criteria then combines the data using Simple Additive Weighting method. The method was tested on real known location settlement from Venetian period in south coast Crete.




# Example 2

Political Representation: Perspectives from Fuzzy Systems Theory
(Research Report 2006-17)

**By Janusz Kacprzyk (Systems Research Institute Polish Academy of Sciences)**
**and Hannu Nurmi (Academy of Finland)**

**Abstract**
The theory of fuzzy sets has been applied to social choice primarily in the contexts where one is given a set of individual fuzzy preference relations and the aim is to find a non-fuzzy choice set of winners or best alternatives. In this article we discuss the problem of composing multimember deliberative bodies starting again from a set of individual fuzzy preference relations. We outline methods of aggregating these relations into a measure of how well each candidate represents each voter in terms of the latter's preferences. Our main goal is to show how the considerations discussed in the context of individual non-fuzzy complete and transitive preference relations can be extended into the domain of fuzzy preference relations.

# THANK YOU

use

RCIN.org.pl

IBS PAN