Foreword to the special issue on
"Novel approaches and soft methodologies in Geographic Information Systems: a Decision Support perspective"

The domain of Geographic (or, broadly, Spatial) Information Systems (or, shortly, GIS) has undergone during the last twenty years a truly dramatic development. At the commercial end the respective systems and their contents are present virtually everywhere, from highly sophisticated on-line emergency service centers, equipped with extremely expensive hardware and software, through design offices where off-line applications are used for engineering purposes, like in the case of infrastructure development, down to car-mounted simplified applications.

The synergy in the triangle of business, technology and research has been in this domain truly exemplary. The key ingredient was the presence of know-how and technologies that could bring the respective costs down to market acceptable levels. Not just that the maps and computers have existed side by side, but aerial photography, satellite imaging, as well as the Web have considerably added to the speed and ampleness of development.

On the top of this the theory of pattern recognition has reached quite a level of maturity at the moment it became needed in the domain of GIS. On the other hand, as usual in the development of science and technology, it is definitely the applications of GIS and related techniques that are driving the progress in all the pertinent fields of scientific endeavor.

The systems developed are meant to support decision making under various circumstances, like those outlined at the outset. Hence, they must be equipped with the capacities allowing for their ready use not just – only – for analytical purposes, but as operational tools for a handy use in making proper choices. This puts additional requirements on features of these systems.

What are the research problems that are of primary importance to GIS today?

There is whole array of such problems, and they are of a highly differentiated nature. They refer to the representation and processing of uncertainty, unavoidably associated with spatial data at appropriately high levels of resolution and/or when various sources and kinds of data are accounted for together. They refer also to the interpretation, meaning transformation of "raw" data into categories that can be used directly for design, planning and decision making in general. In both these types of problems soft methodologies may be of a significant assistance, especially so as we rarely deal with uncertainty of a classical statistical character.

A standard problem in data analysis is that of outlier detection. All the questions around it, from the definition down to an effective interpretation of results, apply equally to spatial data. In particular, one of the very specific problems in this domain is the identification of "dynamic outliers", e.g. trucks, whose trajectories may indicate a strange kind of behaviour, implying trafficking or other type of a non-legal activity. The very first prerequisite for such an analysis, though, is to detect and track properly the dynamic behaviour or movement in space.

Yet another question, perhaps of a slightly more technical character, consists in the utilization of the available power of the Web in the sense of available information. It appears that we have still quite some way to go before information available from the Web would have been used "automatically" in such applications as GIS. Still, efforts aiming at a maximum possible use of what is available through and in the Web should already give a high value added.

The present special issue of *Control & Cybernetics*, devoted to novel and soft approaches in GIS, with special emphasis on the decision support perspective, opens with the paper from Peter Keenan, providing an overview of the domain and an assessment of its maturity.

The two papers, which follow, one from Roy Ladner, Frederick Petry, Elizabeth Warner and Kaylan Gupta, and the other from Jiri Horak, Jan Unucka, Josef Stromsky, Vladimir Marsik and Antonin Orlik, show the methods and techniques, with which GIS and related DSS can be enhanced through the use of Web services, with a particular reference to modelling.

Then, Ademar Schmitz and Ashley Morris take up one of the fundamental questions in GIS, that is the manipulation of regions in space under the conditions of fuzziness of their definition. Next, Nico Van de Weghe, Anthony Cohn, Guy de Tré and Philippe De Maeyer approach another fundamental question, that of representation of dynamics, and relative dynamics, in GIS.

The paper by Pece Gorsevski, Piotr Jankowski and Paul Gessler deals with an application concerning landslide hazard mapping. As it is usual in application oriented works, various approaches have to be combined, in this case those based on fuzzy logic and the AHP. Jőrg Verstraete, Guy De Tré and Axel Hallez treat an important technical question of modelling fuzzy entities, here with the use of bitmap based structures. Finally, from a different angle, that of a distributed use of spatial database systems, Gregory Vert, Ashley Morris and Jill Heaton propose a method that, rather than being meant for, uses the decision support paradigm for handing the locking problem.

Thus, the present special issue of *Control & Cybernetics* contains a selection of papers that deal with various aspects of research and technical problems mentioned before. These papers do not only originate from different scientific backgrounds and hence also problem formulations, but also from different institutional frameworks. This concerns, in particular, the sources of funding.

The entire special issue appears largely owing to the funds from the European Union 5th FP "TRANSCAT" (TRANSCAT EVK1-CT2002-00124), within

which also the paper by Horak et al., was prepared. The DSS system containing a GIS functionality, with an ample use of Web-based capacities in several aspects, described in the paper, is the primary output from the TRANSCAT Project. The contents and results of the Project can be seen on the Web site *http://www.vsb.cz/transcat* or the Polish one: *http://transcat.ibspan.waw.pl* or the official Web site of the Project *http://transcat-project.net*. Some other methodological work on the Project (see, e.g., decision analytic applications functioning on the Polish web site) was funded through the Decision of the Chairman of the State Committee for Scientific Research (KBN) No. 55/E-82/SPB/5.PR UE/DZ 385/2003-2005 of 16 July 2003. The usual disclaimer concerning views, opinions and potential endorsements applies here in full, of course.

Among the other papers, some are a result of another project. This project has been funded in part by the National Academy of Sciences under the Collaboration in Basic Science and Engineering Program (COBASE), supported by Contract No. INT-0002341 from the National Science Foundation. The contents of the related papers do not necessarily reflect the views or policies of the National Academy of Sciences or the National Science Foundation, nor does mention of trade names, commercial products or organizations imply endorsement by the National Academy of Sciences or the National Science Foundation.

We definitely hope that this issue of *Control & Cybernetics* will contribute to the advance of knowledge on the new techniques and approaches applicable in the broadly conceived domain of GIS, and therefore to the progress of this domain as well.

The Guest Editors