



Theses of dissertation

DATA INVESTIGATION IN GEOINFORMATICS

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1. Summary of the dissertation and Scientific Contributions

Geoinformatics is interdisciplinary science. The geoinformatical professionals work with special data from different kinds of sources. The attributes of data depend on the particular task however the data managed in a certain system have to be organized in homogenous structure.

Applications presented in my thesis are just some examples representing the capabilities of geoinformatics. However the variety of these applications demonstrates the comprehensive potential of GIS: efficient data acquisition, data management and analyses. The discussed applications and results prove that geoinformatics exceptionally supports the information society.

I.

I have researched and identified several historical data sources that enable to construct geoinformatic systems, and verified the possibility of arranging and organizing the historical data into homogenous structure which can be used for statistical analysis. I have investigated the attribute and geometric quality of various historical map-types to test their applicability in urban environmental reconstruction. [3] [11] [12] [14]

II.

My research has shown that significant historic events and their effects can be demonstrated applying geoinformatic tools based on reasonable structured data. I demonstrated that the application potential of data sources used in historical analysis depends on the length of the period analyzed, its distance in time from the present, the spatial coverage and the subject of the analysis. [3] [11] [12] [13]

The social and historical geoinformatical system (human application) discussed in the second chapter mostly needs secondary acquired geographical data. The homogeneity is guaranteed by the common georeference system. The primary goal of the geographical database is environmental reconstruction. Since the end-users are coming from different fields, the attributes' sources are to be authentic. The integrated statistical data have to be published by certified institution.

III.

I have developed a geoinformatic system that is capable of fully supporting archeological expeditions to previously unknown areas, including the quality assessment of the available data. The method demonstrated through this example can support the construction of expeditionary geoinformatic systems of different application fields. [2] [4] [5] [6]

The geoinformatical system presented in the third chapter based on an archeological expedition. The system has various functions: prior environmental data collection, field work preparation, navigation, and integration of archeological data acquired on-site. The short period of time and the low budget limited the potential of data acquisition. Despite the specific circumstances and restrictions, the methods and techniques of GIS are able to support such projects.

IV.

I developed a process for evaluating the hyperspectral images from Mars Express, applying the known image processing tools (SAM, UNMIX) with multiple iterations to allow for a more detailed and wider analysis. In order to enhance the quality analysis and improve data acquisition I involved high resolution space images in the analysis (THEMIS, Moc). [7] [8] [10]

The goal of planetary science's geoinformatics is acquiring, managing and analyzing remotely sensed data. Since the data is acquired at various resolutions, the homogeneity of geographical features is not the primary criteria during the phase of prior data collection. The methods of metadata processing are newly developed but widely used by scientists. The special feature of hyperspectral data is also discussed in the fourth chapter: besides the high spectral resolution rate the spatial resolution is low.

V.

I developed a method for establishing a geoinformatic support system for surface mining, with a special emphasis on the evaluation of the potential of various specific data. The method is also capable of supporting various engineering applications related to this field. [1] [9]

Surface mining works are motivated by economical issues. Besides the mining companies, owners, and persons related to the mine, even the local, regional and governmental authorities would use the products of mine GIS. Therefore such system requires strict quality management and engineering approach. In order to ensure providing authentic information, both data acquisition and processing have to adopt reliable and valid sources. Applying these conditions the decision making system can be based on certified database.

2. Publications linked to the theses

[1] Ládai, András Dénes: Térinformatika a külszíni bányászatban. GEOMATIKAI KÖZLEMÉNYEK XII. 2009.

[2] Ládai, András Dénes – Barsi, Árpád: Potential of GIS applications in archeological expedition and documentation: Hungarian Merowe Dam Salvage Project 2006. ALLGEMEINE VERMESSUNGS-NACHRICHTEN 115. 333-337. o. 2008.

[3] Ládai, András Dénes: Historical development of Kosice (Kassa) and its region - geoinformatical analysis. PERIODICA POLYTECHNICA-CIVIL ENGINEERING 52. 35-38. o. 2008.

[4] Ládai, András Dénes – Barsi, Árpád: Analyzing automatic satellite image classification in the desert of Sudan. PERIODICA POLYTECHNICA-CIVIL ENGINEERING 52. 23-27. o. 2008.

[5] Ládai, András Dénes: Adatgyűjtés és navigáció egy ismeretlen expedíciós területen. GEOMATIKAI KÖZLEMÉNYEK X. 265-271. o. 2007.

[6] Ládai, András Dénes. Egy mérnök feladatai a Magyar Merowe-gát Régészeti Projektben. TÉRINFORMATIKA XVIII. 18-21. o. 2006.

- [7] Sotin, C. – Le Mouélic, S. – Combe, J-P. – Quesnel, Y. – Langlais, B. – Mustard, J F. – Ladaï, A. D. – Bibring, J-P. – Langevin, Y. – Gendrin, A.: Mineralogy of the Magnetic Anomaly Site South of Syrtis Derived from OMEGA/Mars Express Hyperspectral Data. Lunar and Planetary Science Conference XXXVI. Texas, USA, 2005.03.14 - 2005.03.18.
- [8] Ládai, András Dénes: Hiperspektrális adatgyűjtés a Mars felszínéről. Doktori kutatások a BME Építőmérnöki Karán. Budapest, Magyarország, 2005.03.02 - 2005.03.02. 52-55. o.
- [9] Ládai, András Dénes – Tóth, Zoltán: Egy bányaművelési térkép korszerűsítése. BÁNYÁSZATI KOHÁSZATI LAPOK – BÁNYÁSZAT 138. 13-15. o. 2005.
- [10] Ládai, András Dénes - Barsi, Árpád - Le Mouelic, Stephane – Sotin, Christophe - Combe, Jean-Philippe: A Mars felszínének kőzettani vizsgálata hiperspektrális felvételek alapján. GEODÉZIA ÉS KARTOGRÁFIA LVII. 14-18. o. 2005.
- [11] Ládai, András Dénes: Urbanization and historical/societal analysis with geoinformational methods – Kosice (Kassa) and its region. II. PhD CivilExpo Symposium Proceedings: BUTE Dept. of Highway and Railway Engineering. Budapest, Magyarország, 2004.01.29-2004.01.30. Budapest, 171-176. o.
- [12] Ládai, András Dénes: Urbanisztikai vizsgálatok térinformatikai módszerekkel: területi, történelmi és társadalmi elemzések. ÉPKO, Nemzetközi Építéstudományi Konferencia. Csíksomlyó, Románia, 2004.06.03-2004.06.06. 254-262. o.
- [13] Ládai, András Dénes: Történelmi események elemzése térinformatikai módszerekkel - Szepes Vármegye. GEOMATIKAI KÖZLEMÉNYEK VII. 111-118. o. 2004.
- [14] Ládai, András Dénes – Kugler Zsófia – Tóth Zoltán – Barsi Árpád: A pest-budai nagy árvíz - térinformatikus szemmel. TÉRINFORMATIKA XVI. 16-18. o. 2004.