Introduction

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1 THE URBAN DATA MANAGEMENT SYMPOSIUM

The Urban Data Management Society has organised international symposia at various locations throughout Europe since 1971, and UDMS 2013 will mark its second visit to London. From its outset, UDMS has highlighted changes and trends in urban data and urban data management. However, the rate of emergence of new data and new technologies has never been as rapid as it is now. Trends including smart cities, smart phones, social media, 3D modelling, volunteered geographic information, building information modelling and the Internet of Things all generate information about the urban environment and the people who live there. Additionally the volume of data generated in part through such techniques has in turn resulted in research into 'big data' – how best to handle the data, analyse it, visualise it in different contexts. Thus the challenges and opportunities facing those working with these *New* types of Urban Data are manifold. Given this, the general theme for UDMS 2013 was "Recent and Emerging Trends in the Management of *New Urban Data."*

This book contains a selection of the long papers that were submitted for UDMS 2013 – 20 in total. Each paper was reviewed by three independent academic reviewers from around the world, both for academic quality and for clarity in communication, and the book is intended to be suitable for different readers – from city planners and architects to academics, students and policy makers and those involved in urban planning.

The topics covered in this book represent some of the current trends in urban and regional data management. We have organised the book into six (6) parts: Urban Development (4 papers), Statistics and Geo-Visualisation (4 papers), Smart Cities and Big Data (3 papers), Remote Sensing (3 papers), 3D Modelling and Applications (4 papers) and Ontologies (2 papers).

Part 1: Urban Development

The understanding, analysis and application of urban datasets to real-world problems remains a core focus of UDMS, and this volume offers four papers in this theme.

The first article addresses the important issue of accessibility information and tourism, describing a multi-municipality approach to share accessibility data relating to four separate tourist locations. The authors have integrated this data into one portal, providing a one-stop-shop for wheelchair users and those having other physical limitations such as sensory disabilities who may be considering tourism in the locality.

Both the second and third papers in this grouping deal with property demand and valuations. The second paper examines housing stock in Latvia, with a particular focus on both current availability of housing but also on future requirements based on demographic trends. In addition to this, the authors also focus on the suitability of new dwellings by investigating the factors that influence choice of dwelling in the general public. The paper is particularly timely, given that a free dwelling market in Latvia has only emerged in 1991 – prior to that date, much of the housing stock was state owned.

The third paper in this group also addresses the issue of real estate. However, in this case the author examines the pricing structures for housing stock, and re-focusses the debate from the actual price paid for the purchase to the asking price. In addition, the paper investigates the problem resulting when modelling pricing of apartment blocks which may have very varying price ranges depending on whether the apartment is situated on the ground or upper floor.

The final paper in this section provides an alternative view on urban development, focussing on a review of current technology underpinning the increasing emergence of battery electric vehicles.. The paper presents the battery electric vehicles-BEVs bibliography that starts with the early eras of invention up till 2015 outlook. It gives a broad overview of BEV market and technology in a chronological classification while sheds light on the stakeholders' focus attentions in each stage. The authors present a look at the future, making use of graphical simulation solutions to address issues such as system usability and obsoleteness and non-compliance.

Part 2: Statistics and Geo-Visualisation

This group of papers address an aspect of on-going relevance to producers and users of urban datasets – what is the most effective means to analyse and visualise the datasets, in particular to facilitate rapid communication of data, synthesis of large quantities of data and increase user understanding? This is of particular importance give that the emergence of open data and free and open source software has led to an increased use of such data by non-expert users.

The first paper describes a systematic series of psycho-cognitive tests to identify the most useful method of representing an urban indicator – passenger flows in a metro system, running the tests with both expert and non-expert users. Preliminary results indicate that perhaps colour provides a less useful visual variable than texture, line size or changes in colour intensity.

Similarly to the first paper in this group, the authors of the second paper also seek to identify appropriate methods of visualisation of spatial data, with the particular aim of reducing the complexity of maps that may be hard to read for the non-expert users. They propose the use of chorems – which are visual schematized representations- to facilitate this process and describe a process used to semi-automatically generate a chorem map for migratory flows in Tunisia.

The third paper combines statistical analysis and health data, investigating the increasing emergence of lung cancer cases in Izmir, Turkey between 1995 and 2007. It investigates the use of GIS to support spatially-focussed statistical analysis of the cases of cancer (in combination with other datasets), along with an investigation as to how best to map such data given that there may be issues with the underlying source data such as missing addresses as well as technical issues relating to data interoperability. Clustering analysis is used to detect spatially significant patterns that warrant further investigation.

The final paper in the group develops a qualitative system to help managers of urban sites, and the work specifically focusses on a means to evaluate 'annoyances'. Recognising that factors such as age, gender, health and exposure duration matter, as well as the nature of the annoyance itself (e.g. dust, behaviour of other people, the configuration of the urban landscape), the authors develop a model of annoyance that takes these multiple factors into account.

Part 3 – Smart Cities and Big Data

The third group of papers in this book addresses a topic not directly covered in previous UDMS conferences – how to manage, process and understand the increasing quantities of data that are emerging both with the growth in size of 'traditional' geospatial datasets (e.g. very detailed topographic mapping) and with the newer forms of data resulting from emerging smart cities and their associated sensors.

The first paper focusses on efficient processing of large geospatial datasets, moving the field of topological data structure creation into a new area – that of parallel processing. Starting with simple feature polygons, the proposed algorithm makes use of segment intersection algorithm to 'crack' the polygons and then triangulate them into a Delauney triangulation. Finally, the resulting topological structure is generated from this triangulation. The resulting algorithm exhibits O(n log n) behaviour.

The second paper takes a more conceptual approach to this data management task, clearly stating that the main currency of a Smart City Environment is data. The main challenge, therefore, is to integrate the different data sources with a focus on the use case of understanding individual carbon consumption.

The third paper addresses the very topical issue of the interaction between virtual networks such as those encountered in social media and physical, urban space – what are the influences that digital social networks exert or could exert on cities and on the use of urban spaces? The

authors propose that given that the increase of such use of social media, it is important for planners to also engage with the public in this way.

Part 4: Remote Sensing

Unlike Smart Cities and Big Data, papers relating to remote sensing and applications making use of remotely sensed data have featured prominently in previous editions of the UDMS Annual and do so again in 2013. Authors contributing papers for this topic are, however, now taking greater advantage of the increasing availability of time-series datasets, with the first two papers in this grouping monitor change in urban environments.

The first paper in this section makes use of satellite imagery to address issues relating to urban development – in this case, changes in land use and land cover. The authors identify the need for such techniques to monitor the growth of mega-cities. A case study highlights the importance of this work, showing an 86% decrease in vegetation per capita between 1990 and 2011 for the test area in Ikorodu, Lagos, Nigeria, which is mirrored in the increasing population found in census figures for the same time period.

The second paper in this group addresses similar issues to the first – i.e. issues of Urban Sprawl. In this case, too, the authors make use of multi-temporal satellite data for their analysis, but in contrast to the paper above, they carry out a case study based in Southern Italy monitoring the expansion of several very small towns. The investigation here also focusses on the identification of spatial auto-correlation in the satellite imagery – i.e. the evaluation of the relationships between geographical objects and their spatial patterns – to detect urban areas from the satellite images.

The final paper addresses an important issue particularly in situations where high-quality mapping data (building information) is not available via standard mapping processes such as aerial photogrammetry, Light Detection and Ranging (LiDaR) survey or ground-based survey – how to extract building data from satellite imagery. Importantly, the method proposed in the paper is unsupervised – i.e. it does not require a preliminary training data set to be configured prior to execution. The results achieved show accuracy of above 85%.

Part 5: 3D Modelling and Applications

The use of 3D GIS for urban modelling has moved from a very niche area of academic research to an almost mainstream trend, and an ever-increasing number of 3D City Models are now becoming available, many of them free of charge. This emergence has been supported by the establishing of standards that facilitate data interoperability, in particular CityGML. As with previous editions of UDMS, the third dimension continues to be one of the most important themes of the conference, and this volume includes four papers on this topic.

The first paper addresses an important issue that is perhaps currently impeding the uptake of 3D GIS - i.e. the volume of data required to visualise a city model, along with additional data

to store the semantics of that model. The authors have developed a compression and decompression approach to facilitate the transmission of large 3D datasets, required to underpin a 3D Spatial Data Infrastructure, making use of CityGML. The implementation proves that lossless compression is achievable.

The second paper proposes a method to identify appropriate and less appropriate sites for solar panels by determining impact of shadow cast by other buildings. This is achieved by triangulating the surfaces into small triangles and measuring the shadow potential of representative triangles in each surface by generating an artificial 'sun's ray' and permits potential to be evaluated both for roof surfaces but also for the sides of buildings.

The third paper addresses an as yet relatively under-researched area in 3D GIS – that of 3D data quality and the automated approaches required to evaluate 3D data against specific measures of quality. Taking geometric quality as a focus, the paper gives a detailed implementation of the 'City Doctor' tool developed to address issues including validation of solids, of polygons and of semantics.

The final paper highlights a new and important trend both for 3D GIS and for urban planning and the ability to communicate ideas and concepts with non-specialists – that of 3D printing. As with previous papers in this section, CityGML is used as a specification to guide the printing process. The authors also highlight the further potential of the model to print varying scenarios to permit users to examine different schemes, as well as to add underground and terrain perspectives into the model.

Part 6: Ontologies

The final section of this UDMS Annual presents papers dealing with an issue that relates to much other research in the area of urban data management – Ontologies, which are required to facilitate both the appropriate use of spatial services and to underpin data integration.

The first paper in this group addresses an issue that will increasingly face users of GIS data and analysis – how to identify the most appropriate Geospatial Web Service (GWS) from those available to an end user. The need for this work is driven by an increasing availability of such services, and equally the ease of access to these services by end users as they are provided online. The paper proposes an ontology-driven process to narrow down the list of potential GWS, making use of the metadata describing the GWS to find the most appropriate match.

The second paper investigates ontologies for specific use in data conflation in disaster situations – specifically, those required for earthquakes, addressing the problem of integrating heterogeneous data in such situations to provide semantic interoperability.

2 OUR THANKS

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