GIS Application in Housing Price Studies: Case Study of 2014 Kaohsiung Gas Explosion

LUO Yilan and SUN Yajie

Abstract: The city of Kaohsiung has experienced a disastrous gas explosion on July 31th, 2014 due to petrochemical pipeline blast. After months of negotiation, Kaohsiung government, for the first time, opened the pipeline map to public on June 9th, 2015. This paper examines peoples risk aversion attitude toward pipeline location after the disastrous pipeline explosion by studying transactions in Kaohsiung housing market. Our results show that residential housing prices within 1.3 km of pipelines dropped 2% after the pipeline map came out, which is a significant decrease comparing to the increasing trend right after the explosion.

# housing price, hedonic regression (price) model, difference-in-difference (DID), hazard, disaster, exogenous shock

Analysing GIS Methodologies Used in Evacuation Planning

CHENG Wan Li and Stephanie KHOO

Introduction (excerpt and edited): The number of disasters continues to rise, as a result of a combination of increased vulnerability (from more people living in dangerous places) and climate change. A disaster is a shocking event that seriously disrupts the functioning of a community or society, by causing human, material, economic or environmental damage that cannot be handled by local agencies through standard procedures. Disaster management aims to reduce the impact of disasters and plan for emergency response. A common framework to use when discussing disaster management is the disaster management cycle which considers four cyclical stages: planning and mitigation, preparedness, response, and recovery. In this paper, we choose to focus on how GIS can be used in disaster preparedness, as it plays a vital role in minimising the damage caused by a particular disaster. We are specifically interested in evacuation planning. The importance of evacuation planning is multi-fold. People displaced from their usual residence face long-term social and psychological harm and suffer double the rate of illnesses compared to those undisplaced. Hence, a well-developed plan is required to minimise negative impacts and facilitate evacuation in an efficient manner.

# disaster, evacuation, risk, vulnerability, population estimation, minimum cost path analysis, multi-criteria decision analysis (MCDA), evacuation difficulty index, spatial optimization, linked open data (LOD)

Analysing Spatial Patterns with Social Media Data: A Case Study in Wuhan, China

WANG Jianyu and Isabelle CHAN

Abstract: With the mounting prevalence of social media use in recent years, not only in Singapore but across the world, this presents an exciting new track for research in the Geographic Information Systems (GIS) field and other related studies such as social dynamics. This study seeks to firstly review the academic studies that have been carried out on social media data over the past ten years, and secondly, conduct a case study with social media data collected from Dianping.com, a popular Consumer Review Website (CRW) in China that allows consumers to book, review and recommend restaurants in their vicinity, among various other services available for its users. The case study revealed interesting findings based on the spatial and statistical distributions of restaurants in Wuhan city.

# Social dynamics, Social media, Wuhan

Augmented Reality Applications to Planning & Architecture

Winston YAP and ZHANG Yan

Abstract: AR is emerging as a fast paced and competitive technology that is shaping industries. In the field of planning and architecture, AR is currently changing workflows and opening new windows of opportunities in the design process. With the first stationary AR prototype named “The Sword of Damocles” completed in the 1960s at Harvard University, the technology has since progressed to become much more portable and globally accessible. This shift in application mode has spurred increasing thought on possible application methods to address the wider interest of the community at large. In the field of planning and architecture, AR application can be used to help individuals with no planning or architecture background to understand the man-made environment. Building upon the arguments of famous planners like Jane Jacobs and Kevin Lynch, contemporary planners have realized the importance of engaging communities to build stewardship. AR can serve as an important tool to achieve this goal by helping people to understand the spatial implications of urban regeneration or redevelopment works that would otherwise be complicated to them through 2D plans. The paper reflects upon the current use of AR in the field of planning and architecture while providing a general introduction of the AR interface and operative characteristics.

# Urban planning, architecture, augmented reality, virtual reality

GIS Applications in Urban Planning: The Measurement of Urban Sprawl
Exploring How Different Types of DEM Affect Sea Level Rise Inundation Results from the Bathtub Model

HU Kang Hong Benjamin and Erickson Casiles LANUZA

Introduction: With sea-level rise (SLR) projections becoming more severe and a reality by the end of 21st century, the consequent impacts of flooding from sea surge are likely become more devastating especially to coastal cities globally. The monetary costs and the thousands of casualties resulting from flood hazards in the last decade have amounted to billions of dollars (USD), underscoring the importance of mitigation and adaptation measures. A key and increasingly relevant approach lies in flood inundation modelling of urbanized coastal regions. These flood inundation models have become a valuable tool for urban planners, policy makers and citizens themselves and offering scientific evidence and an opportunity to tackle the effects of climate change and SLR in the form of vulnerability assessments and maps. Notably, the ability of such models in predicting and mapping the extent and severity of flood hazards depend on capability and complexity of the models as well as the quality of elevation data used. The use of a simplistic inundation model provides a quick overview of the flood hazard arising from SLR subsequently proceeding to a more complex inundation model to produce more accurate flood vulnerability assessments. This study focuses on a conventionally used simplistic conceptual bathtub model to explore how the inundation model interacts with different types of digital elevation models (DEMs) to affect SLR mapping results, through a flooding simulation of 1m SLR on the Mekong Delta in Vietnam.

#: Sea-level rise, flood inundation model, bathtub model, hydrological connectivity, digital elevation model (DEM), Mekong Delta

How Effective is Ethnic Integration Policy (EIP) in Preventing Racial Enclaves in Singapore Public Housing?

LEONG Chan Hoong, KO Weiliang William, and XU Xiaoyi

Introduction (excerpt and edited): The objective of public housing in Singapore – and by extension, home ownership – is not limited to providing an affordable roof over the head. It was also designed to introduce multi-racial living among residential neighbourhoods and nurture a sense of belongingness. Indeed, public housing (i.e., HDB dwellings) is a pillar of social harmony in Singapore. However, by the mid-1980’s, there were signs of emerging enclaves as selected districts became more attractive to residents of certain racial groups. In sensing a drift to racial congregation, the Ethnic Integration Policy (EIP) targeting the resale market was introduced in 1989 to address this leaning. This study aims to explore the effectiveness of EIP in mitigating racial clustering since its inception 29 years ago by examining the spatial distribution of HDB flats that have met the three racial residential limits. Spatial data accessible via HDB Map Services and EIP status portal were downloaded and converted into maps with the help of OneMap APIs. The location data were then subject to spatial autocorrelation analyses. Collectively, the locations of the blocks experiencing over-quota and the characteristics of their respectively neighbourhoods will inform policymakers about the underlying racial dynamics within and across housing estates.

#: Ethnic integration policy (EIP), racial enclaves, public housing, HDB map service, One Map API, Morean's I, Singapore

Study on Spatial Distribution of PM2.5 Concentration

ZHUO Rui and LIN Yuqi

Introduction (excerpt and edited): The problem of urban air pollution has become more and more serious, which influences human’s daily life and health. The fine particulate PM2.5 is particularly harmful for human health. For controlling and preventing PM2.5 pollution, the spatial distribution of PM2.5 concentration and which factors have an interaction with it need to be identified accurately. Traditional approach to obtain PM2.5 concentration data from ground monitoring sites is not spatially continuous due to sparsely distributed air quality monitoring stations in most cities. In recent years, with the development of satellite remote sensing technology, the method of monitoring and simulating PM2.5 concentration based on remote sensing technology with high temporal-spatial resolution has been widely studied and applied. In the process of research, the geographical elements such as land use, road traffic and meteorology elements (wind speed, relative humidity, air pressure, temperature, precipitation) are gradually considered into the model structure. At present, there are mainly six methods to simulate PM2.5 concentration surface: 1) Spatial interpolation; 2) MODIS remote sensing image inversion; 3) Atmospheric dispersion model; 4) Land use regression (LUR) model; 5) Geo-weighted regression (GWR) model; 6) neural network model. In our project, we study on how the PM2.5 concentration distributes in Beijing-Tianjin-Hebei area in 2013. Specifically, we compare two main modelling methods–LUR model and neural network model–and validate these models by cross-validation. The model that obtains the better precision on predicting PM2.5 concentration will be applied in our study area.

#: PM2.5, air polution, geographic-weighted regression (GWR), neural network Beijing-Tianjin-Hebei

GIS-based Accessibility Analysis of Public Service Facilities
LU Yanru and WANG Binghui

Introduction: As the rapid population growth and the acceleration of urbanization process, rational and scientific urban planning to make cities more efficiently and human live more comfortably has drawn attention on the global scale. Public service facilities are the buildings or infrastructures constructed for satisfying residents’ daily requirements, including health care facilities, sports facilities, public parks, education facilities, and so on and so forth. Apart from providing variety public service facilities, if the accessibility to facilities is equal for residents, in other words, if the facilities are distributed evenly, is equally important. This study will introduce several methods, based on Geographical Information System (GIS), for quantifying accessibility of public service facilities, to provide advices on urban planning and also see how GIS can help us evaluating accessibility.

#: public service facility, accessibility, floating catchment area (FCA), gravity model, network analysis, Kriging

GIS-based MCDA Land Use Suitability

GAO Yujia and ZENG Junya

Introduction (excerpt and edited): With the increasing of population and economic, human activities have continuous impacts on land use. As a result, these impacts might lead to series complexities toward environment and land resources development. To evaluate what the extent does these impacts influence the land use and environment, we need to analysis land use suitability. Previously, various methods of spatial analysis for land use are commonly used in the suitability assessment studies. Specifically in accessing the suitability of land, GIS-based approaches, multicriteria decision analysis (MCDA), the analytical hierarchy process (AHP) method, fuzzy logic techniques, and artificial neural networks were frequently used. It should be pointed out that many case studies use a combination of these methods. All of these studies have been greatly important for land suitability assessment. However, most of these methods are based on knowledge and experiences of experts. Subjectivity is therefore an issue with these technologies. This report discusses two main methods that could avoid too dependence on experts which are Elimination method and BPNN model. It also discusses AHP-SA method for less uncertainty in MCDA.

#: land use suitability, multicriteria decision analysis (MCDA), analytic hierarchy process (AHP), fuzzy logic, artificial neural network

A Difference-in-Differences Approach to Evaluate the Effect of MRT Station on Public Housing Prices in Singapore

LIN Jie and ZHOU Xuejun

Introduction: In a country as land-scarce as Singapore, real estate, and real estate prices, are issues that are important to its economy and its inhabitants. Evaluating the impact of MRT station on real-estate values is an important application of the Difference-in-Differences approach. It is considered that the opening of the MRT stations will accelerate the growth of housing prices. The purpose of this case study is to prove whether it is true. Combined with other physical and location characteristics like area and age of the houses and the facilities surrounding the houses, this research can help predict housing prices and help government formulate reasonable price regulation and land use policies.

#: Housing price, mass rapid transit (MRT), difference-in-differences (DID), hedonic price model, geocoding, geocoding

Literature Review of Spatial Interpolation Tools for Elevation Point Data

XU Jingyi and LAI Roxanne

Introduction: Spatial interpolation is a technique used to create a continuous surface from a set of discrete points. There are many different ways of applying spatial interpolation to a dataset, and each interpolation tool embodies a different mathematical approach for determining the result, but they all make use of the existing data points to predict values at other unknown locations. Spatial interpolation has been used for diverse purposes – from precipitation studies to terrain analyses. In this paper, we focus on analysing spatial interpolation as a technique to interpolate a continuous digital land surface model from existing elevation point data (obtained as spot heights from professional surveyors) in ArcGIS. We conducted a literature review of suitability of each method for the dataset and explored different types of spatial interpolation tools found in ArcGIS as applied to elevation point data. The purpose of such an analysis is to improve the efficiency of current methods of creating surface models used by architects and planners for terrain analysis.

#: spatial interpolation, topography, point data, inverse distance weighting, natural neighbors, spline, triangular irregular network (TIN)