

## Airborne LiDAR bathymetry survey in Japanese Pacific coast in 2013

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In 2013, Airborne lidar bathymetry survey in Japanese Pacific coast was planned and partially conducted at several selected-sites.

The objective of this survey is to acquire detailed bathymetry data in Japanese Pacific coast which are important for Tsunami simulation as well as monitoring of coastal environment and ecosystem heavily damaged by the Great East Japan Earthquake occurred in March 2011.

An airborne lidar bathymetry system, Fugro LADS Mk. III, was brought to Japan for the first time in October 2012. Data acquisition flights over several coastal areas in Hokkaido, Tohoku, Mie, and Tokushima were conducted in November and December, 2012, and remaining areas in Tohoku and Izu were conducted in September and October, 2013. Obtained data are currently being calibrated and evaluated.

In this presentation, the outline of the survey including instrument specifications, mapping areas, and the survey schedule as well as lidar data acquired will be presented.

Keywords: Airborne LiDAR

## Identification of sidewalk steepness from LIDAR data for Tsukuba University campus bicycle riders

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### (1) Motivation

Bicycles are the most prominent travelling mode in many universities. Measurement of safety factors for sidewalk bicycle riders is essential for university authorities in order to concern public safety and to improve campus facility management information system. Information of sidewalk steepness is useful for daily bicycle riders inside the university campus in order to prevent unnecessary accidents while they are riding, especially at night.

### (2) Data and Methods

In this study, we used very fine scale Light Detection And Ranging LIDAR data to identify the sidewalk steepness by integrating with Smart Field Data Collection System\* and deliver the information through Campus Web-GIS.

### (3) Results

Based on our study, LIDAR data are much promising to detect sidewalk steepness in open spaces. However, the accuracy was reduced in some areas where the sidewalk covered with trees and bridges. Intensive field investigations are required to correct them. We built a *Smart Field Data Collection System* to correct and modify the results by using Android smart phone application.

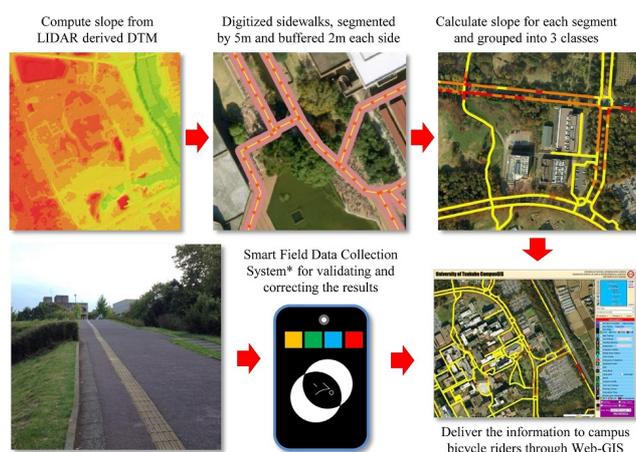
### (4) Prospect

Identification of sidewalk steepness from LIDAR data is cost and time effective. Additional user friendly real-time Web-based GIS field data collection system to collect, store and modify the results by multiple users is a great benefit for data validating purposes.

### (5) References

Yuji Murayama and Ko Ko Lwin, (2013). Smart Data Collection and Real-time Digital Cartography, IGU Kyoto Regional Conference 2013, August 4-9, Kyoto, Japan.

Keywords: Lidar, fieldwork, campusGIS



## The Buffer Zone Model of Natural Conservation Area

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### 1. Introduction

In the Kii mountainous region in the south Kinki area, there are preserved beautiful forest and river. However, the area faces problems of sustaining local industries as number of successors was declining due to the decrease of birthrate which is the major problem of Japanese society. Especially the decline of population and competitiveness of local industries are serious problems.

The 'Sacred Sites and Pilgrimage Routes in the Kii Mountain Range' are registered under the World Heritage Site in July 2004. This is the second example of linear type World Heritage Site. The first Site was the 'Camino de Santiago', which means the 'Way of St. James' in northern Spain.

The buffer zone of the 'Sacred Sites and Pilgrimage Routes in the Kii Mountain Range' is set as fifty meters from the center of the trails for both sides. This fifty meters' buffer zone was set without theory in terms of conservation of the environment around the World Heritage registered area.

The core area of the 'Camino de Santiago' is linear type as well. It connects cultural monuments, cathedrals and beautiful nature sites in Spain and in France. The buffer zones of the area was set for thirty meters from the center of the trails for both sides. However, if considering the visibility of the Pyrenees mountainous areas, wider area should be covered as buffer zone. As there are no standard criteria for the buffer zone setting that the study aims to develop GIS, which can determine the appropriate buffer zone.

### 2. Purpose of Report

In this report, we tried two studies; one was to survey the visibility of forest with plants laser measurement device. Secondly, the study achieved the method to describe the forest model in digital format. As for the further step, we will analyze the relationship between the result of the survey and the model. Based on the data we obtained, we will try to make a model to set buffer zone for conservation area.

### 3. Analysis

The analyzed area of this report is Koyasan Cyoichi-michi trail in the 'Sacred Sites and Pilgrimage Routes in the Kii Mountain Range' World Heritage Site. We surveyed several points using 3D laser scanner. The points were determined based on the pre-survey by photo and conventional measured. The points we surveyed differ such as vegetation and geographical conditions. The typical vegetation was the cluster of plants of cryptomeria. On an average within the seventeen meters there were many obstacles, which disturb visibility (24.7%).

We also analyzed to application of the survey results to a model plantation area for the comparison. The artificial plantation model is created from the typical trunks of trees with locations and even distances, which make the model to be quantitative.

We set the viewpoint surface every one meters. We estimated that the visible area and invisible area can be determined by setting lines between human visions and trees within. It showed the difference between visible area and invisible area. The percentage of the transitivity of visibility is calculated based on the above results.

The model is set based on periodical growth of plants. The previous study indicated that statistically cryptomeria of forty to sixty years old is majority of plantation. We calculated the distances of transitivity (an average distance) based on the visible-invisible analysis using GIS system. Finally, we verified the results (photographs) at the actual sites.

### 4. Conclusion

The study found out the possibility of the method that make the model of the buffer zone related with real space. The model we established in this study can expect statistically reliable results from simple survey method and objective data. The study will fine-tune results in applying the detailed data. Simultaneously, we aim to develop criteria based on the differences of the part of trees, as well as other natural environment.

Keywords: buffer zone, world heritage, Sacred Sites and Pilgrimage Routes in the Kii Mountain Range, GIS

## Effects of the buffer models in the estimation of the spatial SPM distribution at the sky of the Yokohama city

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In the estimation of the SPM distribution on successive region of interest from the concentrations observed at the observatories located in various places, the kriging method (Matheron, 1973) has been frequently employed. At the case, the universal kriging with auxiliary maps is used for minimize the variance of the estimation. In this study, two types of the auxiliary maps were used in the universal kriging estimation of the SPM concentration distribution. One of the map was a terrain map based on the DEM, and the other map is a buffer map generated from the buffer model based on the buffer distance from the coastline. However, if the region of interest is a wide area that includes a sea part and the land part, and if the observed values of SPM concentration at sea part have not been obtained, the validity of the estimated SPM distribution by the universal kriging may be affected by the used buffer models. Therefore, the effect of the buffer maps in the estimation of the SPM spatial distribution by a universal kriging was investigated in this study.

The SPM concentration data used in this study were published by the National Institute for Environmental Studies. The DEM data was extracted from the digital elevation models that have been published from the Geographical Survey Institute used with the FGDV application. The buffer model were created by the GIS applications based on the coastline data extracted from 1:200,000 Japan seamless geological map that was published from the Geological Survey of Japan. The coordinate projection method of all data were converted to Japan datum 2000 (JGD2000) to minimize the occurrence of error due to the difference of the projection method in geospatial computing. In the representation and geospatial statistical analysis of the data, the R language and its geospatial packages and, the Google earth and FOSS4G were used.

In this study, the observation points of the SPM concentration were present only on the land area and not present on the sea part. Moreover, the altitude of the sea part were all zero in the DEM data. Therefore, in the prediction by the universal kriging at the sea part, even if the variance of the prediction is small, the accuracy of the prediction may be lost at the relatively large buffer distances. So, some care may be required when the predicted distributions are used.

Keywords: GIS, Kriging, R-Language, FOSS4G, Google earth, JPGIS-GML-DEM

## Investigation of indoor positioning technology focused on signboard in railway station

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The acquisition of the outdoor location information has become convenient and precise by the appearance and development of the satellite positioning technology. Recently, it has been more high precise positioning on a centimeter level by the launch of the quasi-zenith satellite in 2010. So, the various services utilizing the location information have been produced. In this way, the location information has become more important and essential as a kind of social infrastructures. Under such circumstances, the acquisition of location information in the indoor environment where the satellite radio wave cannot reach has been regarded important as a next step.

In this study, the authors are going to investigate an indoor positioning estimation technology focused on the railway station. In the railway station, the various needs, such as the advancement of amenities, the facilitation of pedestrian movement, the universal design associated with an aging society, the creation of a compact space appropriate for the population decline society and so on, have been required. In particular, the development of the railway station with multiple functions like business has been recently promoted in the metropolitan areas. So, the spatial structure of the railway station has been complicate because it has been required to play various daily roles for urban residents. And the precise acquisition of location information is more important in the indoor environment like the railway station which has much complexity in recent years. Therefore, the authors are going to investigate an indoor positioning estimation technology in the railway station space. Especially, the authors pay their attention to the signboards of important information indicating "positional relations of the space" in the railway station.

First of all, the authors built the database of the sign system and the floor maps to estimate the indoor location. The authors built it with three-dimensional information including the display height in addition to the plane information by extracting the signboard from the photograph. Also, they built the attribute information like the size and direction of sign boards, and the type and number of pictograms in the database. So, they tried to estimate an indoor location by using the photograph. Actually, they extracted signboards in the photograph by using the image processing technology. After that, the rough location where the signboards were taken in photos can be grasped by matching the attribute information. It is necessary to set an area in each signboard. In this study, the authors set up "the effective visual field range" of signboard, because they assumed to take a photograph when the signboard is confirmed. Finally, they are going to estimate a detailed indoor location by using photogrammetry technology. For the purpose, it is necessary to orient the already known three points with coordinates. Therefore, in this study, the detailed location is estimated by using three-dimensional coordinates on four corners of the signboard in the database. This study could obtain certain results as an indoor positioning technology through the investigation of "the extraction of a signboard from the photograph", "the estimation of the area from effective visual field range" and "the estimation of the point location by photogrammetry technology".

In future, it is necessary to make an effort for the improvement of accuracy related to the technology used in this study. In addition, the authors have to build the system that can automatically estimate an indoor position from the photograph.

Keywords: railway station space, railway signboards, indoor positioning, image processing

## Handling non-aggregated person trip data with Web-GIS

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Understanding of human mobility from spatial perspective is important for urban transport planners, human geographers, social scientists and other spatial information users. Advances in geospatial data collection methods and communication devices, we can nowadays collect, store and integrate large amounts of data with GPS and GIS technologies, including mobile phone log data, real-time weather information, person flow data etc. However, handling of these Spatial Big Data require computational power and considerable period of time. Extraction of information from these Spatial Big Data is also challenging for end users in terms of time consuming and requires knowledge on spatial data handling and processing. Here we construct a Web-GIS to extract, visualize and analyze the Person Trip Survey (PTS) data by providing common GIS analytical functions to novice to expert users in timely manner.

Keywords: GIS, person trip, big data, spatial analysis, WebGIS, visualization

## The Process of Growth and Cityscape Transition in Modern Osaka

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Most of big cities in modern Japan had been growing up remarkably with modernization from the Meiji period. Especially, the structure of space has been changing dramatically throughout a revival development in the post-war and in the high economic growth period. As the result, it have been become difficult to see the cityscapes of the past which built up with the modernization. However, in recent years after the arrangement of urban infrastructure settled down, the community development or a tourism using the historical environment have been carried out, and the interest in history has been increasing. In other words, to keep the historical environment has been increasing importance as property of city. On the other hand, GIS becomes more familiar to us by geospatial information technology spreads rapidly in recent years, in the middle of a highly information-oriented society. Especially, the utilization GIS is effective for the historical research, because it can process long-term spatiotemporal information like transition analysis.

Osaka was prosperous as the Aqua Metropolis in Edo period, and has become the modern city crowded with public transport and high-rise buildings in Kansai area at present. In this study, the authors are trying to investigate the historical transition in Osaka with modernization by using geospatial information technology. And they are going to recognize again the existence of characteristics in urban space which formed and disappeared with modernization, and to aim at reconstructing the historical environment.

It becomes necessary to arrange the long-term change efficiently in the study of urban transition. Therefore the authors decided to use the topographical map for six terms in this study from the middle of Meiji period when the modernization began. The authors make the spatial data which the street and the wetlands from this topographical map. And they constructed the urban transition database by using both these data and the database which was already built the river and the railway in our laboratory. As a result of expressed urban transition, the authors grasped that Yodo River which was the most catchment area in the present was formed with repairing Nakatsu River in the late Meiji period. And, the Dohjima canal was dug in Umeda from the early Meiji until before the war, the authors thought that this area was different urban space from present day. Paying attention to the street, the right bank area of the old Yodo River focusing Umeda has been becoming earlier urbanization than the other areas. At the same time, the reconstruction of buildings in the built-up area repeated with modernization, and the authors found the possibility that a changing of the scene was taking place close to the old Yodo River. From these results, the authors direct their attention to Umeda and the old Yodo River basin, and tried to simulate of the cityscape transition using the three-dimensional models in this study.

A terrain model is important for constructing urban model. In this study, the terrain was created 140 kilometers square using digital elevation model (DEM) data based a knowledge of the precedent study. The features are created as landmarks and general houses using CAD/CG. The authors selected Osaka station of Umeda and the mint of the old Yodo River basin for landmarks. These are reconstructed in great detail basing historical materials. As a results of the simulation, the authors could visualized the landscape transition in Umeda and the old Yodo River basin with modernization.

As the result of this study, the authors clarified the historical transition in the part of Osaka by using GIS and CAD/CG. At the same time, they reconstructed the historical environment as property of Osaka. In the near future, they are going to construct the animation of the transition of Osaka for the communication tool by using created spatial data. And it is necessary for three-dimension models to improve the accuracy.

Keywords: modernization, cityscape transition, Umeda, old-Yodo River

## Landscape analysis of daimyo garden using photograph information

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In recent years, social media in the information technology have been developed remarkably. The scenes at sightseeing are photographed, and the photos are accumulated as the personal spatio-temporal information in a non-structured state on the Internet. In this study, the authors analyze the landscape phenomenon by using personal photographs, the photos are accumulated on the Internet in daimyo gardens.

Specifically, they take photograph images and spatio-temporal information on site and they pay their attention to the both sides of the space and time, and analyze the data on using GIS. At first, they choose the case study area from daimyo gardens where many tourists visit at present. Then, they pay their attention to the flickr is a photograph community site, and they make a photograph information database and grasp the scene phenomenon by using it.

Among other things, the three famous gardens in Japan are Kairakuen, Kenrokuen, and Korakuen. And Riturin-park is a beautiful garden as well as the three famous gardens. In addition, there are sightseeing spots that many people visit at present. Then, they collected spatio-temporal information and photograph images taken by the visitors in the four gardens by using the flickr API. As a result, Kenrokuen was selected as the case study garden for analysis.

At first, they utilize the Exif information contained in the photographic image data. This metadata is the information of the camera itself, and various information including the F-number and the focus distance are recorded with the positioning data. The Exif information is the index recorded at the time of the photography. In this study, the authors grasp visual characteristics of Kenrokuen by using the focus distance and a photography direction.

Based on the positional information, they plotted the focus distance on GIS with conversion into the 35mm film camera. As a result, they were able to grasp the characteristic in the garden. First of all, around the Ume grove, an angle of view range is narrow and people look the fixed scenes. People watched the buds and the flowers of the plum closely. The second is around the Kotoji-torou area. This area is an angle of view range is wide, and photography is carried out of showed, using the plural focus distances.

Then, the analysis was focused on the photographic images, The photography position is not usually fixed and shows a variety of distribution for one object. Therefore, the authors grasp each viewpoint field by a directional distribution analysis. In this analysis, the point cloud are photography positions, so the standard deviation ellipse created by the analysis is regard as the photography viewpoint field.

First of all, they classify the photographs and create the photography viewpoint fields. As a result, it was revealed that the place, where plural viewpoints fields were overlapped, while people went round the gardens. So, in the sequence around the garden, the people do not watch an object in turn, and it is thought that the features were seen under the complicate influence. In addition, as they investigate the relationship between the subject and the viewpoint field individually, they found several characteristics from the positional relationship between the object and the shape of the standard deviation ellipse. So, they classified photography viewpoint field based on the analysis and grasped viewpoint field with four different characteristics. They grasp on landscape phenomenon in viewpoint field at minute time, and they were similar to expression of the camera work.

In this study, the authors grasped visual characteristics of the case study area by using the Exif information. In addition, they grasp each viewpoint field for every photography object, and was able to model the viewpoint field.

Keywords: daimyo garden, landscape, photograph information

## Spatial pattern of agriculture using GIS and small area statistics

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The author used small area statistics of agriculture and composed grid square statistics to make spatial pattern of agriculture in the Kanto District of Japan using GIS. The grid square statistics is suitable for analyses in combination with other ready-made social and environmental grid-square statistics.

## GIS analysis of Australian urban social geography by using Census Table Builder Data designated by ABS

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A body of literature about multi-cultural aspects in Australia can be found in the fields of international politics, international relations and Australian history as well as Australian geography. Diverse origins of immigrants had a great impact on the changing structure of metropolitan areas in Australia. Based on some previous studies, non-English speaking immigrants, e.g. Greek and Italian in the 1960s, tended to live in the suburbs located 10-15 km apart from the Melbourne metropolitan core. These suburban areas were relatively “ less convenient area ” in terms of public transportation, but newly developed area supported strongly by motorization. New university, huge industrial parks, distribution centres and relocated suburban offices have been established in these newly developed areas. Immigrants in 1960s could only find affordable houses in these “ new suburbs, ” resulted in the expansion of the metropolitan area.

After 1990s and later, Australian cities are strongly affected by a “ surge ” of immigrants from Asian countries. They tended to live in the existed Asian communities located at the peripheries of the metropolitan area, much farther than “ new suburbs. ” Footscray in the west, Glen Waverley in the east and Springvale in the southeastern suburbs are typical examples of those communities.

In this paper, I focused on the changing structure of Sydney and Melbourne metropolitan areas in terms of diverse origins of immigrants. A GIS-based mapping with “ table-builder data ” distributed by Australian Bureau of Statistics was used to identify the process. This paper not only provides a methodological innovation but also a new and practical contribution to urban-social process studies.

Keywords: GIS, Australia, Urban area, Sydney, Melbourne, metropolitan area