

2011 IEEE Geoscience and Remote Sensing
Symposium

2011 IEEE 地球科學與遙感探測國際研討會

發表論文題目：

海報發表

Automatic extraction of shadow and non-shadow
landslide area from ADS-40 image by stratified
classification methodology

系所別：生物資源研究所

研究生：謝依達

派赴國家：加拿大

出國期間：100年8月22~31日

中華民國一百年八月一日

摘要

國立屏東科技大學生物資源研究所博士生謝依達參加 2011 IEEE 地球科學與遙感探測國際研討會(2011 IEEE Geoscience and Remote Sensing Symposium)，並以海報發表論文，題目為 Automatic extraction of shadow and non-shadow landslide area from ADS-40 image by stratified classification methodology (圖 1)。

AUTOMATIC EXTRACTION OF SHADOW AND NON-SHADOW LANDSLIDE AREA FROM ADS-40 IMAGE BY STRATIFIED CLASSIFICATION



Yi-Ta Hsieh¹, Shou-Tsung Wu², Chia-Sung Liao³, Yau-Guang Yui⁴, Jan-Chang Chen⁵, Yuh-Lung Chung⁶

¹Department of Geomatics Engineering, National Donggong University, 900 Taichung Rd., Taichung, Taiwan

²Department of Marine Geomatics, National Donggong University, 900 Taichung Rd., Taichung, Taiwan

³Department of Optical Engineering and Information Engineering, National Donggong University, 900 Taichung Rd., Taichung, Taiwan

⁴Department of Geomatics Engineering, National Donggong University, 900 Taichung Rd., Taichung, Taiwan

⁵Department of Geomatics Engineering, National Donggong University, 900 Taichung Rd., Taichung, Taiwan

⁶Department of Geomatics Engineering, National Donggong University, 900 Taichung Rd., Taichung, Taiwan

1. Introduction

Sediment disasters happened very frequently in Taiwan. Landslides and debris flows often seriously endanger the lives of people and the enormous property damage in mountainous regions. Therefore, it is important to monitoring landslide. Previous landslide mapping carried out by interpretation of stereoscopic aerial photographs, it can get accurately mapping results, but it takes a lot of manpower and time. Satellite remote sensing techniques have been successfully applied to landslide investigations, to identify and map landslides using digital image analysis. But, for optical remote sensing is affected by shadows, it is difficult to extract the information of shadow region. The shaded area of the landslide is often ignored in the landslide interpretation procedures. Recently, digital photogrammetric technology can achieve high spatial resolution, multi-spectral, 12-bit high radiometric resolution aerial image, and those airborne sensors offer some potential for the landslide interpretation of shaded area. The study aims to detect the landslides quickly and accurately from shadow areas and non-shadow areas by stratified classification method and via ADS-40 airborne multispectral images.

2. Methods

2.1 Study site and materials

The study area is located in the Nantou county, central Taiwan. The two dates of ADS-40 image sets were used. With shadow image (2008/12/27) was used for image digital analysis, and shadow-free image (2008/9/21) was used for validation of the shadow area landslide.

2.2 Shadow detection

In this study, we separated shaded area from non-shaded area using brightness method, and the brightness threshold value was determined by bimodal histogram splitting method, which selects the threshold by identifying the value at the valley between the two peaks in the histogram as the threshold for shadows and $B_{brightness} = \frac{R+G+B+IR}{4}$ non-shadows.

2.3 Landslide detection: Non-shaded area landslide

2.3.1 Vegetation index enhancement

In order to enhance the spectral characteristics differences between vegetation and non-vegetation, vegetation index enhancement technique was selected to help identify. NDVI can enhance the spectral characteristics differences between vegetation and non-vegetation for analysis images.

$$NDVI = \frac{NIR - R}{NIR + R}$$

2.3.2 ISODATA unsupervised classification

We used iterative self-organizing data analysis technique (ISODATA) unsupervised classification to classify the area of vegetation and non-vegetation. Using ISODATA to classify NDVI image into the 2, 3, 4 classes in the final output, respectively. The 3, 4 classes were derived to grouped non-vegetation class. The classification with maximum number of iterations set to 6, and the convergence threshold set to 0.95. The pixels were identified for each of the classes. Then, we get the distribution of non-vegetation area as the preliminary non-shaded landslide map.

2.3.3 Data filter

After we got the preliminary non-shaded landslide map, the data filters were used to reduce the classification noise (like salt and pepper effects). We use of existing land use layers to filter out artificial building area, and we also applied a 30m² minimum size of area filter. In order to reduce the classification error.

2.4 Landslide detection: shaded area

The shaded area landslide detection processes is the same as non-shaded area landslide detection processes. (1.vegetation index enhancement, 2. ISODATA, 3. Data filter).

2.5 Accuracy assessment

An accuracy assessment was performed for the non-shaded and shaded area landslide results, respectively. The non-shaded area landslide results were validated by interpretation of analysis image (2008/12/27). The shadow-free image (2008/9/21) was used for validation of the shadow area landslide. An 800 random points were sampled for non-shaded (400 points) and shaded area landslide (400 points) results. The user's accuracy, producer's accuracy, overall accuracy, and Kappa statistic were also calculated.

3. Results and discussion

3.1 Shadow detection

Table I shows an error matrix that was derived from the shadow detection results, the overall accuracy is reached to 98.72%, and the Kappa statistic is 0.98. The result shows high accurate shadow detection. The bimodal histogram splitting method has been successfully applied to threshold for shadows and non-shadows in many studies, and it provides a simple, robust way for threshold of shadow.

Observed \ Predicted	Shadow	Non-shadow	Sum
Shadow	100	2	102
Non-shadow	1	97	98
Sum	101	99	200

Overall Accuracy = 197/200 = 98.50%
Kappa = 197/200 = 0.985

3.2 Landslide detection

The landslide detection results (non-shadow, shadow) indicate four classes ISODATA cluster (NSA-4) which were reached the highest accuracy (92.75%, 85.75%). The non-shadow area landslide detection shows acceptable result. The classification of shaded area by 12-bit image radiation information has a certain capacity.

Class	Actual	Class	Producer's Accuracy (%)	User's Accuracy (%)	Overall Accuracy (%)
NSA-1	100	NSA-1	92.75	92.75	92.75
NSA-2	100	NSA-2	85.75	85.75	85.75
NSA-3	100	NSA-3	92.75	92.75	92.75
NSA-4	100	NSA-4	85.75	85.75	85.75

4. Conclusion

The result shows high accurate shadow and non-shadow area landslide detection. The classification of shaded area by 12-bit image radiation information has a certain capacity. This automated process can effectively and quickly obtain information of shadow and non-shadow landslide.

圖 1 2011 IEEE 地球科學與遙感探測國際研討會發表海報

2011 IEEE Geoscience and Remote Sensing Symposium 由 IEEE GRSS 日本分會主辦，會議地點原在日本仙台，由於今年 3 月 11 日東日本的大地震，以及相伴的大海

嘯淹沒了許多城鎮與村莊，超過15000人喪生，由於許多關鍵因素大會將IGARSS2011會議場地，由日本仙台改到加拿大溫哥華。

本次會議共100多國參與，涵蓋議題包括先進分析技術、土地遙測應用、海洋遙測應用、大氣遙測應用、環境遙測應用、感測器與載台研究、遙測資料管理、遙測資料教育、政策。共計2222篇論文投稿，經由嚴格審查，共計有1495篇論文通過審查，其中共計口頭發表835篇，共分為175個次議題；海報發表660篇，共分為75個次議題。

表1 會議議題

A	Advances in Analysis Techniques
A.1	Electromagnetic Modeling
A.2	InSAR and High Resolution SAR
A.3	POL and POLInSAR
A.4	Bistatic SAR
A.5	High Resolution Optical Sensing
A.6	Hyperspectral Sensing
A.7	Image Processing
A.8	Information Extraction
A.9	Geographic Information Science
A.10	Others
L	Land
L.1	Land Use and Land Cover Change
L.2	Soils and Soil Moisture
L.3	Forests and Vegetation
L.4	Land Ice and Snow
L.5	Wetlands and Inland Waters
L.6	Natural Disaster/Land slide
L.7	Others
M	Atmosphere
M.1	Precipitation and Clouds
M.2	Weather Prediction and Data Assimilation ??

M.3	Atmospheric Sounding
M.4	Aerosols and Atmospheric Chemistry
M.5	Others
O	Oceans
O.1	Ocean Biology (Color) and Water Quality
O.2	Ocean Surface Winds and Currents
O.3	Ocean Temperature and Salinity
O.4	Ocean Altimetry
O.5	Sea Ice
O.6	Others
E	Environmental Applications
E.1	Subsurface Sensing / Ground Penetrating Radar
E.2	Urban and Built Environment
E.3	Coastal and Wetlands
E.4	Pollution and Contamination
E.5	Geology and Solid Earth
E.6	Agroecosystems
E.7	Others
S	Sensors and Platforms
S.1	SAR Instruments, Missions and Calibration
S.2	Active Microwave
S.3	Radiometer Instruments and Calibration
S.4	Lidar Sensors
S.5	Passive Optical and Hyperspectral Sensors
S.6	UAV and Airborne Platforms
S.7	Ground-Based Systems
S.8	Others
D	Data Management, Dissemination, Education and Policy
D.1	Data Management and Systems
D.2	Remote Sensing Data and Policy Decisions

D.3	Education and Remote Sensing
SPC	Student Paper Contest

一、目的

IEEE 地球科學與遙感探測國際研討會每年舉辦一次，希望藉由本次國際研討會交流，以瞭解目前全球地球科學與遙測研究的趨勢外，亦可將本次研究重點與其他國家學者交流，互相交換意見，並尋求外來合作機會。

二、參加會議經過

2011年7月24~29日於加拿大溫哥華國際會議中心參加2011 IEEE 地球科學與遙感探測國際研討會。



圖2 研討會會場一隅

學生本次發表的內容主要以崩塌地製圖之研究為主，國際間對於崩塌地研究的議題所佔比例也相當高，崩塌地製圖的研究，多以遙測資料進行影像數值分析為主。

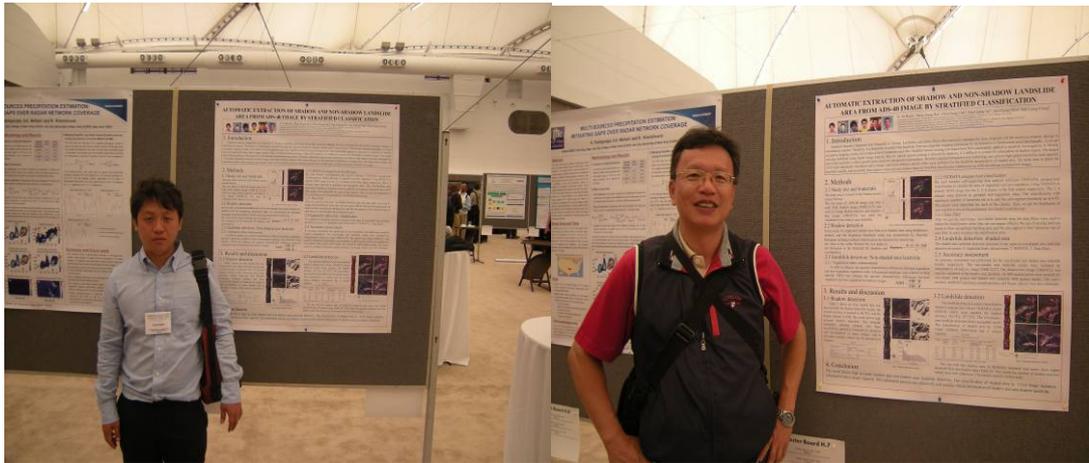


圖 2 海報會場一禹

本研究以數值航測影像進行崩塌地製圖，並針對陰影區域與非陰影區域的影像，進行崩塌地製圖。再與會中，有多位學者對本研究提出多方建議，多針對陰影區域製圖的建議，建議未來可搭配其他高光譜遙測資料進行研究等等意見。

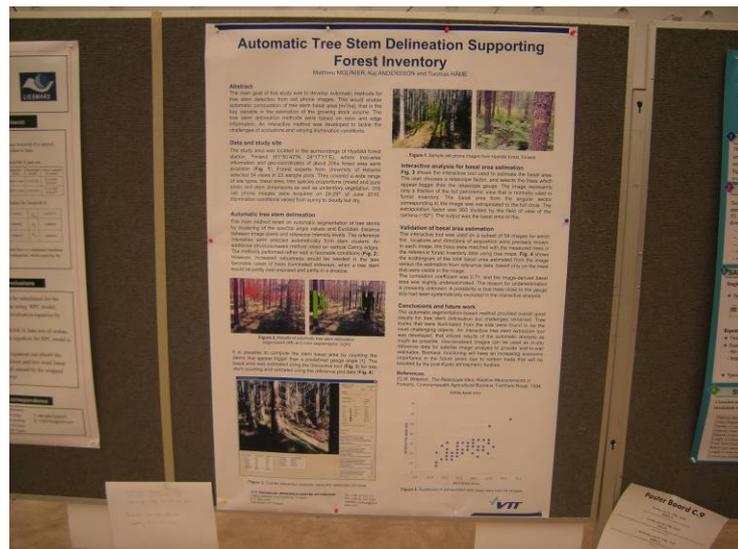


圖 3 海報會場次一禹

本次會議聆聽多場口頭發表場次，包括目前遙測航測趨勢與發展，影像分析技術的研究、災害偵測技術的研究、全球氣候變遷、森林觀測的研究等等議題，與會中新增許多研究方法論與分析技術之概念，可供未來研究之參考。



圖 4 口頭報告場次一禹

三、與會心得

聽了許多場次報告者專業的報告後，學生覺得在專業知識及技術方面還有許多進步空間，未來希望可以將所研究針對林地災害著手，利用先進遙測技術，希望可以更快獲得資訊、節省人力與物力，並配合森林資源多目標經營之發展趨勢，培育林木、遊憩及野生動物資源等之經營管理訓練後，使自己能夠發揮所學專長，讓森林資源發揮永續性、公益性及經濟性之最大效益。

四、建議

感謝恩師鍾玉龍教授讓學生有機會可以參加本次國際研討會，也感謝教育部及本校在經費方面的補助交通費(18,000 元)，使學生能順利參與 2011 IEEE 地球科學與遙感探測國際研討會。

本次大會不僅讓學生在專業知識上有更深入的瞭解，讓學生瞭解到目前世界地球科學與遙測上的發展趨勢，除了在增廣見聞外，更學習到許多報告及解說的技巧，使學生不會再畏懼用英文報告與回答，未來若還有機會上台發表，必會發揮所學。整體而言，本次研討會圓滿落幕，對學生而言獲益良多，受用無窮。

五、攜回資料名稱及內容

2011 IEEE 地球科學與遙感探測國際研討會論文集摘要、論文集光碟、相關海報、書籍與書目。

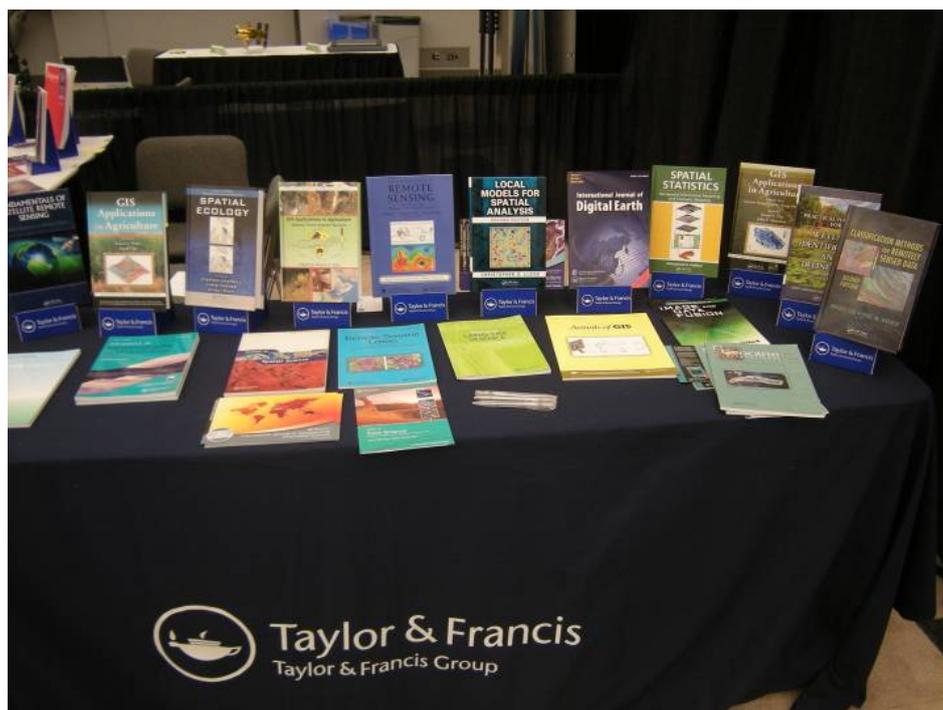


圖 5 攜回相關資料