利用 python 自動化快速繪製地震誘發山崩之山崩潛感圖

報告者：沈楷庭
指導教授：董家鈞 老師
報告日期：2023/02/24

摘要

台灣位於環太平洋火山地震帶上，一年中發生地震的次數可說是不計其數，台灣又有許多活動斷層，可能正在醞釀大地震的發生，根據統計，發生地震所奪走的生命財產損失除了地震本身外，再來就是地震所引發的山崩，因此在地震發生時能快速且準確地知道哪裡可能會發生山崩是件重要的事，除了可以盡快疏散村民，也可以提供給救難隊，讓他們知道哪裡需要救援。

本研究希望透過 python 可以即時的繪製山崩潛感圖，減少費時的人工資料處理，透過程式在數分鐘內及時發布山崩潛感圖，降低生命財產的損失，在本研究中參考了李錫堤教授 2014 年在 Engineering Geology 發表的文章來製作本研究的模型，文章內使用羅吉斯回歸計算潛感值，使用了坡度、坡向、岩性…等八個因子作分析，將因子代入回歸式，得到全台灣的潛感值，最終根據統計，Area under the Curve of ROC（AUC）=0.906，另外也使用了全新的概念生產模型，在本研究中將使用愛氏震度(Arias Intensity)把資料做劃分，並計算出在不同震度下的羅吉斯回歸模型，期望可以利用此方法找出在不同震度下哪些因子會有較顯著的影響。

在未來希望能挑選一個最適當的模型，並轉換成自動化程式，當主震發生時，在第一時間利用遙測技術蒐集山崩目錄以及強震站的地震訊號，進行羅吉斯迴歸分析得到模型，在配合現在正在發展的餘震預測技術，先行得到餘震可能的震度圖，將這些因子代入計算好的模型，就可以得到餘震可能造成的山崩分布，進而減少餘震帶來的二次傷害。

關鍵字：羅吉斯回歸、山崩潛感圖、機器學習

Using python to automatically draw the landslide susceptibility map of earthquake-induced landslides

Presenter：Kai-Ting SHEN
Advisor：Prof. Jia-Jyun Dong
Date：2023/02/24

Abstract

Taiwan is located on the Pacific Ring of Fire, where earthquakes occur frequently throughout the year. With numerous active faults, the possibility of a major earthquake is always present. Statistics show that in addition to the earthquake itself, landslides caused by the earthquake can also result in significant loss of life and property. Therefore, it is important to quickly and accurately identify areas at risk of landslides during an earthquake, not only for the evacuation of residents but also for rescue operations by emergency personnel.

This study aims to use Python to produce real-time landslide susceptibility maps, reducing the need for time-consuming manual data processing. By using the model developed by Professor Chyi-Tyi Lee in 2014, which employs logistic regression to calculate the susceptibility based on eight factors including slope, aspect, and lithology and so on. This logistic regression equation was applied to obtain the landslide susceptibility values for the entire of Taiwan. The resulting Area Under the Curve of ROC (AUC) was 0.906. Additionally, the study used a new concept production model, utilizing Arias Intensity to divide the data and calculate the logistic regression model under different seismic intensities. The hope is that this method can identify which factors have a significant impact on landslides under different seismic intensities.

In the future, the goal is to select the most suitable model and convert it into an automated program. When a main earthquake occurs, remote sensing technology will be used to collect information on landslides and seismic signals from strong motion stations. Logistic regression analysis will be conducted to generate a model, then after combining the developing technology of aftershock prediction, an aftershock intensity map will be generated. By inputting this information into the previously calculated model, the distribution of potential landslides caused by aftershocks can be identified, reducing the potential for secondary damage.

Keyword: Logistic Regression, Susceptibility map, machine learning