應用人工智慧技術發展坡地崩塌風險評估模式

Developing Landslide Risk Evaluation Model using Artificial Intelligence (AI) Techniques

主管單位：行政院農業委員會水土保持局

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摘要

本團隊過去在農委會水土保持局(以下簡稱水保局)相關計畫中，已透過建立易損性模式，針對坡地崩塌發生之可能性進行研究，針對陳有蘭溪、旗山溪、荖濃溪集水區（以下簡稱陳荖旗）等示範區進行相關資料蒐集彙整，完成雙變量坡地易損性分析，針對不同類型之坡面導出不同雨量觸發因子(最大小時降雨和總有效累積雨量)及崩塌地文因子(地質、坡度、坡向、河道遠近、植生、歷史崩塌)之易損性曲線，並與降雨危害曲線整合為一套崩塌風險警戒機制模式。

過去本計畫所發展之雙變量坡地易損性曲面是建立在有限的颱風事件中，不能將其視為適用於所有豪大雨及颱風事件，因為不同的災害事件代表不同災害規模(Scale disaster)，這對重點聚落而言將會造成不同程度的災害問題，因此本計畫期於今年度計畫中將盤點 2008-2018 全台重大颱風豪雨事件，經資料探索，初探各事件於陳荖旗的雨量範圍，並針對雨量範圍決定事件規模，以挑選具有各規模代表性之事件的衛星影像進行環境資料(地文資料)的萃取，以擴增崩塌事件資料庫。另一方面，隨著機器學習及人工智慧(AI)技術的興起，如何將本計畫過去所累積大量之崩塌資料庫(事件、雨量、地文資訊、崩塌地判釋等)與人工智慧技術有效的融合亦將是本計畫今年目的之一：精進求取崩塌比率之研究，由於人工智慧演算法建立通常需要一個包含大量資料的資料庫做為支撐，因此對於擴大資料數據集及資料數據之品質控管則就相對重要，本計畫將利用人工智慧類神經網路建立崩塌比率評估模型，基本上，其具有包含許多外部神經元的主要架構，該概念可以使用類似的神經網絡結構來構建更複雜的深度網絡，其優勢為大量資料能夠即時回應、處理及快速運算，減少人工求取參數之成本，且其能夠在獲取到新的資料後再次調整自身參數，以保持良好的推估模式及精準度。經過上述的人工智慧技術於崩塌比率評估模式精進後，後續亦可整合於本計畫過去所發展之崩塌風險警戒機制模式，以達到協助防災應變決策之目的。

關鍵詞：風險管理、人工智慧、警戒模式、坡面單元、崩塌

Abstract

The research group of this project has been worked with Soil and Water Conservation Bureau (SWCB) for years in developing fragility curve model for landslide potential evaluation. The study areas in the previous projects are at Chenyoulan, Laonong, and Qishan catchments (CLQ catchments). The research group had completed the bi-variable landslide model, including the triggering factors (max. hourly rainfall and accumulated rainfall), and environmental factors (geology, slope, aspects, distance to rivers, vegetation coverage, and landslide history). In association with the rainfall hazards, the landslide potential evaluation model was established.

In the previous studies, the data used to develop the landslide potential evaluation model was from limited events of typhoons and heavy rainfalls. To extend the database and the capability of the model, more typhoon or heavy rainfall events will be included in the model in order to consider the impacts of scale and intensity of an event. The events occurred during 2008 to 2018 will be selected to estimate the event scale and impact range, and be used to reasonably represent the influence in terms of rainfall indices. The satellite images of selected events will be also used for identifying landslide locations and areas. Besides, the application of artificial intelligence (AI) is increasing in many fields. Lots of data obtained from the previous researches will be used for AI application, in order to enhance the data processing and parameter determination of landslide ratio curves. Because a database of lots of data is usually necessary for AI adoption, extending current database and increasing quality of data is very important. The Artificial Neural Network (ANN) algorithm will be applied in estimating landslide ratio and its curve parameters. Basically, ANN contains a lot of neurons, and can be used to construct complicated networks. The advantages of using ANN are fast data processing, calculation, and responds, and reduced cost of manual operations. ANN can self-adjust to match a better results and accuracy. Through the ANN process, the landslide potential evaluation will be enhanced in data processing and better capacity of representing the landslide risk. The combination of AI application and the models from previous researches will result in a considerably reasonable model for landslide risk evaluation.

Keywords：Risk management, Artificial Intelligence, Warning criteria, Slop unit, Landslides