

機械視覺應用於土石流監測之研究

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摘 要 本研究之目的在於藉由「機械視覺」(Machine Vision)原理,分別針對不同土石流流動現象,研擬不同土石流情境之影像處理法則,以非接觸監測方法判識土石流是否發生。

本文經由數位影像處理與機械視覺理論分析,分別針對實驗與現場模擬土石流之發生流動過程分析,以「移動之物體判識」、「土石流波前判識」、「現場溪床之特定物判識」及「土石流與洪水紋理判識」等四種影像處理方法,進行土石流影像監測及土石流特徵值研究,並以水槽實驗對現場之不同情境加以輔助模擬,驗證相關參數值之正確性,以增進影像判識成功率。

經由室內渠槽球體滾動、渠槽土石流模擬實驗及實際影像分析結果,針對物體移動速度檢定、波前變化亮度差值、漆石影像灰階直方圖及影像紋理參數予以探討,其檢定結果良好,說明以機械視覺理論作為土石流判識是為可行。最後,各影像處理方法之監測門檻值予以整理歸納,並提出監測流程之整合方案建議,以提供建立土石流判識監測系統之應用參考。

關鍵詞: 機械視覺, 土石流判識, 數位影像處理。

'Machine Vision' Applied for Detecting the Debris Flow

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ABSTRACT This study proposes a machine vision system for detecting the occurrence of debris flow. The image process methods for determining a variety of debris flow conditions are developed without the aid of other contact-type sensors.

Various physical quantities of the debris flow, such as velocity and displacement, can be determined by the machine-vision system. Four categories of machine-vision detection methods, including 'floating article on the debris flow', 'wave front of debris flow', 'specific objects on the stream bed' and 'image texture recognition', were proposed and analyzed by flume experiments and actual field video records. Through considering the complexity of experimental conditions, the results can calibrate the parameters used in the computer model effectively and verify the feasibility of machine-vision detection.

Through the ball rolling test and debris flow test in the flume, specific objects could be well recognized when the objects were painted white or silver. The front of the debris flow could easily be identified when the crucial brightness threshold was determined

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beforehand. In addition, the velocity and the texture of the debris flow could also be estimated. In general, the experimental results showed that the machine-vision methods derived in this study have a reasonably good accuracy of detection. Finally, the threshold of each detection method as well as an integrated detecting system are proposed so that this machine vision system is capable of acting as an alternative alarm system in detecting debris flow .

Key Words: machine vision, debris flow detecting, digital image processing.