高光譜影像應用之建物石綿浪板監測

Monitoring Of Building Asbestos Wave Board By Hyperspectral Image Application

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摘　要

石綿因其絕熱、耐腐蝕等特性在民國 60、70 年代廣泛應用於各種建材，目前世界衛生組織(WHO)也已將其列為一級致癌物，而環保署也從民國 78 年將石綿列為公告毒性化學物質，直到民國 95 年，經濟部標準檢驗局公告禁止使用石綿建材。雖然石綿建材已完全禁用，但過往使用之石綿建材仍舊存在，尤其以石綿浪板為主。高光譜影像因窄波特性能快速判釋石綿浪板與其他建物屋頂材質差異，研究中測試了傳統光譜角(SAM)以及深度學習 U-NET 分類方式，皆得到良好成效，因而使用部分臺灣地區現有的高光譜影像作為後續航拍影像、衛星影像地真資料，更利用地面高光譜儀器蒐集石綿瓦屋頂高光譜，並搭配合格石綿檢測實驗室進行定性定量檢測，用於驗證判釋結果，均得到良好回饋，最終成果匯入網路版地理資訊系統-「波形石綿瓦屋頂空間分布系統」，提供後續地方政府以及基層人員進行拆除以及相關管理與管制之用。

關鍵詞：石綿，高光譜影像，地理資訊系統

Abstract

Asbestos had been widely used in a variety of building materials for its adiabatic and corrosion-resistant nature. However, medical research has found asbestos fibers to be harmful to the human health and the World Health Organization (WHO) currently classified asbestos as one of the primary carcinogens. Since 1989, the Environmental Protection Administration has also revised regulations to list asbestos as a declared toxic chemical substance. By 2006, asbestos was completely banned as a building material from BSMI (Bureau of Standards, Metrology and Inspection). Nevertheless, earlier construction projects made of asbestos materials still remained in existence. In order to investigate the asbestos roofs in Taiwan, this project combined remote sensing technology (i.e. hyperspectral, aerial and satellite images) with artificial intelligence and machine learning to identify their distribution. Hyperspectral

images can quickly interpret the difference between asbestos corrugated board and other building roof materials due to the narrow band performance. In the study, the traditional spectral angle(Spectral Angle Mapping,SAM) and the deep learning U-NET classification method were tested, and good results were obtained. Furthermore, ground-based hyperspectral imagers were also used to collect asbestos-related hyperspectral data. The asbestos roof tiles collected were tested qualitatively and quantitatively by asbestos laboratories This project established a Web geographic information system (GIS)– the “Baseline Survey Map of Corrugated Wave Asbestos Roof Tiles” to help local governments demolish, manage, and regulate asbestos.

Keywords: Asbestos，Hyperspectral imagers，Geographic Information System