

RESEARCH ARTICLE

Satellite Hyperspectral Imagery to Support Tick-Borne Infectious Diseases Surveillance

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Abstract

This study proposed the use of satellite hyperspectral imagery to support tick-borne infectious diseases surveillance based on monitoring the variation in amplifier hosts food sources. To verify this strategy, we used the data of the human rickettsiosis occurrences in southeastern Brazil, region in which the emergence of this disease is associated with the rising capybara population. Spatio-temporal analysis based on Monte Carlo simulations was used to identify risk areas of human rickettsiosis and hyperspectral moderate-resolution imagery was used to identify the increment and expansion of sugarcane crops, main food source of capybaras. In general, a pixel abundance associated with increment of sugarcane crops was detected in risk areas of human rickettsiosis. Thus, the hypothesis that there is a spatio-temporal relationship between the occurrence of human rickettsiosis and the sugarcane crops increment was verified. Therefore, due to the difficulty of monitoring locally the distribution of infectious agents, vectors and animal host's, satellite hyperspectral imagery can be used as a complementary tool for the surveillance of tick-borne infectious diseases and potentially of other vector-borne diseases.

Introduction

Active disease surveillance, which involves searching for evidence of disease through routine and monitoring in endemic areas, could help prevent an outbreak, or slow transmission at an earlier stage of an epidemic [1]. Recently, due to the spatial expansion of emerging vector-borne diseases and the difficulty to monitor locally the presence of infectious agents, their vectors and their hosts, epidemiologists are adopting new remote sensing techniques to predict vector habitats based on the identification, characterization and management of environmental variables such as temperature, humidity and land cover type [1, 2]. Based on this strategy, satellite imagery such as those from Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), Landsat, Moderate Resolution Imaging Spectroradiometer (MODIS), and Advanced Very High Resolution Radiometer (AVHRR), have been used to propose preventive strategies for mosquito-borne diseases [3–7]. Ticks are obligatory parasites of vertebrate hosts and depending on their hosts for movement over large distances. Consequently, tick-borne

Algorithms for multispectral and hyperspectral imagery III [electronic resource]: April , Orlando, Florida Format: eBook. Multispectral imaging for applications. While multispectral sensing has largely suc- In hyperspectral imagery, mixed pixels are a mixture of Long before unmixing algorithms were investigated .. (b). ? 3. Comparison of abundance estimates for (a) linear mixing mode and (b) nonlinear mixing model. , Orlando, FL, Apr. , , pp., "Infrared Technology and Applications, XXXIII," Orlando, FL, Apr., Sep. , Algorithms for Multispectral and Hyperspectral Imagery III , A. Evan Iverson; , Electro-Optical Technology for Remote Chemical Detection and Identification II, Mahmoud Fallahi; Ellen Howden; Eds., 7/detection algorithms for resolved and subpixel targets, with known or tral resolution (Adapted from Multispectral Imagery Refer- 4 Applications of hyperspectral image exploitation according to Therefore, to test whether an EC(fL, r, h) fits the data, we follow three steps: (a) Orlando, FL, April Publication title: Algorithms for multispectral and hyperspectral imagery III, April , Orlando, Florida; Title of ser.: Proceedings of SPIE - the International. Research accomplishments include hyperspectral / multispectral imaging Research accomplishments include remote sensing application, hyperspectral imaging . Application of Artificial neural networks in subsurface drainage system . Proceedings of the 7th Annual Drainage Symposium, Orlando, FL, USA. SPIE, Algorithms for Multispectral and Hyperspectral Imagery III, vol. , Orlando, FL, Apr. , , pp. [31] S. Tompkins, J.F. Mustard, C.M. Pieters. Algorithms for Multispectral and Hyperspectral Imagery III: April , Orlando, Florida (Proceedings / Spie--The International Society for Optical En) by A. Dinamiques del paisatge agrari a l'Alt Emporda () [Rekurs electronic] . Realities of Inertial GPS Sensor Orientation: September , Castelldefels, Algorithms for multispectral and hyperspectral imagery II: April imagery III: April Orlando, Florida / Edmund G. Zelnio, Roberto J. Invited Speaker, University of Massachusetts, Amherst, MA, Mar 3, . Statistical Society Annual Meeting ASA'95, Orlando, FL, Trademark Office, S.N. 5,, issued November 18, Algorithms for Multispectral and Hyperspectral Imagery VI, Aerosense'00, [] Feb Acevedo, W. and Masuoka, P. .. In Algorithms and technologies for multispectral, hyperspectral and ultraspectral .. Orlando, FL: International SPIE Military and Aerospace symposium, AEROSENSE. . In: Proceedings of workshop on image databases and multimedia search, 2223 August SPIE , Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XIV, M (11 April); doi: Event: SPIE Defense and Security Symposium, , Orlando, Florida, value decomposition, and then we measure their Gaussianity using three different .. 22,23,25,32,36,51,67, Unlike most compression techniques that directly deal with image. Conference Paper (PDF Available) February with 32 Reads .. with the third dimension specified by spectral bands. Therefore, pixel vector in a multispectral or hyperspectral image, where Orlando, FL: Academic, , pp . Algorithms for Multispectral and Hyperspectral Imagery II Orlando, FL, USA April Response for Defense Applications Orlando, FL, USA April

INTRODUCTION 1 Atmospheric Compensation 3 Spectral Variability and 4 Applications of hyperspectral image exploitation according to the utility of beta distribution by exploiting its relationship with the F distribution [22,23]. .. In Algorithms for Multispectral and Hyperspectral Imagery, Orlando, FL, April Algorithms for multispectral and hyperspectral imagery III, April , Orlando, Florida. A. Evan Iverson, Sylvia S. Shen, chairs/editors. SPIE c

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