MASTER OF SCIENCE
IN
SYSTEMS TECHNOLOGY

THE POTENTIAL IMPACT OF HYPERSPECTRAL IMAGERY ON AMPHIBIOUS WARFARE PLANNING

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Military image analysts primarily use panchromatic and radar images to aid situational awareness in preparing a mission plan. Although analysts rely on these two formats, there are situations where these two sensors are unable to detect potential threats, i.e., buried mines. The Department of Defense has proposed using a hyperspectral sensor to detect threats that otherwise may not be detected by existing sensors. In order to determine the utility of hyperspectral imagery for mission planning, a task analysis was conducted at two Joint Intelligence Centers to measure image analysts' preferences to infrared, radar, panchromatic, and hyperspectral imagery during an amphibious planning process. The results showed that the image analysts were most confident using panchromatic imagery for the majority of the planning tasks; however, the analysts exhibited uncertainty for other tasks, such as detecting buried mines. Further analysis showed that image analysts could reduce their uncertainty in detecting buried mines and producing bathymetric maps by using hyperspectral imagery. Although hyperspectral imagery reduced uncertainty during mission planning, operators report that this imagery is confusing. To integrate hyperspectral imagery in mission planning, image analysts must be trained to interpret a hyperspectral scene and understand how to exploit its' spectral characteristics.

DoD KEY TECHNOLOGY AREA: Sensors

KEYWORDS: Sensors, Visual Information Processing, Hyperspectral Imagery, Spectral Imagery, Image Interpretation, Amphibious Planning

SENSOR FUSION FOR TERRAIN CATEGORIZATION

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Spaceborne multispectral imaging for terrain classification has been used successfully to identify types of crops and ground cover for agricultural and land management purposes. The information derived from combining multiple sensors operating in different spectral bands into a single image has proven more valuable than that derived from a single band. Although multispectral imaging has not traditionally been associated with military reconnaissance satellites, the ability to automatically identify terrain type has military applications in battlefield characterization and target location. This thesis constructs a multispectral image by combining data from different sensors, and then uses this image for terrain

categorization, or TERCAT. One military location in Southern California, San Clemente Island, was imaged using both civilian and National Technical Means (NTM) spacecraft. The civilian images were merged and analyzed using commercial imagery analysis software, producing classification maps of high quality and compared with the results of the same process performed on the NTM data. The military utility of TERCAT products was explored, with emphasis on the intelligence value of the products.

DoD KEY TECHNOLOGY AREA: Sensors

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