DETECTION OF SEARCH AND RESCUE TARGETS IN DIGITISED
MULTISPECTRAL IMAGERY USING ARTIFICIAL NEURAL NETWORKS

By

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ABSTRACT

Search and Rescue (SAR) operations usually involve aircraft overflying possible target areas with target identification effected manually by observers. Automating the identification not only aids the search crew in reducing fatigue, but also helps in finding targets that may be missed or are not very visible to the naked eye. An automated method using a multispectral camera coupled with an artificial neural network was developed to identify search and rescue orange targets from digitised imagery. A deployable C++ program was written to incorporate an image prefilter phase that used spectral ratios to isolate the orange colour of the target, and a feedforward neural network that correctly identified whether the remaining pixels from the prefiltering phase were in fact target pixels.

Data were gathered under a variety of environmental conditions, such as different amounts of ambient light over open fields, water, summer forest, autumn forest, and snow. In all, approximately 40 images containing a search and rescue orange target were collected.

Three prefiltering mechanisms were examined: spectral ratios, principal component analysis, and correlation coefficients. Of the three methods, spectral ratios was the most successful in eliminating the largest percentage of non-target image data with the most efficiency. On average, the processing time for a set of filter bands using the spectral ratio was 20 seconds, including the time to run through the neural network. This was faster than both the principal component and the correlation coefficient methods that averaged over 60 seconds and 45 seconds respectively.

Remaining pixels from the prefiltering phase were passed to the neural network for positive identification. A backpropagation feedforward neural network with 12 hidden nodes, trained using the extended delta-bar-delta rule, was found to give the optimum results in both the training and test sets. The network achieved a correlation coefficient of 0.97 between the predicted and actual output value, with a root mean squared error of 0.19. In validation, the network was able to isolate and identify the search and rescue orange target in every case, with few false positive results and no false negative ones.
References


