Gas Plume Species Identification in LWIR Hyperspectral Imagery by Regression Analyses

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Abstract:

Identification of constituent gases in effluent plumes is performed using linear least-squares regression techniques. Overhead thermal hyperspectral imagery is used for this study. Synthetic imagery is employed as the test-case for algorithm development. Synthetic images are generated by the Digital Imaging and Remote Sensing Image Generation (DIRSIG) Model. The use of synthetic data provides a direct measure of the success of the algorithm through the comparison with truth map outputs. In image test-cases, plumes emanating from factory stacks will have been identified using a separate detection algorithm. The gas identification algorithm being developed in this work will then be used only on pixels having been determined to contain the plume. Stepwise linear regression is considered in this study. Stepwise regression is attractive for this application as only those gases truly in the plume will be present in the final model. Preliminary results from the study show that stepwise regression is successful at correctly identifying the gases present in a plume. Analysis of the results indicates that the spectral overlap of absorption features in different gas species leads to false identifications.

David Pogorzala received a Bachelor's degree in Imaging Science from Rochester Institute of Technology in 2002 and is currently working on his Imaging Science Masters degree. His research interests include remote sensing, synthetic image generation, target identification and algorithm development. His thesis involves the identification of plume gas species present in factory stack releases in overhead imagery using linear regression techniques.