Dr Pouya Bolourchi from Final International University, Turkey, talks to Electronics Letters about his paper 'Entropy score based feature selection for moment based SAR image classification', page 593.

Tell us a little bit about your field of research.

Feature detection and classification of images is one of the most fascinating topics in image processing, which is why I have been working on various topics in this subject field for more than five years. My recent research focus has included remote sensing, especially in the classification of synthetic aperture radar (SAR) images of ground vehicles. The increasing number of databases, as a result of enhanced SAR acquisition systems, has turned this field into a major research direction to follow. I believe that the industrial demand for remote sensing will exponentially grow and there will be more opportunities to improve the processing and analysis of SAR images. Target recognition consists of three major phases, including feature extraction, feature selection and classification. My research contributes to the first two phases.

What advance have you reported in your Electronics Letters paper?

Instead of proposing a new feature extraction technique, this Letter focuses on the selection of the most discriminative features that are generated by different feature extraction algorithms. The proposed entropy score-based feature selection method is effective for maximising the level of discrimination between different classes by incorporating only the most discriminant features in the selected feature subset.

In the first phase, we applied 12 moment methods for feature extraction. The extracted features from different moment methods can be fused to form a high-dimensional feature vector. However, reducing the dimensionality and increasing the performance of such a vector are two difficult challenges to overcome. Therefore, we propose a unique approach, which selects the top moments after sorting the 12 moments using an entropy score-driven feature selection. The approach is powered by an entropy-score metric, which is introduced to select the feature vectors that maximise the entropy ratio of total sample population and the average of within-class populations. Having a high entropy score guarantees a feature vector with high-scattered total population and low class-specific deviation, which can be used as a strong class-separation score.

What challenges did you face to achieve this?

The main task in automatic target recognition is to enhance recognition. SAR with high-resolution images is superior to optical images, due to their robust ability to work in all weather conditions, during day and night. However, extracting many features from such a high-resolution image is a challenging task. Furthermore, positional variations of the target, due to angle variations in airborne radar signals, generate images that are not scaled. For recognition enhancement, the proposed entropy-score method follows the moment-based feature extraction process to perform feature selection. The biggest challenge was to perform dimensionality reduction, while increasing the discrimination between classes.

What do you think the impact of this work will be?

In the short term, the proposed algorithm can be effectively applied to many different fields, ranging from hyperspectral images to biomedical images, in order to perform efficient feature selection after forming a high-dimensional feature space. In the longer term, the proposed entropy-score-based method can be developed to increase the discrimination between classes considered. The mathematical foundations of the proposed method will also be explored to provide theoretical alternatives in practical applications to provide possible improvements.

How are you planning to continue this work?

Currently, I am working on Alzheimer’s disease detection in 3D Magnetic Resonance Imaging (MRI) images. Moment methods in the feature extraction stage and entropy-score in feature selection phase can be adopted in this field. In the case of MRI images, dimensionality reduction must be performed for effective classification. However, I believe that detection of Alzheimer’s disease without any treatment is meaningless, so instead of bi-level classification, we plan to determine the level of Alzheimer’s disease for possible early treatment.

How do you think your field will develop over the next ten years?

Detection and classification research is growing rapidly. The application of classification varies from face recognition to security, to medical image diagnosis. There is a big hope that image processing will contribute to medical science for the diagnosis of difficult diseases, like cancer and Alzheimer’s disease, over the coming years. The developing role of image processing in medical science is obvious in recent years and is expected to grow rapidly in the coming decades.