RANDOM FOREST CLASSIFIER CONTRIBUTION IN THE DIFFERENTIAL DIAGNOSIS OF MOVEMENT DISORDERS STUDIED BY 123I MIBG CARDIAC SCINTIGRAPHY

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BACKGROUND-AIM

The Random Forest (RF) classifier belongs to the so called ensemble methods which use a large number of single basic classifiers independently trained on the same training set, whose final decision process is based on the overall classification vote provided by the basic classifiers. In this study we investigated a group of patients undergoing cardiac 123I MIBG scintigraphy with semiquantitative analysis to evaluate if RF classifier is able to contribute to the differential diagnosis of movement disorders, in term of classification accuracy and interpretability of the obtained data.

METHODS

We enrolled 85 consecutive pts, 50 of whom (class 1) classified as Parkinson disease (PD) and 35 (class 2) as other movement disorders, 26 of whom with atypical parkinsonian syndrome (PS) and 9 essential tremor (ET). All pts underwent cardiac scintigraphy in anterior and anterior left oblique views (matrix size: 128x128 pixel) at 15min (early-E) and 240 min (delayed-D) after 111 MBq of 123I-MIBG iv injection, using a dual head gamma camera (INFINIA-GE Medical System) equipped with low energy, high resolution parallel hole collimators; the images were evaluated by semiquantitative analysis, calculating early and delayed heart/mediastinum (H/M) uptake ratios by the mean count density measurement in manually drawn ROIs in anterior view and indicating in the feature ROIt1 and ROIt2. RF was implemented in Matlab code and the "leave one out" method was used to evaluate classification performance.

RESULTS

The validation procedure using both features, ROIt1 and ROIt2, provided a very good classification accuracy. RF, in addition to classification also computed a percent level of confidence for the assigned class for each subject. This allowed the partition of the feature plane in high and low level of classification confidence for the two classes. The feature plane had been divided in 4 macroregions with different degree of confidence in the classification: region A-PD (high confidence), region B- PS/ET (high confidence), region C-D for both classes (low confidence). A separation threshold between the most confidence regions resulted about 1.55 for both ROIt1 and ROIt2, thus meaning that pts with uptake values lower 1.55 were classified as PD, while higher value as PS or ET. Globally, RF permitted to achieve a classification pt performance of 98.5% using ROIt1 and ROIt2 of 97.5% using only ROIt1 and 95.5% using only ROIt2, both the selected features being effective in distinguishing the difference between the two diagnostic pt classes.

CONCLUSION

In this study RF classifier was able to differentiate between PD and PS+ET with great accuracy, thus contributing to the clinical diagnosis and showing as a discriminative uptake value 1.55. This result could be of remarkable clinical interest for both diagnostic and therapeutic purpose.