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NON-LINEAR STATISTICS (ELASTIC MAP) IMPLEMENTATION TO DETECT PARKINSONS DISEASE vs. ESSENTIAL TREMOR

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Parkinsons disease and essential tremor are quite difficult to distinguish through custom diagnostics. Both pathologies manifest in tremor. Unlike essential tremor, Parkinsons disease may be detected through olfactory dysfunction, quite before any motor manifestation. There are some fine differences in tremor pattern observed for Parkinsons disease patients, in comparison to those with essential tremor. Currently, there are several technical tools to measure mechanical features of tremor. Besides, olfactory dysfunction may also be used as diagnostic feature, for such patients.

We analyzed the records of tremor obtained from patients with Parkinsons disease and essential tremor; the patients did not differ statistically in age, in these two groups, with unbiased sex representation. For both patient groups, kinetic features of tremor have been measured and recorded. Also, the olfactory function was measured, using standard protocol of Sniffins stick test. Finally, each patient in the record is characterized with 332 variables.

It was found that custom statistics is able to distinguish patients with essential tremor from those with Parkinsons disease when compared over a tight set of variables; greater majority of data does not yield any reliable separation. Reciprocally, any linear (e. g. K-means) clustering technique failed to resolve the patients with essential tremor, and those with Parkinsons disease. On the contrary, non-linear statistics, that is elastic map technique, was the powerful tool to cluster the patients. Clustering developed by elastic map reliable differentiate patients with Parkinsons disease from the patients with essential tremor. It should be stressed that reliable clustering is observed over the subset of kinetic records comprising those with the distribution pattern close to the normal one; elimination of all other variables improved clustering. Moreover, a combination of these selected kinetic data and olfactory function measurements also improved the clustering.

Comparative analysis of olfactory function data obtained both from sick patients and healthy people reveals almost no difference between them. This controversy was hypothesized to result from the peculiarities of the current Sniffins test one subtest. To resolve the problem, we proposed the new version of the protocol, and tested it over the healthy people. The new version stipulates randomization of testing of various smell agent concentrations, instead of a regular one proposed by the standard protocol. Implementation of the new version significantly improved the test feasibility.

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