Implementing of the Artificial Intelligence for Classification of Isometrically Applied Force Tremor for Neuromuscular System Disorders Diagnostics

Alexey A. Mekler[1], Liudmila A. Dmitrieva[2], Alexey S. Minin[2], Dmitriy G. Schwarz[3], Yuri A. Kuperin[2], Sergey P. Romanov[4]

[1]Institute of Human Brain, Russian Acad. Sci., Saint-Petersburg, Russia
[2]Saint-Petersburg State University, Saint-Petersburg, Russia
[3]Saint Petersburg State Polytechnical University, Saint-Petersburg, Russia;
[4]acad. Pavlov Institute of Physiology Russian Academy of Sciences, Saint-Petersburg, Russia

Presented work aims development of the intellectual data classification for construction of the systems for automated diagnostics of the human motion system disorders.

Human muscle activity signals were used as an input data - tensotremorograms recordings (TTG), obtained from the output of the force gauge, to which hands' fingers force was applied. These signals were studied, as well as their additive components - so called intrinsic mode functions, which were obtained implementing EMD (Empirical Mode Decomposition) method. It was supposed, that classification quality could be improved, if noise component, extracted via EMD, will be subtracted from the TTG. In later experiments this hypothesis was proved.

Two algorithms of the intellectual data classification were implemented: Kohonen Self Organizing Maps and adaptive binary classifier (ABC). Both of these classifiers were applied to TTGs, which were preprocessed in the different ways. Preprocessing included different ways of IMFs superposition, combining different sets of IMFs and applying to synthesized time series Fourier transform and wavelet transform. Classification efficacy was rated as the percentage of successfully diagnosed subjects.

As a result of the study it was determined that the best classification quality is performed by SOM in combination with the following data preprocessing: IMF#1 was subtracted from TTG and fast Fourier transform was been applied to residue. We have determined some fragments of the spectrum, which provide the most reliable classification. Classification quality has reached 82%.

The result from ABC is slightly worse. Here the best result is reached when ABC is applied to residue after subtraction of the IMF#1 from TTG. As far as ABC by its nature is an amplitude discriminator, there are no further signal transforms are performed.

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