Doctoral thesis abstract

Luria's test elements analysis in the computer aided diagnosis of neurodegenerative diseases

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This doctoral dissertation presents a methodology that allows the fully automatic extraction of writing characteristics that indicate pathology (Parkinson's disease or progressive supranuclear palsy). The handwriting samples were obtained in clinical conditions by experts in the field of neuropsychology using the Luria's Alternating Series Test (drawing by the examined the continuation of a given pattern consisting of a series of alternating rectangles and triangles). The test was performed in the classic version, used in clinical practice using a sheet of paper and a pencil. Then, it was scanned and saved as a graphic file. A thesis was formulated: ***Computer analysis of the graphic representation of the Luria's series allows the determination of features enabling the assignment of patients to the groups: control seniors, patients with Parkinson's disease or progressive supranuclear palsy***.

To demonstrate the validity of the thesis, the following tasks were carried out:

- Image database of the Luria series drawn by patients with Parkinson's disease or progressive supranuclear palsy, and representatives of the corresponding control group was collected and organized.
- Individual characters (correct triangles and rectangles) were automatically detected by data pre-processing, unnecessary objects removal, contrast enhancement, presentation of the series in the form of a one-dimensional signal, series baseline calculation, regions of interest delineation, characteristics definition, character definition, and verification.
- A feature vector was defined and the elements were extracted.
- Statistical analysis of features obtained by means of a semi-automatic process of determining character masks was carried out.
- A classifier was built to assign the individual study to one of three groups.
- The accuracy of the classifier based on automatically and semi-automatically extracted features was compared.

The conducted experiments indicate that the developed methodology enables an automatic division of the Luria's series into individual characters and shortens the data analysis. The presentation of the series as a one- and two-dimensional signal allows the extraction of previously unmeasurable features. These features enable the screening and three-class classification for Parkinson's disease, progressive supranuclear palsy, and the senior control group.