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Spatial and Dynamical Handwriting Analysis in Mild Cognitive Impairment

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Abstract

Background and Objectives Standard clinical procedure of Mild Cognitive Impairment (MCI) assessment employs time-consuming tests of psychological evaluation and requires the involvement of specialists. The employment of quantitative methods proves to be superior to clinical judgment, yet reliable, fast and inexpensive tests are not available. This study was conducted as a first step towards the development of a diagnostic tool based on handwriting.

Methods In this paper the handwriting sample of a group of 37 patients with MCI (mean age 76.1±5.8) and 37 healthy controls (mean age 74.8±5.7) was collected using a Livescribe Echo Pen while completing three tasks: (1) regular writing, (2) all-capital-letters writing, and (3) single letter multiply repeated. Parameters differentiating both groups were selected in each task.

Results Subjects with confirmed MCI needed more time to complete task one (median 119.5 s, IQR – interquartile range – 38.1 vs. 95.1 s, IQR 29.2 in control and MCI group, p-value<0.05) and two (median 84.2 s, IQR 49.2 and 53.7 s, IQR 30.5 in control and MCI group) as their writing was significantly slower. These results were associated with a longer time to complete a single stroke of written text. The written text was also noticeably larger in the MCI group in all three tasks (e.g. median height of the text block in task 2 being 22.3 mm, IQR 12.9 in MCI and 20.2 mm, IQR 8.7 in control group). Moreover, the MCI group showed more variation in the dynamics of writing: longer pause between strokes in task 1 and 2. The all-capital-letters task produced most of the discriminating features.

Conclusion Proposed handwriting features are significant in distinguishing MCI patients. Inclusion of quantitative handwriting analysis in psychological assessment may be a step forward towards a fast MCI diagnosis.

Keywords: telegeriatrics, handwriting analysis, handwriting features, Mild Cognitive Impairment, automatic handwriting processing

1. Introduction

According to the latest estimates of the United Nation's Department of Economic and Social Affairs [1] the number of people older than 60 years stands already at 901 million (12% of world's population) and grows each year

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