Daily-life gait impairment detection

Advanced statistical analyses at the service of gait-affected individuals

H2020 SOCIETAL CHALLENGES: Health

PRODUCTIVE SECTOR: Biomedicine and Health Care

PROBLEM DESCRIPTION

Gait impairment comes with a major loss of autonomy, ultimately affecting the quality of life. Can we detect gait changes before symptoms appear so as to propose therapies to avoid or delay their occurrence?

CHALLENGES AND GOALS

- Measuring gait with a lightweight device that individuals forget they are wearing to limit biases.
- Designing a biomarker called Individual Gait Pattern, sensitive to changes in gait.

MATHEMATICAL AND COMPUTATIONAL METHODS

The main idea is to provide a so-called Individual Gait Pattern (IGP) which describes the average rotation of the hip over time during a typical gait cycle. This is achieved using a tiny motion sensor, clipped on the right side of the belt, that records data to a secure server through a dedicated smartphone. The data comes in the form of a time series of unit quaternions. These are complex mathematical objects that motivated the development of specific statistical methods such as finding clusters of patients with similar gait impairment or designing risk indicators.
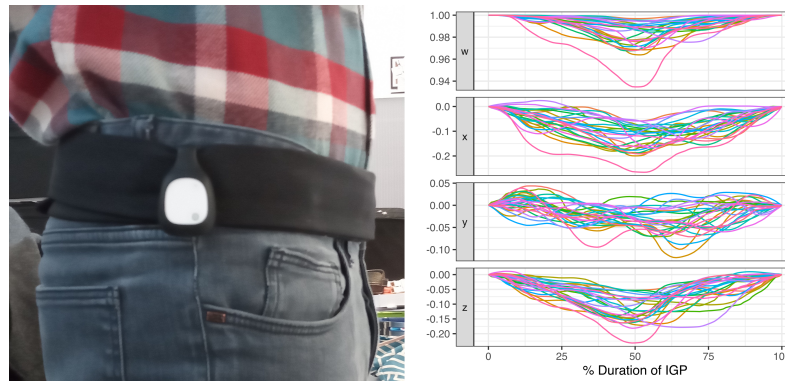

eGait device and IGPs of 27 patients diagnosed with multiple sclerosis

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Results and Benefits

We analysed and clustered the IGP of 27 patients diagnosed with multiple sclerosis. Cluster 1 regroups patients with no clinical evidence of gait impairment only, while Cluster 2 regroups patients with mild walking deficiency. This suggests that the IGP detects clinically-invisible gait differences.
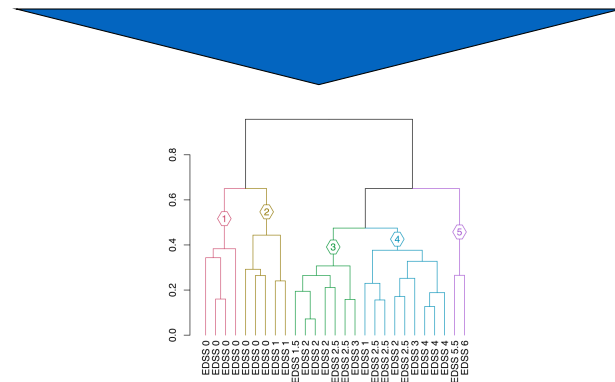
In the long term, the proposed device should help clinicians to assess gait impairment, in daily life, for patients with any gait-affecting disorder.
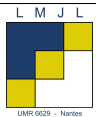
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