System for Inertial Data Collection and Data Visualization for Individualized Medicine with Focus on Parkinson's Disease

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Parkinson's disease (PD) affects the central nervous system and causes symptoms related to movement, such as hand tremors. Currently, PD diagnosis is based on the Unified Parkinson's Disease Rating Scale performed subjectively by doctors and often without computer systems. The present research aims to develop a computational system capable of helping the diagnosis and prognosis of PD. In order to develop a device capable of collecting inertial data (InD) and providing a solid database, a wearable hardware for collecting human hand movements was developed. Performed tests show that the use of triaxial inertial sensors (i.e., accelerometer) are sufficient for describing the individuals' movements. When performing the first tests, it was necessary to build an end-to-end system to control the equipment. For this, a client-server communication was developed. Aiming to facilitate the visualization of the information, this work focused on the use of a dimensional reduction technique, the Principal Component Analysis. In order to facilitate the use of the system, a modern and easy-to-use graphical user interface (GUI) was developed with the QT framework in Python language. The whole system is composed by the hardware - which deals with: (i) data collection; and (ii) data transmission - and software, which includes: (i) hardware control; (ii) data storage; (iii) data processing; and (iv) data visualization. Furthermore, the software provides, using mathematical feature extraction, the classification of individuals with PD and without PD. Thus, the developed system adequately performs the capture of InD, treatment, analysis, and plotting. Also, the GUI enables a simplified use of the developed system when compared to similar researches with a total cost of 50 dollars.

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