New Approaches to Personalized Training Programs for Chronic Patients

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MEDICINE 4.0: NEW APPROACHES TO PERSONALIZED TRAINING PROGRAMS FOR CHRONIC PATIENTS.

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Abstract

The personal sensors are now commonly found in smartphones, bracelet, smart watches, and other similar market-devices. These electronic artefacts can profitably be used to detect and classify human movements in everyday life, especially in patient with chronic disease like Multiple Sclerosis', Parkinson's, Alzheimer's. The practical benefits are evident: wearable instruments can follow the patient everywhere, they are non intrusive and respect intimacy. This enables a new approach to telemedicine and medicine 4.0: continuous monitoring of the patients activities during daily life using off-the-shelf tools, can be exploited to evaluate biomechanical capabilities, human behavior, and even cognitive abilities. On the other hand, these methodologies rise important questions: are the relative results reliable enough to ensure a correct medical diagnosis and to support the therapy, and under which conditions and why?

A recent proposed approach, the *Ff x IVFf* transform for sensor analysis, a supervised machine-learning method developed by one of the authors, has made it possible to achieve high precision on inertial and environmental sensors in real-time analysis. Thanks to this method it is also possible to reduce the number of worn body sensors without losing overall accuracy (98.4%, $p < 0.01$, with only two wearables).

On this evidence we implement a new model of healthcare that is based on patient involvement, where assistance is brought from the clinic to the home with invariance in the quality of patient services, giving social, psychological and economic benefits.

The use of intelligent analysis give flexibility to the approach and objectivity to data. The continuous monitoring allows to identify epiphenomena that may not be noticed in a normal medical scrutiny. Cluster analysis on these data allows the patient to be profiled on objective aspects and to tune medical and pharmacological therapies to measurable evidences and individual responses.

Such an approach – intelligent, adaptive and innovative – can dramatically reduce socio-assistive costs by eliminating (or at least reducing) the need for "in-person" care, and reducing the time of hospitalization of the patient, introducing a new type and more personalized form of social medicine enhanced by intelligent approaches.

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