An Approach to Home Environment Monitoring of People with Disabilities Through AIoT

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Abstract. *This work presents the proposal for developing an approach based on AIoT (Artificial Intelligence of Things) to assist in the care of people with some kind of disability, in the context of the domestic environment. The goal is to select and evaluate the Machine Learning algorithms that are best suited to monitoring environments, in the context of Assisted Living, as well as the most relevant data collection methodologies, to create a monitoring approach.*

1. Introduction

More than a billion people around the world live with some form of disability, and increasingly need Assistive Technology resources and/or services that can improve their quality of life. In this context, the integration of IoT with Assistive Technology and AIoT (Artificial Intelligence of Things) is observed. AIoT uses Machine Learning (ML) algorithms to analyze the collected data and discover patterns to assist in decision making. This fusion of technologies aims to improve people's quality of life. However, solutions of this type, at low cost, are still incipient.

So, there is Assistive Technology (AT), which is the term used to identify the whole set of resources and services that contribute to providing or expanding the functional abilities of people with some type of temporary or permanent disability, promoting an independent and inclusive life [Hersh, Ferreira and Ramirez 2018]. For this, IoT appears as an ally [Viel et al 2018]. Along with the IoT, there are ML models, and the concept of AIoT [de Freitas et al 2022]. Through IoT, it is possible to capture data in virtually any situation, which generates a huge volume of data to be processed. ML models, on the other hand, use such data to predict behavior and make decisions [Mohamed 2020]. In this perspective, this work presents the proposal of the selection and analysis of ML models and data collection methods aimed at designing an approach for monitoring the home environment of people with disabilities, through AIoT. From this, it will be possible to monitor and analyze data produced by the various devices used by the disabled person and which are connected to the network, inside a house. As well as monitoring and analyzing that person's behavior, seeking to improve some aspect of their life. The insights generated by ML models can help caregivers and health

professionals to think about new strategies to assist this person and improve their quality of life.

2. The Approach Proposed

In a first moment we are working on monitoring elderly people in activities of daily living (ADL). To develop the proposed approach, the following steps were established: definition of deficiencies to be considered; definition of the physiological environmental variables to be used; selection of ML algorithms to be analyzed; creation of the database; application and evaluation of algorithms; and evaluation of the insights obtained. To test the potential of this approach, a first study focusses on the detection of anomalies in ADL using the Novelty Detection technique. This solution consists of identifying days that present anomaly, and for days classified as abnormal, inferring which were the activities that caused this classification. To compose the solution, the algorithms Local Outlier Factor, Isolation Forest, One-Class SVM and Robust Covariance Estimator were evaluated, as well as the minimum number of weeks of training data for Accuracy and F1-Score greater than 85%.

3. Preliminary Considerations

The current stage of work is focused on establishing data collection mechanisms and database composition. In addition to monitoring activities, environmental and physiological variables will be incorporated into the base. And later, the previously tested algorithms will be applied and analyzed.

In addition to analyzing the algorithms, performance tests will also be carried out to check how the solution behaves when managing several users simultaneously, seeking to optimize the process.

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