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Fall Detection for Elderly People Using Machine Learning

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ABSTRACT

The state of one's health is a major source of concern, and this unavoidable uncertainty only grows with age. As a result, caring for our aging population is a duty of great importance. To improve people's quality of life, technology is being used in this way. 'Fall' is one of the leading causes of health decline and death among the elderly. In light of the aforementioned problem, a novel system has been proposed to detect falls in the elderly using machine learning. While other methods, such as recording and processing webcam images, have proven useful for detecting falls, this study is the first to use a data set that includes information from sensors actually used by the elderly. It is possible to implant the sensor in an item like a belt or watches, and then use the data recorded from the sensor's activities and changes. Further, we have attempted to construct, using the flask framework, a prediction system that can determine whether or not the recorded sensor activity represents a fall, thereby allowing caregivers to take the necessary precautions. It has been found that support vector machines (SVM) and decision trees can be used for prediction, with the latter providing a high level of accuracy compared to other algorithms.

Keywords: Elderly People, Machine Learning, Fall Detection

I. INTRODUCTION

As children and grandchildren leave home for college and the workforce, today's elderly are increasingly likely to live alone. Homebound seniors still face a significant risk of falling, whether from an accident or because of a preexisting health condition; failure to act within the required time frame could have fatal consequences. According to the World Health Organization, falls in the home are the leading cause of accidental death and serious injury. They are more likely to injure themselves or wander off when they are home alone, whether as a result of forgetfulness or a predisposition to wandering. Until they return home, the family may not realize that the elderly member has fallen or is unconscious. Those in their golden years would be unable to advocate for themselves, get medical attention, or communicate their condition to others. If the information about the fall could be communicated to the worried family members or caregivers, they could take immediate measures to mitigate the negative effects of the fall for a variety of

reasons. People with Parkinson's disease, whose nervous systems are already compromised, and the elderly, who are often trying to care for themselves independently, both have common causes for falls. A fall can be caused by a variety of physical factors, including an unsteady gait, blurred vision from age, distracted thinking, and so on. Hip fractures and other serious injuries are common results of these falls, further diminishing the quality of life for the elderly.

II. PROBLEM STATEMENT

As children and grandchildren leave home for college and the workforce, today's elderly are increasingly likely to live alone. Homebound seniors still face a significant risk of falling, whether from an accident or because of a preexisting health condition; failure to act within the required time frame could have fatal consequences. According to the World Health Organization, falls in the home are the leading cause of accidental death and serious injury. They are more likely to injure themselves or wander off when they are home alone, whether as a result of forgetfulness or a predisposition to wandering. Until they return home, the family may not realize that the elderly member has fallen or is unconscious. Those in their golden years would be unable to advocate for themselves, get medical attention, or communicate their condition to others. If the information about the fall could be communicated to the worried family members or caregivers, they could take immediate measures to mitigate the negative effects of the fall for a variety of reasons. People with Parkinson's disease, whose nervous systems are already compromised, and the elderly, who are often trying to care for themselves independently, both have common causes for falls. Asymmetries in gait, impaired vision due to age, distracted attention, and other similar factors can all contribute to the onset of a fall. The elderly suffer serious injuries, such as hip fractures, from these falls, further diminishing their quality of life. Consequently, the goal of this project was to propose a new method for identifying falls among the elderly by employing machine learning methods. Several machine learning algorithms can be trained on the fall dataset to find the one that works best in a given situation. Accelerometers, gyroscopes, etc. are examples of sensors that can be used to get real-time input from the elderly. An issue with fault detection systems is that they can give off false alarms. Therefore, it is essential that we construct a system with a low rate of false positives. Good accuracy can be obtained using SVM and decision trees, it has been found. When compared to the others, decision trees have the highest rate of accuracy.

III. EXISTING SYSTEM

Most hip fractures and other injuries occur as a result of falls. As the elderly person's health declines and deteriorates, death is a real possibility if emergency care is not given to treat these injuries and fractures. Having a reliable fall detection system in place is crucial for geriatric patients to receive the care they need. False alarms, or alerting fall when there is fall-like activity but not exactly a fall, are a significant challenge to developing accurate fall detection systems. Studies have mostly concentrated on finding ways to enhance the fall detection system's accuracy and decrease false alarms.

Disadvantages:

- Mistaken alarms
- Possesses a high propensity for making mistakes

Model of Proposed System:

We propose to create a machine-learning strategy for detecting and analyzing the fall. We also propose rolling out a web app that, given enough data from sensors, can foretell when a patient will fall. The user would be able to upload his sensor parameters and view the machine learning model, as well as receive predictions, on the web. With this project, we hope to develop an automated prediction system that can reliably categorize whether or not an elderly person

has fallen. Here is a breakdown of the system's structure:

Advantages:

• Computerized process

• Greater precision

Machine Learning

There are four types of machine learning. They all differ in their approach, the data type they take as input and give output.

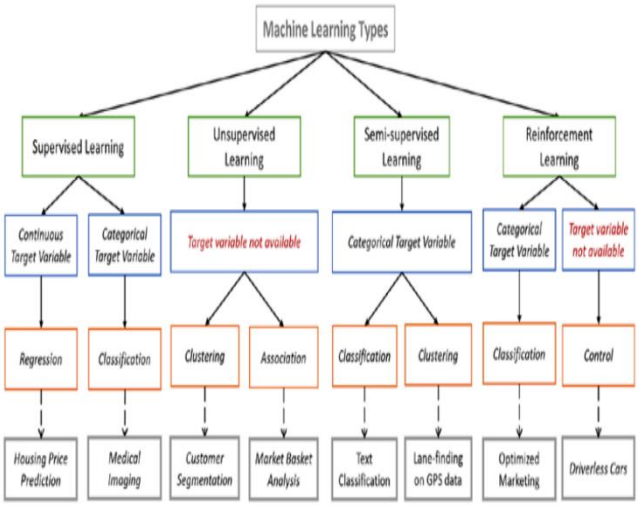
The four types are:

1.*Supervised Learning*: it is a learning in which we train the models using the data which is well labelled that we already know the answers. Basically, it is a task of learning a function that represents an input to an output based on example input output pairs. It infers a function from labeled training data comprising of a set of training examples.

2.*Unsupervised Learning*: it is used on some data in which we don't know the output allowing the algorithm to act on that data without any guidance. It basically groups the data based on the similarities and pattern without any prior knowledge of data. Unlike Supervised Learning, no training will be given to the machine. Therefore, machine is limited to find the hidden structure in an unlabeled data by itself.

3.*Semi-Supervised Learning*: in the learning, it is assumed that the data is the combination of both labeled as well as unlabeled. Its major aim to extract the data from the unlabeled data that could enable learning a discriminative model with better execution.

4.*Reinforcement Learning*: it basically means improving the performance of the machine using trial and error experience. There is unkind teacher is given, where if a machine predicts wrong then penalty is given and if machine predicts correct then some reward is given.



PYTHON:

The Python 3.8 programming language is being used to create the project's applications. If you're looking for a powerful programming language that doesn't require you to memorize a bunch of syntaxes, look no further than Python. Python is an easy programming language to learn because its syntax is so similar to regular English. It can run sophisticated mathematical computations, incorporate machine learning algorithms, and support object-oriented programming. Its dynamic typing and data structures allow for swift application development. Python is widely regarded as a readable programming language because it uses a larger percentage of English words than any other language. The exponential growth of available data. Since Python's interpreter performs syntax analysis at runtime, the language doesn't need a compiler to fix syntax errors and compile programs. It can run on any OS and comes with a tonne of prebuilt libraries and packages for a wide range of tasks. It's a simple language that's straightforward to study, use, keep up with, and improve. You can access the vast majority of popular databases on the market today with just a few lines of Python code. Using GI programming can help you create applications for both Windows and the web. This language is unique in that it allows developers to choose between functional, structural, and object-oriented programming. Python code is easily portable

to other languages, and it even has garbage collection built in!

FLASK:

Flask is a framework for creating small, fast, and simple web apps. It does this by making available Python's library system. The WSGI Development Environment Flask is a web application framework based on the Andy jinja 2 template engine. Flask is a microframework due to its lightweight nature. The Web Server Gateway Interface (WSGI) toolkit is a standardized protocol and interfaces for implementing common web objects like requests, responses, and helper functions. Python now uses this standard as its baseline for building web applications. It is the universally accepted interface specification for establishing communication between a web server and a web application. Jinja 2 is a popular Python templating engine. Using this method, templates can be linked to various data sources to generate dynamic web content. Flask's architecture makes it easy to create basic web applications. Unfortunately, it lacks basic features like database support and built-in form validation abstraction layers. However, the flask allows for the incorporation of all these features. This flask is a lightweight web framework that can be easily customized.

MYSQL:

Our project makes use of MySQL, an open-source RDBMS, to establish database connections and store information. To store, retrieve, and modify information in a database, My SQL relies heavily on structured query language. There are rows and columns in the tables that hold the data in the database. To facilitate a client-server architecture, MYSQL was developed. The user, or client, connects to the MYSQL client to perform tasks on the database, such as creating tables, modifying data, and retrieving records. The MYSQL client initiates an operation, which is sent to the server, and the server either completes the operation successfully or returns an error message.

Elderly fall detection system

According to data compiled by the World Health Organization, falls rank among the leading causes of accidental death. The effects of these accidents on people over the age of 65 are visible in the data. Diseases of the brain and nervous system, such as Parkinson's, and the natural deterioration of human bodies are to blame. This article presents a novel method for detecting falls in the elderly in real-time. The following elements make up this system:

1. A gadget that can be worn
2. A mobile phone.

The device's communicative capacities would allow it to automatically text an alarm to a user's phone. within a hundred feet of it. When a fall is detected, the mobile device notifies predetermined emergency contacts, such as family members. One benefit of this setup is that the elderly person's cell phone is not required to be carried at all times. In the event of an emergency, a panic button is integrated into the system. After pressing the button, the designated people would be immediately notified.

"Internet of Things and Big Data-based Fall Detection for the Elderly"

For the elderly, falls are a leading cause of serious injuries and health problems. If a senior citizen falls and isn't helped right away, he could die or require life-changing surgery that leaves him less mobile and reduces his overall quality of life. In this article, we discuss a novel method for identifying elderly indoor fall victims. This method relies heavily on low-power wireless sensor networks, smart devices with built-in communication capabilities, large amounts of data, and cloud computing. A 3D access accelerometer is a sensor that can be integrated into any wearable device. In this way, an IoT gateway can process the collected sensor data and interpret the results. In the first place, the gateway would receive regular updates from the sensors, and if a fall were detected, alerts would be sent to the appropriate contacts and groups responsible for the elderly. The aforementioned method has been implemented with the aid of cloud systems because all

this technology cannot be maintained in a local environment. The system's ability to detect falls quickly and accurately has been demonstrated.

IV. PROPOSED MODULAR IMPLEMENTATION

The project's proposed modular implementation is detailed below. It has two separate parts:

1. Admin
2. User

Admin Module

The system administrator is in charge of doing things like:

1. Dataset uploading
2. Analyzing the data in the dataset
3, Dividing the data into a test and a training set4
4. Modelling instruction for SVM and Random Forest algorithms
5. Evaluate how well the algorithms work with the provided data.
6. Take a look at profile info and forecasts for a user 6

User Module:

The machine learning services provided by the system include:

1. Entering one's login information
2. It's important to remember to record the settings for your sensors in your system's database.
3. Get your autumn forecast.

Architecture diagram:

An architecture diagram is a visual representation of a system's concepts, principles, elements, and components. It is an abstract representation of the system's structure and behaviour. It's possible to define different levels of abstraction, such as a purely conceptual one, in which only the ideas behind the system are shown. Logical abstractions provide further insight into the workings of the concepts by illustrating their underlying principles and constituent parts. A system's design can be seen at the physical abstraction level, the lowest level of abstraction. Any of the aforementioned three abstraction levels may be shown in the Architecture diagram as appropriate.

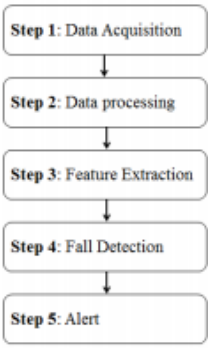


Figure 1 System flow

V. Conclusion and Future Work

Conclusion

This project describes a system that uses a portable sensor to detect when an individual has fallen. The target demographic here is the senior population. It is proposed to use a machine learning algorithm to identify potential slips and falls from a person's routines. Most people would rather use the threshold approach than the Machine Learning strategy. This is because of a pattern known as pre-trained Gait, which results in fewer false positives. The decision tree's ability to define and categorize each attribute to a class allows it to provide greater accuracy than SVM. When compared to SVM, which slows down the system, a decision tree can make predictions more quickly. A model's performance can be measured with tools like sensitivity, specificity, accuracy, and confusion matrix. The best accuracy for detecting falls that can be achieved with a decision tree algorithm is 96%. Training the models on a large dataset and determining the best features to use can boost accuracy. In addition, we propose deploying the model to a web application and making it available to the students, parents, and faculty to reduce attrition and assist students in their areas of need.

Future Work:

As part of future enhancement, we are planning to improve the ground plane segmentation to reduce the false detections. The public data set is restricted with only one person per video. As part of enhancing the

current work, we are investigating the possibility to detect the falls from videos where multiple people are present under various conditions and multiple falls within a single video.

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