

Design and Development of Context Aware Abnormal Activity Recognition System for Elderly and Disabled Person Using ML/DL Approach

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Abstract- Elderly and disabled person activity recognition in smart home is actively topic for getting to changes in physical and behavioral profiles of person health . Different activity recognition solutions have been before now proposed to put into use system with some wearable sensors and smartphones. This work aims to provide automated system for (different from what's usually expected) condition detection and also send alert to the nearest family member of that person. For this system different Convolutional Neural Network (CNN) models such as CNN-VGG, AlexNet are going to be used. Internet of Things (IoT) is seen as new way of thinking, (totally changing and improving) by extending Internet connectivity to many physical objects connected with people (who use a product or service) daily life. In this paper, an Internet of Things (IoT) based activity recognition is proposed for activity supervising within (related to people who use a product or service) home network.

Keywords- Internet of Things, user resident activity recognition, Machine Learning/Deep Learning, Firebase cloud..

I. INTRODUCTION

IoT is a lamp of our life which bring during we live on the earth and it is a discipline field that including advanced technologies such as wireless sensor network, A.I plays an important role in many domains containing up of uses such as smart cities traffic jam, waste management ,health care, security, emergency services, industrial control, and older (person) and disabled person health care. older (person) and disabled person care represents one of the hottest use areas for the IoT.

The idea of the "Smart House" is generally used to refer to any surrounding conditions designed to help people in their everyday activities in order to advance independent (way of living) smart home automation system are designed for any person, (without any concern about/having nothing to do with) whether they have a disability or not. These Smart Houses include sensors to communicate with other in their daily activities[1] . Context aware system plays most important role in IOT for person activity watching/ supervising and decision making application, context aware environment is the ability of a system to collect

information about people (surrounding conditions) at any given time and change a environment and get better system behaviours in the same in that way.

context-aware figuring calculating uses software and hardware to automatically gather and carefully study data to guide responses .

In this paper, we monitor activity of older (person) and disabled person and train system in the same way using different machine and deep learning computer code related .home automation big picture aware system for old and disabled person take advance action in watching/supervising person at home. alert system play most important role .this system is design to handle person (different from what's usually expected) condition using activity watching/supervising system if any (different from what's usually expected) condition happen with person system send alert to other family member[2] . The main aim of this paper is compare the performance of machine learning and deep learning ways of doing things for HAR.

The machine learning and deep learning sets of computer instructions used in comparison. decision tree, Support Vector Machines (SVM), Random Forest, faster CNN are compare with each other for better (quality of being very close to the truth or true number) .

We survey a simple and effective approach of feature selection method. Fall detection is a major challenge in the public healthcare domain, especially for the old as the decline of their physical fitness, the services put into use on the automatic fall detection and activity watching/supervising system presented in this paper .

The Machine learning object detection algorithm benefits to detect activity faster and in accurate manner. For detection of activity, the Deep Neural Network is promising which is an extension of the Convolution Neural Network. DNN mainly used for two purposes, first is for image classification and second is for object detection [4]. Rule based approach is mainly used to store and utilize knowledge or information to expand information in a useful and systematic way. Rule-based system is better in systems involving human-crafted and it provides automatic problem solving tools for capturing the human expertise along with capability of decision making.

Ubiquitous computing is a promising technological path of innovation. Ubiquitous Computing paraphrases the paradigm of hardware and software components which are connected by wireless communication .

II. RELATED WORK

A. IOT

The Internet of Things permits individuals and things to be associated Anytime, Anyplace and Anyone. IOT, which can complete preferably utilizing any way and any assistance. The IoT can be seen as either supporting human or modern applications. So there are two kinds of IOT: initial one is Human Internet of Things (HIoT) which related with human driven application as for various sensors and wearable gadgets. While second one is the Industrial Internet of Things (IIoT) which identified with mechanical IOT application like as brilliant office and so on[3].

Middleware of IOT:

There are different classes of middleware utilized Internet of Thing (IoT). In situation based middleware connection among segments and its applications, and the various members communicate through occasions. Every occasion has a sort, just as a lot of composed parameters whose particular qualities portray the particular state. In administration situated plan worldview, it constructs programming or applications as administrations. In the operator based way to deal with middleware, applications are partitioned into particular projects to encourage infusion and dissemination through the system utilizing portable specialists. While moving starting with one hub then onto the next, specialists keep up their execution state[4]. In database- situated middleware, a sensor arrange is seen as a virtual social database framework. An application can question the database utilizing a SQL like inquiry language, which empowers the plan of complex inquiries. In an application explicit (i.e., application-driven) way to deal with middleware centers around asset the executives support(i.e., QoS support) for a particular application or application space by actualizing a design that tunes with the system or framework dependent on the application or application area necessities.

B. Context Awareness Concept

Context awareness imposes conscious focus on computer applications and systems. A context-aware system utilizes context to deal with relevant information and services for the intended user. The relevancy depends on the user specific tasks. The context awareness frameworks are typically meant to support data acquisition, meaningful data representation, delivery of service and reaction. Context models recognize a tangible subset of the context that is sensibly attainable from sensors, applications and users and have capability to be used in the execution of the task. Wherein the context model built for a specific context-aware application is usually explicitly programmed by the application developer[5].

Setting Awareness is only demonstration of detecting information from sensor and responds as indicated by them dependent on various parameters. For portrayal of Context there is need of recognize parameters like area, personality, action, time. For that reason we will probably create middleware to perceive human exercises and anticipate future human action dependent on notable information. The primary thought of action acknowledgment is to perceive everyday

regular human abnormal activity in smart home. In Ubiquitous Computing the major question included is consciousness of setting which comprising of differing circumstances of clients, including his exercises, area, ecological boundaries, gadget and organize and their cooperation with each other[6]. Presently a days Internet of Things (IoT) is extremely famous and fundamental idea which alludes to the universe of physical gadgets associated with the system/Internet, from your machines or wearable gadgets which encountering a different movement of person.

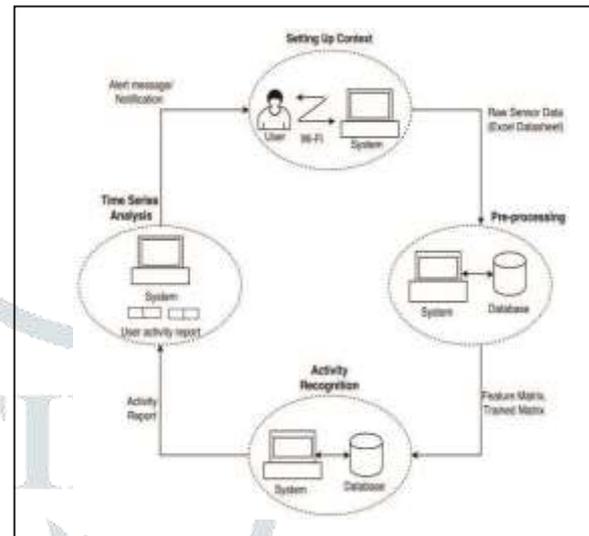


Fig.1 Context Information Life Cycle

present fig.1 is represent huge developing worldview of IoT. sensors, applications and clients and have capacity to be utilized in the execution of the undertaking. Wherein the setting model worked for a particular setting mindful application is typically unequivocally customized by the application engineer.

III. System Architecture

A. Proposed System flow

1) Context & Sensor Reading as Input:

IoT and Context Aware System

Early activity detection is important to prevent the accident as it saves money as well as lives. In camera,RFID sensor is used to detect person activity and send alert performs two actions at a time. GSM modem used to send text messages to the mobile when person activity is detected and there is caution of abnormal. These all sensors are instrumented to microcontroller as per IoT ecosystem needs.

2) Video to frame generator

When the camera starts, system captures the video. So the input to the proposed system is by means of video. First step is to create frames from the video which is to be categorized using CNN architecture. OpenCV is used for the generation of frames from source input.

3) Machine Learning

In this section, the three machine learning techniques used in our comparison are defined.

1. **Decision Trees** : Decision trees are one of the common algorithms for classification problems such as Human Activity Recognition. Decision Trees are easy to understand. However, if there is a non-linear relationship between predictors and outcome, accuracy will suffer[7].
2. **Random Forest** : Random forest is also the algorithm which tends to combine weak learners to improve accuracy. It bootstraps different predictors and builds multiple weak trees from bootstrapped predictors. Bootstrapping of predictors ensures less correlated trees. And finally it combines weak decision trees to predict the outcome. This algorithm also yields much better classification accuracy over decision trees[7].
3. **Support Vector Machine** : It is also a supervised learning algorithm. SVM model represents samples as points in space and separates the points based on outcome categories with a clear dividing gap[8].

4) Convolutional Neural Network Models

Convolutional neural systems (CNNs) are neural systems and demonstrated to be successful in zones, for example, picture acknowledgment and order. The fundamental qualities of CNNs is their capacity to be prepared through the cycle of managed learning[9]. Preparing of neural system is needed to display some framework with the utilization of explicit information which contains coordinating of data sources and yields of framework to be demonstrated. The systems comprises of numerous convolutional layers and numerous channels relying on which layer is utilized trailed by completely associated layers and with softmax work. The system of various convolutional layers is prepared. Each layer is having 32 channels of size 3x3, Rectified Linear Units (ReLU) activation[10]. The four fundamental CNNs designs are being tried in the issue examined in this work concerning the recognition of yield ailments and seriousness assessment of person from pictures of activity , for example, VGG, AlexNet, GoogleNet and Overfeat[11].

- **Transductive transfer learning**: Source and target tasks are similar, but corresponding domains are different. The source domain has a labeled data while target domain do not have a labeled data.

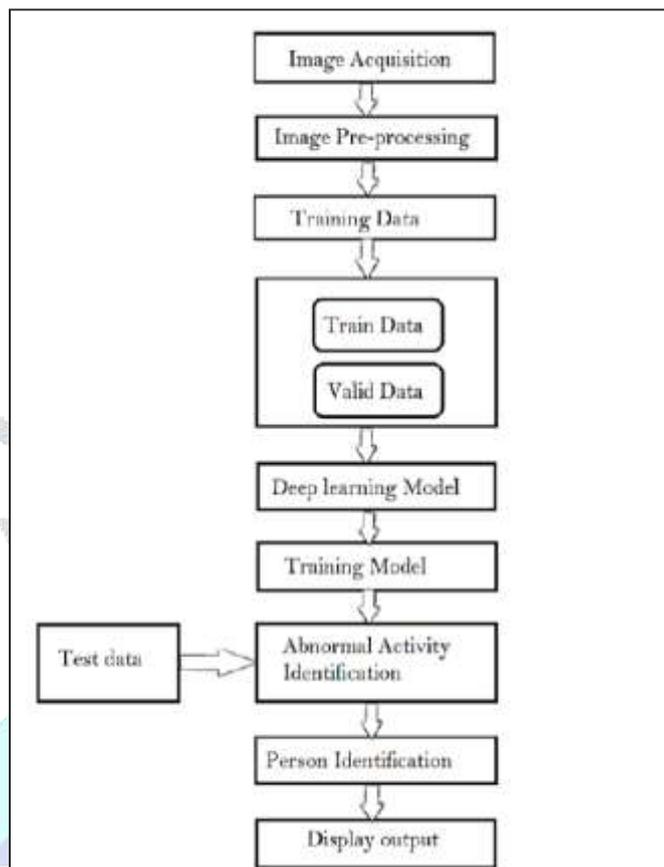


Figure 2: Convolutional Neural Network

5) Transfer Learning

Transfer learning is very specific to deep learning. In transfer learning , we can use from previously trained models for training newer models and to tackle the problems of having less data for newer task. Following are the strategies of transfer learning[10]:

- **Inductive transfer learning**: The source and target domains are the same, but source and target tasks are different from each other. Algorithm tries to utilize the inductive biases of source domain to help to improve target task.
- **Unsupervised transfer learning**: It is similar to inductive transfer, focuses on supervised tasks in the target domain. The tasks are different with similar source and target domains.

6) Training and Testing datasets

A dataset containing pattern of abnormal person activity. The entire dataset is divided into two sets that is training dataset and testing dataset, 80% of pattern are formed the training set and 20% formed as testing set[8]. The 80/20 splitting ratio of training/testing dataset is most commonly used, the other ratio (e. g. 70/30) might not have significant impact on the performance of model

Context information elements	Context information elements values
Person ID	Father, Mother, Son, Daughter
Time	Morning, Noon, Afternoon, Evening, Night, Latenight
Day	Workday, Holiday
Location	Outside, Bedroom, Living-room, Kitchen, Toilet
Activity	Standing, Sitting, Walking, Reading, Lying, Eating, Watching

Figure 3: Context information element

Dataset:

Sr.No	Action class	label
1	Normal person	in front of screen
2	Abnormal person	in front of screen

Figure 4: The action categories and labels in the dataset

- Images from Internet
- Real-time Camera Images in Smart Space in lab

III. RESULT AND ANALYSIS

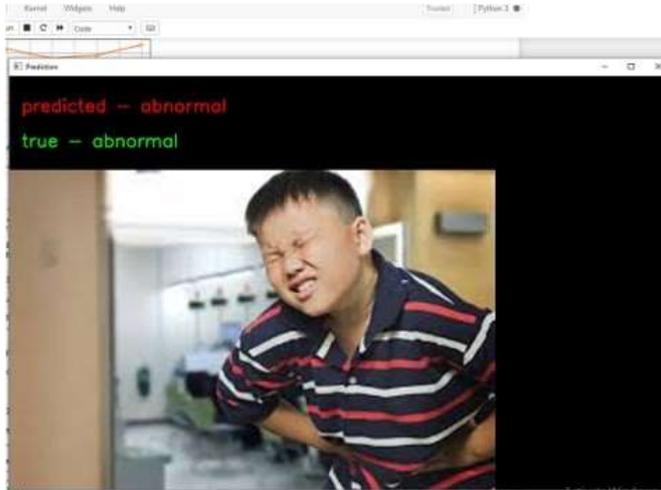


Figure 5: The figure shows the person abnormal in dialog box.

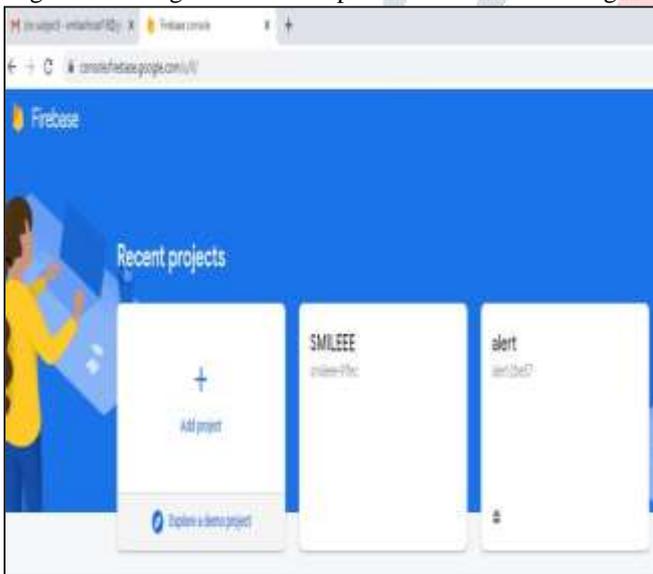


Figure 6: Firebase Cloud Messaging

IV. Cloud Platform

The Firebase Real-time is a cloud-facilitated. Firebase is a NoSQL cloud .A NoSQL gives an approach to capacity and recovery of information that is demonstrated in implies other than the plain relations utilized in social (PC records loaded with data). Information is put away as JSON and (made at least two things appear to be identical or occur simultaneously) in (occurring or perceptible promptly, immediately) to each associated customer. It can manufacture cross stage applications with our

Android, and JavaScript SDKs, and naturally get refreshes with the freshest information. The Firebase Real-time can be gotten to legitimately from a cell phone or internet browser; there's no requirement for an application worker. Security and information approval are accessible through the Firebase Real-time (PC record loaded with data) Security Rules, articulation based principles that are ran/run when information is perused or composed . here any condition happens then framework change their conduct according(automatic alert send from cloud to telephone) cloud informing.

CONCLUSION

To overcome the day-to-day life elderly and disabled accidents which not only causes health loss but they are harmful to live entities as well, this research attempt has been done using building automation system for activity detection. Two approaches namely rule-based and machine learning exercised to provide desirable solution. Wherein different algorithms of CNN family were used to detect activity on image dataset using machine learning approach such as AlexNet, VGG-16, ResNet-50, and LeNet-5. It was found that LeNet-5 provides more accuracy hence the same was employed in the system for image classification. Also different sensors were deployed for the IoT enabled context-aware system to gather more parameters such as RFID which are related to Person identification. Further classification is used with rule-based approach so as to generate alert upon the abnormal activity is detected. The experimental system realized using these two approaches because of unavailability of real-time parameters and images data together. Creating combined multi-parameter real-time dataset .

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