A Smart Health Care Monitor System in IoT Based Human Activities of Daily Living: A Review

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A Smart Health Care Monitor System in IoT Based Human Activities of Daily Living: A Review

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Abstract- IoT is extensively used in all applications. In the healthcare system IoT plays a major role of connecting doctors to the patients by using health monitoring devices. The elderly and the disabled people find this to be very economic and beneficial. There are various methods that monitor the wellbeing of the elderly and in this paper comparison various data mining methods that is being used from the data that is got from things like smart meter, appliance usage, video surveillance and their prediction accuracy is reviewed.

Keywords: ADL, IoT, 3DCNN, KTH, CNN, SMM

I. INTRODUCTION

IoT is a collective term which includes sensors, processors and computers that are connected to the networks. IoT is used in healthcare applications for patient care. It is used to monitor or track patients, expensive equipment, supplies and other valuables in the hospital. The main problem lies in the learning of day today activities of the user. This is very much useful to look after the elderly and diseased people, who are dependent on others for all their activities.

ADL is used to identify the limitations of the patients or the elderly. It is learnt by monitoring the daily activities of the end user from brushing to dressing. If the user is able to do all the activities then any medications are not needed otherwise the user is said to be disabled.Disability is not only burden to the patient but also to the care taker. The factors influencing the disability are to be found so that in future we can predict the disability. Furthermore, some appropriate intervention services can be done so that the loss of health or appetite can be detected at an early stage.

Following are the IoT healthcare application systems [2].Consider for eating disorder patient, the sensors are to be placed in the room where the patient is staying ,constant monitoring of the body temperature and any other symptoms leading to the detrimental of health is to be noted and the medications must be changed accordingly.

Consider an elderly patient with Alzheimer's disease. The patient is to be monitored continuously otherwise they can wander about and lose their way. These patients will soon feel insecure. The IoT devices will monitor them and warn them when they are trying to go out of their comfort or secured zone.

The atmosphere of the hospital itself will be a burden to the patients. The abusive nature of nurses or the next bed patient will disturb the patient and sometime will result in disturbance of mind. When the patient is at home the care takers find it difficult. When health monitoring devices are installed the burden of both the patient and the care taker decreases. The care taker need not monitor 24/7 and at the same time the patient can feel at home and enjoy his life.

Although nowadays the video surveillance is available ,the movement of a particular patient or staff cannot be monitored and when a valuable machine is moved tracking of the device is not possible .The introduction of IoT has made all these possible.

The healthcare providers wanted to provide a solution for patients at low cost without disturbing the cozy life. The patients will stay at home doing their daily activities and at the same time be monitored by the devices which the gives update of their health conditions to their doctors. If there is any change in the daily activities then the health care provider can provide medications based on it.

Data mining is used to mine the related data to get the knowledge about the condition of the elderly person by applying various data mining techniques. The data is available as sensor data or the meter usage data or the usage of appliances. The following section will discuss about various data mining techniques and conclude which data mining technique will provide the best accuracy results.

II. ROLE OF IOT IN ADL

The rise in aging population and rise in chronic health condition has made a shift towards empowering people to manage their well-being at home. Sensing technologies [9] are used in ADL. The existing solution monitors everyday activities and in combination with the algorithm finds the behavior pattern of the user.

Many devices have been developed to improve the health care. Sensors and cloud analytics software analyses the data. Health care providers have been increasing in the past 10 to 15 years and they are connected using mobile computers, PC's, smart phones, tablets and communication badges [10].Many elderly and diseased people who require constant monitoring prefer home based monitoring for hospital. The main difficulty is proving the accurate results using health monitoring from home based system. Many companies are developing solutions to improve communication between patient and health care providers and also real time monitoring is done.

The ongoing healthcare projects provide quality healthcare without disturbing the elderly or the diseased people. All projects focus on cost reduction, power consumption and reliability. An IoT use devices like sensors, smart meters, longitudinal data and now Fog computing is also being used to collect quality data so as to provide accurate predictions. These devices are fixed at home environment or in the body of the particular patient who is to be monitored.

III. COMPARISON OF ALGORITHMS

Yassine [3] developed a model where the data is cleaned and prepared for mining. The frequent patterns are mined from discovering association between appliances - to - appliance. Then by using cluster analysis the association between appliances to time is derived. With these processes the system extracts a pattern which acts as an input to Bayesian network. The output of the system is used by health care applications to determine the wellness of the elderly.

The dataset was collected from smart meters data from 5 houses in UK. It included 400 million raw data which was cleaned and reduced to 20 million data. The overall prediction accuracy of data was 89.58.

Without the use of integrated sensors the data can be retrieved from the usage of smart meters. [6]. Two approaches were used. Firstly the SMM-approach is used to detect human habits by using the relationship between home appliance usages. Secondly, the impulse approach adopts the human memory. This allows the doctor to understand diurnal rhythm.

The SMM approach has limitations in parallel ADLs. It leads to temporal restricted view. The impulse model overcomes this by defining exponential decline function for each ADL. When both the approaches are used together, the accuracy on prediction increases.

It is hazardous for people at elderly age to fall down. In the home, a low cost device which will be able to predict a fall will be a great blessing. The elderly people become disabled due to fall.

Hsieg and Jeng [5] have come up with a method to detect fall. They use a video based fall detection system .Detecting the posture is the main problem. Because the sleeping position and the after fall position is same. A posture that immediately changes to lying position is a fall.

The method uses two ways.

1. Choosing well known parameters: This is done by using 3DCNN for temporal optical flow and CNN for spatial features.
2. Motion based rule detection: Euclidean distance between two consequent images is found before inputting the convolution layer. The back propagation method is used to train the deep network which speeds up the performance

KTH dataset is used to check the performance by adopting monitoring stream videos .k-means method is used to cluster the 3DCNN motion and create temporal

rules. The accuracy of the method was computed to be 92.65.

Subasi [8] has discussed about m-healthcare monitoring system. Data mining approach based on user function in the offline mode is used. MHEALTH dataset is used and sensors are located at various parts of the body and the motion is measured. Various data mining algorithms like ANN, k-NN, SVM, decision tree, CART, Random Forest, Rotation Forest have been implemented using MHEALTH dataset and their prediction accuracy is noticed.

The paper comes out with two models that have got overall classification accuracy to be 99.89.Random forest and SVM are suggested to be the best models that can be used in m-healthcare practitioners to get the accurate human activity recognition.

High detection accuracy in complex environments require large amount of data for every multiplexing scenario.de-multiplexing [4] method simplifies the problem in three steps i) human activities prolong ii)all sensors should not trigger together iii)the frequency changes for de-multiplexing events.

Evaluations on 10 public datasets show that 77% segmentation accuracy and activity detection accuracy of 91% is possible.

IV. CONCLUSIONS

Comparison of various existing algorithms has been done and their prediction accuracy has been taken discussed. Most of the existing algorithms have been modified to meet the need of the hour. ADL in IoT has been analyzed involving various methods have been analyzed. Though various models have been discussed we find the maximum prediction accuracy in Random forest and SVM but these models have been able to predict in offline and the future work can be done in implementing this algorithms in daily activities.

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