A PERSPECTIVE ON MACHINE LEARNING ALGORITHMS AND TRAINING FOR RECOGNIZING THE HUMAN ACTIVITY

Mr. S. Ashok Kumar, Research Scholar, PG & Research Department of Computer Science, Park's College(Autonomous), Tirupur, India
Dr. K.P. Rajesh, Associate Professor & Head, PG & Research Department of Computer Science, Park's College(Autonomous), Tirupur, India

Abstract
Artificial Intelligence (AI) is a buzzword in computer research. The AI is formed with two subsets namely machine learning and deep learning. This paper provides a study on machine learning basics and various machine learning algorithms in existence. The paper also deals with human activity recognition based on machine learning algorithms. This survey paper deals on various parameters involved in identification of the physical activity of the humans. The parameters and training implemented with machine learning and deep learning tools and algorithms have shown considerable results in predicting the human activity recognition. The human activity recognition can be carried out with dataset which can be text based, image based and video based. Various researches prove that text, image and video based recognition with various machine learning algorithm is possible. Various machine learning algorithms and few other data recognizing human activity are organized in this paper so that the paper serves as the base for further research and a study for new researchers.

Keywords: Artificial Intelligence, Human activity, Machine Learning, Supervised algorithm

Introduction
The Machine learning is programming computers to optimize a performance criterion using an example data or using the past experience. The model may be a predictive model to make predictions in the future, or it can be a descriptive model which is used to gain knowledge from data, or it can be of both types. Arthur Samuel a renowned computer games and artificial intelligence expert coined the term "Machine Learning". He defined machine learning as "the field of study that gives computers the ability to learn without being explicitly programmed." However, there is no universally accepted definition for machine learning and different authors define the term in different ways.

The applications of machine learning are retail business, finance, banks, stock market, manufacturing, medicine, science, telecommunication artificial intelligence, vision, speech recognition, robotics, transport and games. The applications of machine learning are not limited to the above. Machine learning is mostly worried using the correct features used to build the right models that can solve the correct tasks. The difference between traditional programming and machine learning programming is explained here.

The **t**raditional programming is a program created that uses input data and will run on a computer to produce the desired output but whereas in machine learning programming the input data and output data are fed together to an algorithm which will create a program or logic which can be further used to predict the future outcomes or results.

Review of Literature
Marie Chan, Daniel Esteve et al described in their research work about, the smart wearable watches which are especially used for the health monitoring system. Their research proposed various smart wearable such as sensor, a smart fabric, nanotechnology chips etc [1].

Deepthi Sehrawat et al proposed in their research paper about the usage of the wearable sensors for detecting the human activity. They have also proposed the smart IOT environment for analyzing the human activity [4]. Myagmarbayar Nergui, Neverez imamoglu et al proposed human activity recognition by using various contour data of the tracked human subject extracted from depth images on the color markers. Various geometric parameters like ratio of height, weight of the tracked subject and distance between the centroid points of upper, lower parts of human body were also

calculated by them from the contour data and they were used by the authors as different features for their activity recognition [12]. Ferhat Attal et al proposed in their research paper that the human activity can be recognized physically based on the human wearable inertial sensor data. They had a study on supervised classifications algorithms namely SVM, GMM, and RF. They also presented the study by comparing the various supervised and unsupervised data sets [6]. Ayokunle Olalekan Ige, Mohd Halim Mohd Noor has proposed a survey for adoption of unsupervised learning algorithms in wearable sensor based recognition. They suggested the reviewing of the activity recognition models for unlabelled datasets.

Artificial Intelligence and Machine Learning

The machine learning algorithms are often categorized by how an algorithm learns to become more accurate in its predictions. The type of algorithm the data scientists or the researcher choose to use depends on what type of data they want to predict. There are four basic learning methods and they are

1. Supervised learning
2. Unsupervised learning
3. Semi-supervised learning
4. Reinforcement learning

Machine Learning (ML) is being vastly used almost in all the areas. ML is an area of study in which the computers have the capability to learn themselves without being programmed. These machines will have the potential to learn by themselves. A machine will learn by itself from its past experiences. For example, if we supply the machine that a tube shaped yellow or red based fruit with such properties is a banana. The next time the machine learns and it is able to predict an object of that shape and properties to be a banana.

***Supervised Learning (SL)*:** SL model will use labeled dataset for training. A labeled dataset has input and output parameters. In this type of learning training and validation, datasets will be found labeled. For example a banana may carry a label on it named “banana”. The machine will read the label and predict that that it is banana fruit. Some of the Supervised Learning Algorithms are decision trees, linear regression, nearest neighbor, logistic regression, Support Vector Machine (SVM) and random forest.

Training: While training the model the data will be in 8:2 ratio which means that 80% of data will be used to train and 20% data will be used for testing. During training process, we should give the input along with 80% of output data. The model learns from these data and it will be ready for testing. During testing process the input is fed from the remaining 20% of data and the model will predict some value based on its learning.

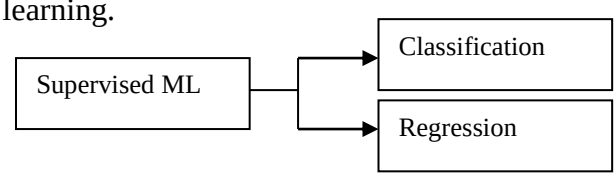

Fig.1. Supervised Learning types

Classification SL: In classification based supervised ML, the output will have defined labels. This can be either binary classification or multiclass classification. In binary classification the model predicts either 0-or-1 or yes-or-no. In multiclass classification, the model has the ability to predict more than one class. Example of multiclass is that the Google mail classifies the mails in classes like social, promotions, updates etc.

Regression SL: In regression based supervised ML, the output will be having a continuous value. The aim is to predict the closest data value nearer to the actual output value. Here the evaluation is carried out by calculating the error value. The smaller the error will provide the greater accuracy of the regression model.

Unsupervised Learning (USL): This machine learning will evaluate and group the unlabeled datasets using specific machine learning algorithms. These algorithms will find the hidden patterns and data without any human involvement. Here we will not provide the output to this model. The

training model has only input parameter values and discovers the groups or patterns on its own. Some unsupervised algorithms are K-Means Clustering, Density-Based Spatial Clustering of Applications with Noise Balanced Iterative Reducing and Clustering using Hierarchies and Hierarchical Clustering

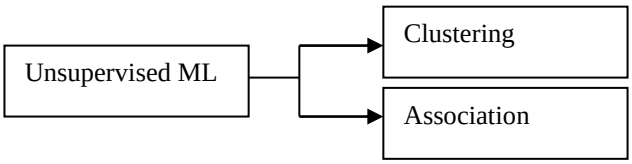

Fig.2. Unsupervised Learning types

Clustering USL: This technique is useful to group the data based on different patterns. Grouping of unlabeled data is called as clustering. These clustering algorithms are used to process unclassified data objects into different groups. Examples of clustering include social network analysis and medical images.

Association USL: This technique is a rule based ML technique which will find out some useful relationship between the various parameters belonging to a big data set. This technique is basically used to analyze sin shopping markets to identify the relationship between various products. Example, in a shopping mall, it is predicted that, if a customer buys bread then he may also buy jam or spread. This is called as association. Hence based on association once the model is trained well this model will predict well and which can be used to increase their sale.

Semi Supervised Learning (SSL): This learning lies between Supervised and Unsupervised techniques. These techniques are used when data is small portion of partially labeled and large portion of partially unlabeled data. The unsupervised techniques are used to predict labels and then these labels are fed to supervised techniques. Some algorithms include generative model, low density separation and laplacian regularization

Reinforcement Learning (RL): The reinforcement learning is a feedback based machine learning technique. The feedback may be either positive or negative. The data will be discovered automatically using the feedbacks. There will be no labeled data present in this technique. There are three methods to put into practice a reinforcement learning algorithm and they are value based, policy based and model based methods.

Human Activity Recognition

The human activity recognition is the most popular and active research area by using machine learning algorithms. Human activity recognition means the ability of the machine to predict the movement of human body. This can be done be using sensors, accelerometer, gyroscope etc. The accelerometer provides the maximum functionality and followed by the gyroscope [9]. The recognition of human activity is majorly used in the health care system which is installed in the residence, hospitals and other medical based centers. These are also used in disease management and disease prevention projects. The training data for human activity recognition can be from text, image, and video datasets.

Human activity recognition aims to classify a person's actions from a series of measurements captured by sensors. Nowadays, collecting this type of data is an easy task because of the growth of Internet of Things (IOT) because everyone has started using any one of the gadget that monitors their movements. The gadgets can be a smart watches, pulsometer, or smart phones. Smart watches are used in various IOT situation including various application like healthcare, medical and fitness. Since the current smart watches are embedded with variety of sensors and heterogeneous wireless protocols. These are used to perform a variety of people based activity recognition. These applications involve sending the sensor data from watches. Processors on current watches are powerful enough to run even deep learning algorithms and may support peak download data rates of more than 50 Mbits/second. The ever growing electronics and wearable technology is producing various cost effective, light weight and eco friendly, products. Paper based electronics in the emerging wearable applications are also implemented [8].

Human Activity Recognition is a type of time series classification problem where you need data from a series of time steps to correctly classify the action being performed. The video based machine learning model will try to learn and distinguish between two same actions based on the environmental and video layers. There are various **v**ideo classification methods used for human activity recognition they are single frame CNN, late and early fusion, using CNN with LSTM and using pose detection and LSTM, using optical flow and CNN and using slow fast networks. A machine learning human recognition model can be trained with sensor collected datasets into the following classes for prediction and classification works.

1. Walking
2. Walking Upstairs
3. Walking Downstairs
4. Sitting
5. Standing
6. Lying

Basics Steps Involved in Human Activity Recognition

The machine learning algorithms are used in various researches and by various researchers in human activity recognition. The following are the steps which are commonly used in any prediction model design and the same will be used in the human activity recognition models. The general steps used in processing the data are listed.

Step 1: Download and Extract the Dataset
Step 2: Visualize the Data with its Labels or Use Unlabelled Data Set
Step 3: Read and Preprocess the Dataset
Step 4: Split the Data into Train and Test Set
Step 5: Construct the Model
Step 6: Compile and Train the Model
Step 7: Plot Model Loss and Accuracy
Step 8: Make Predictions with the Model

Conclusion

The study on machine learning and human activity recognition will serve as a base for researchers on various machine learning algorithms. The algorithms that are in existence in the field of research for recognition of human activity based on various sensor data available from various sources are presented. The human activity data collection, steps in various data processing system and training system are explained. The machine learning algorithms mostly used with human activity recognition is mostly based on the supervised machine learning algorithm with labeled data. Different algorithms can be used with different datasets so that novel research works can be carried out. This survey mostly was presented towards the human activity recognition models based on text dataset, image dataset and video datasets

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