# Human Activity Recognition Using SVM and Deep Learning

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*Abstract*: **Human activity recognition (HAR) is aiming to identify the actions carried out by a person which is required for pedestrian tracking, healthcare, and smart cities applications. The human motions are observed and the speed of the activities are measured using the sensors such as accelerometer, gyroscope and magnetometer sensors. Also, machine learning is needed to code the tasks that are too complex for humans. The machine leaning techniques support vector machine and deep learning are applied in this work. Support Vector Machine classifier, on an existing spatiotemporal feature descriptor resolves the problems in human activity recognition. Deep learning methods such as convolution neural networks and recurrent neural networks are capable and even achieve state-of-the-art results by automatically learning features from the raw sensor data. This work will be implemented using MATLAB. This application is used to improve the performance of accuracy of the human activities and to verify the robustness using large set of dataset.**

*Keywords*: **Human Activity Recognition, Sensor, Convolution Neural Network, Support Vector Machine, Deep Learning.**

## 1. Introduction

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. In electrical engineering and computer science, Image processing is any form of processing for which the input is an image or a series of images or videos, such as photographs or frames of video. The output of image processing can be either an image or a set of characteristics or parameters related to the image. In computer science, digital image processing is the use of computer algorithms to perform image processing on digital images. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Image processing has some clear advantages. Increased accuracy, higher speed and advanced color shade processing technology are just some of the advantages attributed to Keyence's CV700 image processing system. Using that image processing technique in daily sports activity and to recognize the human actions. Human activity recognition is important part in machine learning. It uses for indoor and outdoor environment.

If it works wearable sensor for detecting player performance such as speed, fitness ability, scoring, player mistakes. Without sensor means it takes a player picture and predicting what they have to do in playground.

## 2. Image Processing

Digital image processing deals with manipulation and analysis of images by using computer algorithm, so as to improve pictorial information for better understanding and clarity. This area is characterized by the need for extensive experimental work to establish the viability of proposed solutions to a given problem. Image processing involves the manipulation of images to extract information to emphasize or de-emphasize certain aspects of the information, contained in the image or perform image analysis to extract hidden information. Image processing is used for a number of application areas that include soil testing, good quality seed selection, identification of nutrient deficiencies, monitoring and controlling of stress, weeds and diseases, assessment of crop status and yield. The Computer Vision System aims at recognizing objects of interest from given images and helps in developing the machine, that can perform visual function parallel to human vision. Computer Vision System consists of filtering, coding, enhancement, restoration, feature extraction, analysis and recognition of objects from image. Processing of an image comprises of improvement in its appearance and effective representation of input image suitable for required application.
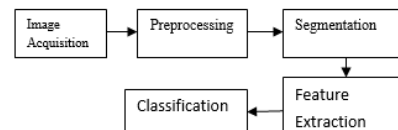


Fig. 1. Steps carried out in Image Processing

Figure shows the generic block diagram of Image analysis system. It includes image acquisition, pre-processing of input image, segmentation, feature extraction and presentation or classification. Image acquisition involves capturing the images in the suitable form. Pre-processing improves the quality of the data by reducing artifacts. Segmentation groups pixel into regions, thereby defining the boundaries of the region of

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interest. Feature extraction and selection provides the measurement vectors. Feature extraction is followed by presentation or classification and is performed by estimating different features of the segmented region. Image acquisition involves capturing the images in the suitable form. Pre-processing improves the quality of the data by reducing artifacts. Segmentation groups pixel into regions, thereby defining the boundaries of the region of interest. Feature extraction and selection provides the measurement vectors. Feature extraction is followed by presentation or classification and is performed by estimating different features of the segmented region.

### 3. Human activity recognition

Activity recognition aims to recognize the actions and goals of one or more agents from a series of observations on the agents' actions and the environmental conditions. Since the 1980s, this research field has captured the attention of several computer science communities due to its strength in providing personalized support for many different applications and its connection to many different fields of study such as medicine, human-computer interaction, or sociology. Due to its many-faceted nature, different fields may refer to activity recognition as plan recognition, goal recognition, intent recognition, behavior recognition, location estimation and location-based services. Sensor-based activity recognition researchers believe that by empowering ubiquitous computers and sensors to monitor the behavior of agents (under consent), these computers will be better suited to act on our behalf. Sensor-based activity recognition integrates the emerging area of sensor networks with novel data mining and machine learning techniques to model a wide range of human activities.

### 4. Support vector machine

A support vector machine is one of the most commonly used supervised ML algorithms. It was initially proposed by Vladimir Vapnik and his colleagues with the aim of solving linear and non-linear binary classification problems. Afterward, this algorithm has been adapted for its application in multiclass classification and regression analysis. The SVM for classification is a deterministic approach that aims to find the hyper plans that best separate the data into classes. These subspaces are the ones that provide the largest margin separation from the classes of the training data with the intention of providing a model with low generalization error for its use with unseen data samples.

SVMs are the basis for the classification of activities in this work. For this reason, we now introduce them, starting from the binary SVM model which is its simplest representation, to the extended case that allows the classification of more than two classes: the multiclass SVM. This algorithm will be further revised throughout the development of this research to tackle specific requirements for our application in aspects such as kernel type, arithmetic used and algorithm output type.
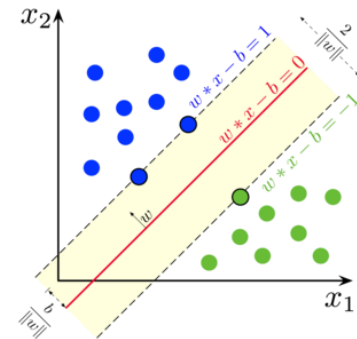


Fig. 2. Hyperplane classify the input data

A Support Vector Machine (SVM) is a discriminative classifier formally defined by a separating hyper-plane. In other words, given labeled training data (supervised learning), the algorithm outputs an optimal hyper-plane which categorizes new examples. The goal of SVM is to identify an optimal separating hyper-plane which maximizes the margin between different classes of the training data. SVM or Support Vector Machine is a linear model for classification and regression problems. It can solve linear and non-linear problems and work well for many practical problems. The idea of SVM is simple: The algorithm creates a line or a hyper-plane which separates the data into classes. SVM stands for Support Vector Machine. In Machine learning, SVMs are learning algorithms used for regression and classification. A set of algorithms called 'Kernel methods' are used to implement non-linear classification. Kernel trick is helpful to do pattern analysis by mapping inputs in higher dimensional space. In machine learning, support-vector machines (SVMs, also support-vector networks) are supervised learning models with associated learning algorithms that analyze data used for classification and regression analysis. In machine learning and statistics, classification is a supervised learning approach in which the computer program learns from the data input given to it and then uses this learning to classify new observation. Linear Classifiers: Logistic Regression, Naive Bayes Classifier. SVM is a supervised machine learning algorithm which can be used for classification or regression problems. It uses a technique called the kernel trick to transform your data and then based on these transformations it finds an optimal boundary between the possible outputs. Multiclass SVM aims to assign labels to instances by using support vector machines, where the labels are drawn from a finite set of several elements. The implemented approach for doing so is to reduce the single multiclass problem into multiple binary classification problems via one-versus-all. Accuracy is one metric for evaluating classification models. Informally, accuracy is the fraction of predictions our model got right.

### 5. Related work

Nihat Inanc [1] proposed in this project, classifying the daily and sports activities recognition is improving human life quality. Human activity Dataset used to validate and evaluate the person activity. The statistical features were extracted from

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the histogram of the local changes. In this work feature extracted were classified by extreme learning machines. The project result proposed approach is enough to recognize the action type, but in order to recognize the actions, or gender, different feature extraction methods. ELM was used in classifications.

E. Mohammadi [2] propose the project is numerous human action recognition algorithms have been developed and evaluated recently. In this project, an ensemble of support vector machines (SVMs) is employed to improve the classification performance by fusing diverse features from different perspectives. Fusion technique to be used in this project for the purpose have been utilized to combine the outputs of single classifiers.

Majd Latah [3] propose that project using the recent approach deep learning widely in order to enhance the recognition accuracy application with different areas. Extract the spatial and temporal feature from adjacent video from using the 3D CNN method. classify each instance based on previously extracted features using support vector machine method. The CNN layer and resolution both are combined of the input frames were reduced to meet the limited memory constraints.

Tahmina Zebin [4] propose the main concept of this project is to compare the performance of different algorithms for human activity recognition by extracting various statistical time domain and frequency domain features from the inertial sensor data. The classification algorithm results are better than other algorithm Support Vector Machines with quadratic kernel classifier (accuracy: 93.5%) and Ensemble classifier with bagging and boosting (accuracy: 94.6%) outperforms other known activity classification algorithms.

Xiaoran Shi, [5] the main aim of this project nowadays many security defence are demand to be increased, anti-terrorism investigation and disaster rescue, human activity classification and recognition. Classification needs a lots of training and testing data, there is a between the simulated data and real data. Spectrogram using the deep convolutional generative adversarial network for expanding and enriching training set and a transfer learned deep convolutional network (DCNN) for feature extraction and classification.

Cho Nilar [6] proposed this project increasing the electronic consumer demands in this world. So it can be predicting the human activity for various application such as monitoring the elderly, and surveillance for detection of suspicious people and objects left in public places. Advantage of this project some techniques have been developed for Human Action Recognition (HAR) using wearable sensors, these devices can place unnecessary mental and physical discomfort on people, especially children and the elderly.

Min-Cheol Kwon [7] proposed in this project the human activity are categories into two ways exercise type and exercise posture. The internet of things has provided many applications for wearable sensors. It proposes a novel classification model that classifies human activities into 11 different categories

including activities that are highly active and less active in daily life. The deep learning convolution neural network are performed and extensive evaluation shows that various daily human activities can be classified with 97.19% accuracy.

Md. Zia Uddin, [8], The main aim of this project Open pose method to be used, which means to extract body skeletons from thermal images an open source library is used. The project work to proposes a thermal camera-based human activity recognition approach using robust features and a deep recurrent neural network. The working method of this project is robust features from the thermal videos are applied to a deep recurrent neural network for activity modeling and recognition.

Qingchang Zhu [9] propose this project inertial sensors used to detect human activity recognition such as healthcare and ubiquitous computing. The labelled data are finding sometimes too difficult. The semi supervised learning method find the accurate result in HAR both the labelled and unlabelled data. The purpose of this method is employs the DLSTM network to extract high-level features. The output of the neural networks when using unlabeled data is compared and evaluated with the past ensemble predictions so as to calculate the unsupervised learning loss.

Sonali [10] the human actions are recognized from the video sequences. In this video sequence are used in various important fields like patient monitoring, video surveillance monitoring system, human computer interaction, dance choreography analysis, analysis of sports event, entertainment environments. Hybrid technique has been demonstrated for the purpose of enhancing the human activity to recognize from the video. The K-NN classifier has find the Euclidean distances between the test data and train data. SVM has a higher generalization capability and provides high accuracy while extracting the video to recognize the rate depends on foreground and background.

## 6. Proposed work

The major criteria to consider in case of activity recognition, is to increase the accuracy of activity recognition through a long-term period of time. The proposed method in this project used support vector machine algorithm and convolution neural network for human activity recognition. Initially the input dataset collected is pre-processed using image processing technique. The image pre-processing technique used noise removal, convert the image to gray scale, threshold the image, complement the image, find the boundaries of the object. The goal is to detect and classify short duration tasks that compose a more complex activity. The aim is to predict and classify long term action like running, jagging, jumping, and playing games. In this work to propose a SVM classifier for activity recognition within a high dimensional feature space. We consider about two major objectives: first, labeling activities and second, learning with few examples. To use multi class SVM classifier since our datasets include multiple activities done by different actors. The classification is then processed using multi class SVM to obtain

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long-term activity recognition. The advantage of the proposed method is that image classification and feature extraction is applied to improve the recognition accuracy. Another advantage is that; the recognition is made based on three different classifications that make it useful to obtain deeper analysis for the future. The proposed approach was employed in order to classify activity type, recognition of action, and gender.

## 7. Conclusion

In this work, Activity recognition is an important field in recent times and there is a need to recognize the demand of human activity for the future concern. In this project the activity recognition is done based on different criteria such as the season, activity recognition and the field where the activity is recognized. By recognize the human activity on different aspects deeper analysis and finding can be obtained. In this phase the detailed study of human activity recognition is done by studying the various types of recognition and the various algorithm used. The need for activity recognition and its application has been made with the existing methods and their advantages and disadvantages have been noted. A suitable dataset has been downloaded for the proposed multiple activity recognizing model that contains all the three required factors. The data is collected and then pre-processed to make it suitable for implementing the next phase for human activity recognition.

## References

[1] Alessandro Manzi, Two-person activity recognition using skeleton data, October 2017.
[2] Sonali, Human Action Recognition using Support Vector Machine and K-Nearest Neighbour. International Journal of Engineering and Technical Research, Volume 3, Issue 4, April 2015.
[3] Cem Direkoˇglu, "Team Activity Recognition in Sports, Centre for Sensor Web Technologies, Dublin City University, Ireland.
[4] Lin Fan, Human activity recognition model based on Decision Tree, School of Computer Science & Technology, Xi'an University of Posts & Telecommunications, China.
[5] Megha D. Bengalur, Human activity recognition using body pose features and support vector machine.
[6] Antonio Bevilacqua1, Human Activity Recognition with Convolutional Neural Networks, nsight Centre for Data Analytics, UCD, Dublin, Ireland.
[7] K. G. Manosha Chathuramali, Faster Human Activity Recognition with SVM, Engineering Research Unit, University of Moratuwa, Sri Lanka, December 2012.
[8] Tahmina Zebin, Evaluation of Supervised Classification Algorithms for Human Activity Recognition with Inertial Sensors, University of Manchester, 2017.
[9] Tushar Dohbal, Human activity recognition using binary motion image and deep learning, Procedia computer science 2015.
[10] E. Mohammadi, Human Activity Recognition Using an Ensemble of Support Vector Machines,2016.
[11] Majd Latah, Human action recognition using support vector machines and 3D convolutional neural networks. International Journal of Advances in Intelligent Informatics, Vol. 3, No 1, March 2017, pp. 47-55.
[12] Xiaoran Shi, Human Activity Recognition Based on Deep Learning Method.
[13] Xiaoran Shi, Yaxin Li, Feng Zhou, Lei Liu The Ministry Key Laboratory of Electronic Information Countermeasure and Simulation Xidian University Xi'an, Shaanxi, China.
[14] Hanyuan Xu, Study on Fast Human Activity Recognition Based on Optimized Feature Selection, 2017 16th International Symposium on Distributed Computing and Applications to Business, Engineering and Science.
[15] Rui Xi, Deep Dilated Convolution on Multimodality Time Series for Human Activity Recognition, IEEE, 2018.
[16] Haipeng Chen, "Assessing impacts of data volume and data set balance in using deep learning approach to human activity recognition," IEEE, 2017.
[17] Jagwinder Kaur Dhillon, A Recent Survey for Human Activity Recoginition Based on Deep Learning Approach, 2017 Fourth International Conference on Image Information Processing (ICIIP).
[18] Zhenguo Shi, Human Activity Recognition Using Deep Learning Networks with Enhanced Channel State information, Global Big Data Technologies Center University of Technology Sydney, Sydney, Australia.
[19] Cho Nilar Phyo, Deep Learning for Recognizing Human Activities using Motions of Skeletal Joints, IEEE Transactions on Consumer Electronics.
[20] Md. Zia Uddin, A Deep Learning-Based Human Activity Recognition in Darkness, IEEE, 2018.
[21] Cheng Xu, A Deep Neural Network for Complex Human Activity Recognition.
[22] Qingchang Zhu, A Novel Semi-Supervised Deep Learning Method for Human Activity Recognition, IEEE Transactions on Industrial Informatics, 2018.