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# Soft Computing Approaches for Human Action Recognition: A Review

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**ABSTRACT:** Human action recognition aims to recognize human body action from large variations in human posture and body size. It become ambitious due to different body movement styles. Action recognition in video become more interesting because of its potential application in daily life such as smart home, smart nursing, patient monitoring etc. Many soft computing techniques are used for solving real life problem, as soft computing gives the combination of natural as well as artificial ideas make easy to implement the problem which is define in theory but difficult in actual implementation. Soft computing techniques like neural networks, support vector machine, genetic algorithm, fuzzy logic, and combination of these techniques as per requirement of their properties are used for the solving real life problem. These approaches gives different results respective to their accuracy in different condition and different dataset used for the evaluation. The main aim of this paper is to provide comparative analysis of commonly used techniques in human action recognition.

**KEYWORDS**: Human action; support vector machine; neural network; genetic algorithm; fuzzy logic; hybrid classifier; PCA

## I. INTRODUCTION

Detection of the human action capture the attention of several computer science communities due to its strength in providing personalized support for many different application and its connection to many different field of study such as medicine, human computer interface or sociology. Human action recognition is a research problem in computer vision that if solve would enhance various application in Human Computer Interface. Action recognition in video sequences makes machines to recognize human using different types of information specially motion information in the videosequences. For classification ofdifferent action perform by the single person or different person performing single action different soft computing techniques are used for effective classification.Detection of human activity robustly emerging as an investigation tool push ahead by the growing need of the people. Action recognition is a method of detecting action that happen in video series [4]. In fact the role model for soft computing is human mind. It refers to a collection of computational techniques in computer science, artificial intelligence, machine learning applied in engineering areas such as aircraft, spacecraft, cooling and heating, communication network, mobile robot, inverters and converters, electric power system, power electronics and motion control etc.

Traditionally soft computing has been comprised by some technical disciplines such as neural network, and fuzzy logic. Support vector machine is well known classifier used in human action recognition which gives more effective result with respect to other. Recognizinghuman actions in real-world environment finds applications in a variety of domains including intelligent video surveillance, customer attributes, and shopping behavior analysis. However, accurate recognition of actions is a highly challenging task due to different backgrounds, situations, and viewpoint variations [3]. Also human motion analysis has recently emerged as one of the most dynamic research topics in the field of computer vision. Especially, the task of assigning labels of action classes to data sequences induced by human activity has attracted much of attention during the past two decades. The focus of this research is real time monitoring of elderly peoples health and recognizing any abnormal activity for e.g. fall recognition. To take advantage of recent advances in information technologies and reduce the burden on hospitals and economy. Also, it is proved that people suffering from long term diseases feel much better in their home environment than hospitals. The human activity and posture recognition have been extensively studied during the past few years. A detailed survey of video based motion and activity recognition systems is discussed in this report. A smart home system for elderly people's health carewill be

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implement by using video monitoring for detect and monitor elderly peopleactivities and generate an alert in emergency situation [5].

## II. RELATED WORK

In [7] authors used technique relies on detecting the interest point using SIFT (scale invariant feature transform) from each frame of the videoA fine tuning step is used to limit the number of interesting points according to the amount of details. Then the popular approach bag of video words is applied with a new normalization technique. This normalization technique remarkably improves the results. Finally a multi class linear support vector machine (SVM) is utilized for classification. Experiments were conducted on the KTH and Weizmann datasets. The results demonstrate that given approach outperforms most existing methods, achieving accuracy of 97.89% for KTH and 96.66% for Weizmann.

In [8] authors used a new approach for human activity recognition in a video sequence by exploiting the key poses of the human silhouettes, and constructing a new classification model. The spatiotemporal shape variations of the human silhouettes are represented by dividing the key poses of the silhouettes into a fixed number of grids and cells, which leads to a noise free depiction. The effectiveness of this approach of activity representation and classification model is tested over three public data sets i.e. Weizmann, KTH, and ballet movement. The comparative analysis shows that this method is superior in terms of recognition accuracy to similar state-of-the-art methods.

In [9] authors used multi-category classifications of human actions are usually performed by solving many one versus rest binary SVM classification tasks. However, it leads to the class imbalance problem. Furthermore, because of environmental problems and intrinsic noise of spatiotemporal features, videos of similar actions may suffer from huge intraclass variations, author address these problems by introducing the energy-based least square twin support vector. Scientist investigate the performance of this methods on Weizmann, KTH dataset.

In [2] author used a system framework is presented to recognize multiple kinds of activities from videos by an SVM multi-class classifier with a binary tree architecture. The framework is composed of three functionally cascaded modules:

1. Detecting and locating people by non-parameter background subtraction approach.
2. Extracting several of features such as local ones from the minimum boundingboxes of human blobs in each frames and a newly defined global one, contourcoding of the motion energy image (CCMEI).
3. Recognizing activities of people by SVM multi-class classifier whose structure is determined by a clustering process.

## III. SOFT COMPUTING APPROACHES

To solve a problem on a computer, there is need of an algorithm. An algorithm is a sequence of instructions that should be carried out to transform the input to output. For example, one can derive an algorithm for sorting. The input is a set of numbers and the output is their ordered list. For the same task, there may be various algorithms and it may be interested in finding the most efficient one, requiring the least number of instructions or memory or both. For some tasks, however, it does not have an algorithm-for example, to tell spam emails from legitimate emails. It know what the input is: an email document that in the simplest case is a file of characters. Soft computing that studies how computers can learn. It relies heavily on techniques and theory from statistics, optimization, algorithms, and in some cases biology. A machine learns improves its performance to solve a certain problem by receiving information about the problem at hand, often observations of how example cases of the problem were solved in the past. In order to learn, machine learning algorithms find exploitable regularities. Soft computing is therefore closely related to pattern recognition and data mining. Several good introductions to the field are available. Machine learning is programming computers to optimize a performance criterion using example data or past experience. It has a model defined up to some parameters, and learning is the execution of a computer program to optimize the parameters of the model using the training data or past experience. The model may be predictive to make predictions in the future, or descriptive to gain knowledge from data, or both. Under the umbrella of soft computing principle constituents are neural networks, fuzzy Systems, Machine Learning, Evolutionary Computation, probabilistic reasoning, etc. and their hybrid approaches. Here some are discus.

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*a. Artificial neural networks:*

An Artificial Neural Network (ANN) is made of many highly interconnected processing elements, which are working in together to solve specific problems. ANN can be configured for problems like pattern recognitions or data mining through learning based models. Also ANN has capabilities like adaptive learning, self-organizing and real time operations using special hardware. ANN based layer approach is used todetect fingertips. After obtaining fingertips vectors, it is transformed into fingerjoint angles to an articulated hand model. For each finger separate network weretrained on same feature vectors, having input space 35 dimensional while output dimensional as only 2. Also Hidden Markov Model (HMM) used for gesture recognition using shape feature [4]. Gesture state is determined after stabilizing the image component as open fingers in consecutive frames.

*b. Support vector machine:*

Support vector machine was initially popular with the NIPS community and now is an active part of the machine learning research around the world. SVM becomes famous when, using pixel maps as input; it gives accuracy comparable to sophisticated neural networks with elaborated features in a handwriting recognition task. It is also being used for many applications, such as hand writing analysis, face analysis and so forth, especially for pattern classification and regression based applications.The foundations of Support Vector Machines (SVM) have been developed by Vapnik and gained popularity due to many promising features such as better empirical performance. The formulation uses the Structural Risk Minimization (SRM) principle, which has been shown to be superior, to traditional Empirical Risk Minimization

(ERM) principle, used by conventional neural networks. SRM minimizes an upper bound on the expected risk, whereas ERM minimizes the error on the training data. It is this difference which equips SVM with a greater ability to generalize, which is the goal in statistical learning. SVMs were developed to solve the classification problem, but recently they have been extended to solve regression problems. The support vector machine [SVM] is a training algorithm. It trains the classifier to predict the class of the new sample. SVM is based on the concept of decision planes that defined decision boundary and point that form the decision boundary between the classes called support vector treat as parameter. SVM is based on the machine learning algorithm invented by vapnik in 1960's[10].

It is also based on the structure risk minimization principle to prevent over fitting. There are 2 key implementations of SVM technique that are mathematical programming and kernel function. It finds an Optimal separates hyper plane between data point of different classes in a high dimensional. Support vector machines are supervised learning models with associated learning algorithms that analyze data and recognize patterns, used for classification and regression analysis. Given a set of training examples, each marked as belonging to one of two categories, an SVM training algorithm builds a model that assigns new examples into one category or the other, making it a non-probabilistic binary linear classifier. An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible [10]. New examples are then mapped into that same space and predicted to belong to a category based on which side of the gap they fall on

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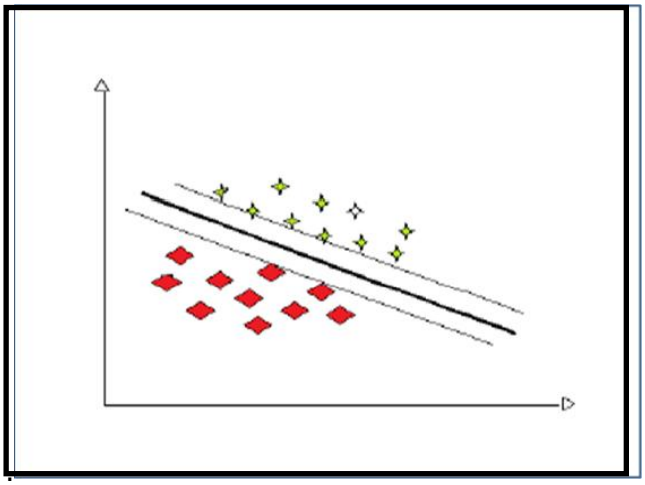

Fig 1. Support vector machine[10]

*c. Fuzzy logic*

Over the past few decades, fuzzy logic has been used in a wide range of problem domains. Although the fuzzy logic is relatively young theory, the areas of applications are very wide: process control, management and decision making, operations research, economies and, the most important, pattern recognition and classification.Dealing with simple black and white answers is no longer satisfactory enough; a degree of membership (suggested by Prof. Zadeh in 1965) became a new way of solvingtheproblems. A fuzzy set is a set whose elementshave degreesofmembership. Anelement of a fuzzy set can be full member (100% membership) or a partial member (between 0% and 100% membership). That is, the membership value assigned to an element is no longer restricted to just two values, but can be 0, 1 or any value in-between. Mathematical function which defines the degree of an element's membership in a fuzzy set is called membership function [15]. The natural description of problems, in linguistic terms, rather than in terms of relationships between precise numerical values is the major advantage of this theory.

d. Genetic algorithms:

Genetic Algorithms are powerful and widely applicable stochastic search and optimization methods based on the concepts of natural selection and natural evaluation.In a genetic algorithm, a population of candidate solutions (called individuals, creatures) to an optimization problem is evolved toward better solutions. Each candidate solution has a set of properties (its chromosomes or genotype) which can be mutated and altered; traditionally, solutions are represented in binary as strings of 0s and 1s, but other encodings are also possible. The evolution usually starts from a population of randomly generated individuals, and is an iterative process, with the population in each iteration called a generation. In each generation, the fitness of every individual in the population is evaluated; the fitness is usually the value of the objective function in the optimization problem being solved. The more fit individuals are stochastically selected from the current population, and each individual's genome is modified (recombined and possibly randomly mutated) to form a new generation. The new generation of candidate solutions is then used in the next iteration of the algorithm. Commonly, the algorithm terminates when either a maximum number of generations has been produced, or a satisfactory fitness level has been reached for the population. The random convergence of solutions in a variant problem with respect to a fitness function is the major disadvantage of genetic algorithm. Among these SVM is accurate methods among all machine learning algorithms. As it finds best classification function for training data.

## IV. HUMAN ACTION DETECTION

In human action detection first step is background subtraction or foreground detection this result into black and white image with the subtracted and background subtraction method delete the fix objects in the image frame and indicate the only the moving object.

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1. Foreground extraction:

The first step is to provide a video sequence of an activity as an input in the system from the dataset. That video contains a number of continuous frames. After that background subtraction technique is used to separate moving object present inside those frames [2]. But these frames contain some noises which may lead to incorrect background subtraction.Fig2. Shows the background subtraction.

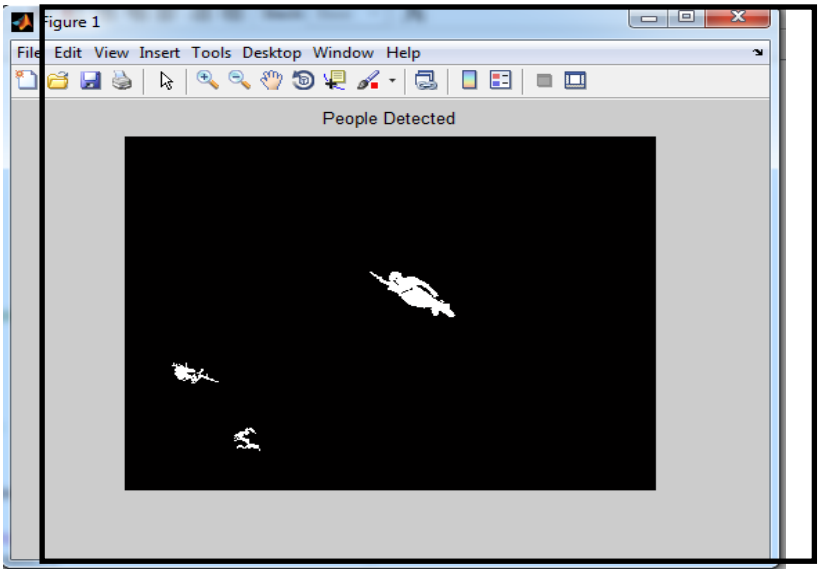


Fig 2: Background subtraction [2]

2. Feature extraction:

A model based approach to extract the features. The extracted foreground that supposed to be a human is segmented into centroid and two leg components for the detection of activity. The features are of two types local and global.The local features are all extracted from minimum bounding box, the extracted local features includes the shape features and motion features extracted from minimum bounding box. Two types of shape feature are extracted from minimum bounding box one is unitary height.

$$h(t) = H(t)/H_{max} \qquad (1)$$

Where $H(t)$ the height of the bounding is box at instantt and $H_{max}$ is the maximum value of $H(t)$among whole activity sequence.

The second is the ratio of height against width.

$R(t) = H(t)/W(t)$(2)

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Fig 3. Minimum bounding box of human body [2].

Another important feature is the global feature which gives the contour coding of the motion energy image as shown in fig 4.

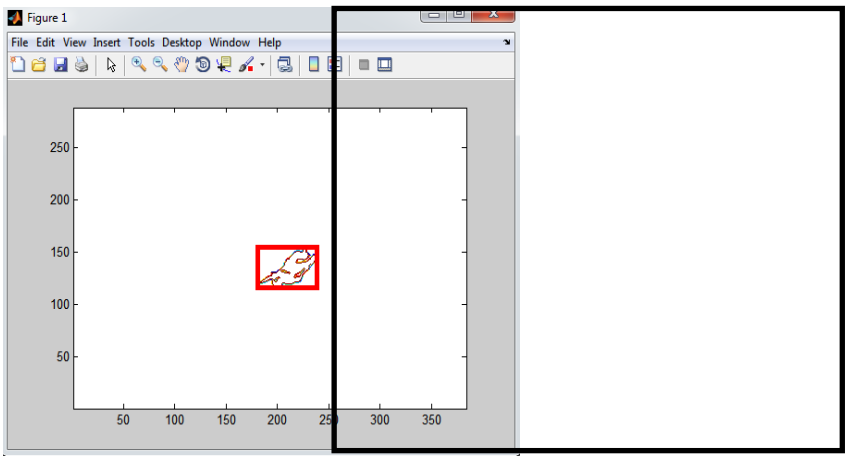


Fig 4. Contour of the moving object in frame [2].

Motion energy image (MEI) and motion history image (MHI) as temporal templates to characterize an action. The MHI is a function of the action duration and dependent on the entire extraction of moving targets in each frames, which is difficult in real scenes.

## V. CONCLUSION AND FUTURE WORK

This paper review soft computing approaches for human action detection. The approaches such as neural networks, support vector machine, genetic algorithms, fuzzy logic etc. It is used in the real time hence become more interesting as it is can used in daily life situation. Human action recognition for the effective patient monitoring is an important field as patient in critical situation needs to observe his every action. It become challenging because of recognition of human action from different body proportions and dissimilar feature of human. Human action captured the attention of several computer science communities because it providepersonalized support for number of application and connection to many field such as medical, human computer interface. In future work, the patient monitoring system which can help to patient having mobility problem. Detection of abnormal activity of patient such as fall, chest pain and provide help for him.

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## REFERENCES

1. Yanyun Lu, 'Application of an incremental SVM algorithm for on-line humanrecognition from video surveillance using texture and color features', Neurocomputing 126 pages 132-140, 2014.
2. HuiminQian, Recognition of human activities using SVM multi-class classifier, Pattern Recognition Letters 31 pages 100-111, 2012.
3. Santosh Kumar Das, Soft Computing Techniques in Various Area ", Department of Computer Science and Engineering, Dr. B. C. Roy Engineering College, Durgapur-713206, W.B. India, pages 59-68, 2013.
4. ShuiwangJi, '3D Convolutional Neural Networks for Human Action Recognition', Arizona State University, Tempe, AZ 85287, USA, 2010.
5. Z.A. Khan, 'Real Time Human Activity Recognition System based on Radon Transform', Dept. of Electronics and Radio Engg. Kyung Hee University,South Korea, IJCA Special Issue on Artificial Intelligence Techniques – NovelApproaches & Practical Applications, 2011.
6. Rudolf Seising, 'A Very Brief History of Soft Computing European Centre forSoft Computing Edificio de Investigation', 2013.
7. Mona M. Moussa, 'An enhanced method for human action recognition ", Journal of Advanced Research (2015) 6, pages 163-169, 2015.
8. D.K. Vishwakarma, 'Hybrid classifier based human activity recognition using the silhouette and cells, Expert Systems with Applications 42, 6957-6965, 2015.
9. Jalal A.Nasiri, 'Energy-based model of least squares twin Support Vector Machines for human action recognition', Signal Processing 104, pages 248-257, 2014.
10. Carlos Serra-Toro, 'exploring some practical issues of SVM+: Is really privileged information that helps', Pattern Recognition Letters 42, pages 40-46, 2014.
11. Jayadeva, 'Twin Support Vector Machines for Pattern Classification', IEEE transaction on pattern analysis, VOL. 29, NO. 5, MAY 2007.
12. Mathieu Barnachon, SadaBouakaz, BoubakeurBoufama, ErwanGuilLou, 'Ongoing human action recognition with motion capture', School of Computer Science, University of Windsor, Canada N9B 3P4 ACM, Volume 47, pages 238-247, 2014.
13. IliasTheodorakopoulos, 'Pose-based human action recognition via sparse representation in dissimilarity space ", J. Vis. Commun. Image R. 25, pages 12-23, 2014.
14. Koen Buys, 'An adaptable system for RGB-D based human body detection and pose estimation', J. Vis. Commun. Image R. 25, pages 39-52, 2014.
15. Nedeljkovic, 'Image Classification Based on Fuzzy Logic ", MapSoft Ltd, Zahumska 26 11000 Belgrade, Serbia and Montenegro, vol 34, 2010.
16. AnielloMinutolo, 'Massimo Esposito, Giuseppe De Pietro Design and validation of a light-weight reasoning system to support remote health monitoring applications', Engineering Applications of Artificial Intelligence, Volume 41, May 2015, Pages 232-248, ISSN 0952-1976, http://dx.doi.org/10.1016/j.engappai.2015.01.019.
17. Koen Buys, Cedric Cagniart, Anatoly Baksheev, Tinne De Laet, Joris De Schutter, Caroline Pantofaru, 'An adaptable system for RGB-D based human body detection and pose estimation', Journal of Visual Communication and ImageRepresentation, Volume 25, Issue 1, January 2014, Pages 39-52, ISSN 1047-3203, http://dx.doi.org/10.1016/j.jvcir.2013.03.011.
18. FerdaOi, Rizwan Chaudhry, GregorijKurillo, Ren Vidal, RuzenaBajcsy, Sequence of the most informative joints (SMIJ): A new representation for human skeletal action recognition, Journal of Visual Communication and Image Representation, Volume 25, Issue 1, January 2014, Pages 24-38, ISSN 1047-3203, http://dx.doi.org/10.1016/j.jvcir.2013.04.007.
19. Akila.K, Chitrakala, A Comparative Analysis of Various Representations ofHuman Action Recognition in a Video, International Journal of Innovative Research in Computer and Communication Engineering, Vol. 2, Issue 1, January2014 ISSN 2320-9801, pages 2829-2837.
20. Jay Prakash Gupta, Pushkar Dixit, Nishant Singh, Vijay BhaskarAemwal, 'Analysis of Gait Pattern to Recognize the Human Activities, InternationalJournal of Artificial Intelligence and Interactive Multimedia', Vol. 2, pages 7-16,2014.
21. Peter Varady, ZoltanBenyo, and BalazsBenyo, 'An Open Architecture Patient Monitoring System Using Standard Technologies', IEEE transactions On information technology in biomedicine, vol. 6, no. 1, mar 2002.
22. PravinPawar, Val Jones, Bert-Jan, van Beijnum, HermieHermens, 'A framework for the comparison of mobile patient monitoring systems', Journal ofBiomedical Informatics, vol. 45 (2012), pages 544556.
23. VikramadityaJakkula,' Tutorial on Support Vector Machine', School of EECS,Washington State University, pages 1-11, 2003.
24. Dell:Naive Bayes Classifier, http://www.statsoft.com/textbook/naive Bayes classifier.
25. Jarod T.Giger, Natalie D. Pope, Bruce Vogt, 'Remote patient monitoring acceptance trends among older adults residing in a frontier state, Computers in Human Behavior', vol.44, pages 174-182, 2014.
26. Shih-pi Ku, Arthur Gretton, Jakob Macke, 'Comparison of pattern recognition methods in classifying high-resolution bold signals obtained at high magnetic field in monkeys', Magnetic Resonance Imaging, vol. 26, pages 1007-1014, 2008.
27. Jia-Tao Zhang, Ah-Chung Tsoi, Sio-Long Lo, 'Scale Invariant Feature TransformFlow Trajectory Approach with Applications to Human Action Recognition',International Joint Conference on Neural Networks, pages 1197-1204, July 11, 2014.
28. Tia Gao, Dan Greenspan, Matt Welsh, 'Improving patient monitoring and tracking in emergency response', The Johns Hopkins University Applied Physics Laboratory, 2004.

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