Retraction

Retraction: An efficient machine learning approach for activity recognition (J. Phys.: Conf. Ser. 1916 012160)

Published 23 February 2022

This article (and all articles in the proceedings volume relating to the same conference) has been retracted by IOP Publishing following an extensive investigation in line with the COPE guidelines. This investigation has uncovered evidence of systematic manipulation of the publication process and considerable citation manipulation.

IOP Publishing respectfully requests that readers consider all work within this volume potentially unreliable, as the volume has not been through a credible peer review process.

IOP Publishing regrets that our usual quality checks did not identify these issues before publication, and have since put additional measures in place to try to prevent these issues from reoccurring. IOP Publishing wishes to credit anonymous whistleblowers and the Problematic Paper Screener [1] for bringing some of the above issues to our attention, prompting us to investigate further.

[1] Cabanac G, Labbé C and Magazinov A 2021 arXiv:2107.06751v1

Retraction published: 23 February 2022
An efficient machine learning approach for activity recognition

K Jashwant$^1$, R Jasvant$^1$, S Siamala Devi$^2$

$^1$UG Student, Computer Science and Engineering, Sri Krishna College of Technology, Coimbatore, Tamilnadu.
$^2$Associate Professor, Computer Science and Engineering, Sri Krishna College of Technology, Coimbatore, Tamilnadu.
$^{17}$tucs050@skct.edu.in

Abstract. The population of older people in western nations are growing drastically. Independent lifestyle is their preference and this leads to fall instances often. Falls of this kind results in severe health issues or sometimes causes deadly damages to the elderly people. Considering this problem, it is highly important to come up with fall discovery systems. A machine learning framework has been proposed in this regard which covers both fall discovery and day to day movement recognition. Utilizing acceleration and speed inputs from dual unrestricted repositories are highly helpful in diagnosing to the maximum of seven movements. Acceleration and angular velocity parameters can be used to extract the attributes that are relevant to time and frequency domain. These attributes are then offered to a classification algorithm. An attempt has been made to check the outcomes of four different procedures for categorizing manual movements. The above-mentioned procedures are the Artificial Neural Network (ANN), K-Nearest Neighbours (KNN), Quadratic Support Vector Machine (QSVM), and FP growth. Power spectral density of the acceleration is used to maximize the outcomes of the classifier. Acceleration data alone is considered for activity discovery in the initial step. Experimental results show that the KNN, ANN, QSVM, and FP growth procedures can attain correctness of 81.2%, 87.8%, 93.2%, and 94.1%. The accuracy of fall detection touches 97.2% and 99.1% with no false positive values for the QSVM and FP growth procedures. As a next phase, the attributes can be taken autocorrelation function and the power spectral density of the acceleration and the angular velocity data that obviously maximizes the classification correctness. Projected attributes are adopted to achieve notable improvement in accuracy of 85.8%, 91.8%, 96.1%, and 97.7% for the KNN, ANN, QSVM, and FP growth algorithm. The accurateness of fall discovery touches 100% for both the QSVM and FP growth procedures in the absence of any incorrect alarm, which is the finest attainable performance.

Keywords: Machine Learning, Angular velocity, Artificial Neural Network, K-Nearest Neighbours, Quadratic Support Vector Machine, FP growth

1. Introduction

Elderlies around 65 years old or older familiarize higher probability of falling and are usually at maximum threat for falls [1]. One third of people above 65 years are projected to fall at least once in a year.

Nearly 21,469 elderly have lost their lives in US during the year 2010 [2] because of injuries caused by falls. Sometimes, fall doesn’t cause physical damage but it ends in anxiety of falling that reduces the movement in older people and it affects their liberation too. Such anxiety of falling is like lasting on the ground for an hour and sometimes beyond that. This obviously results in extensive harm to a person’s mind and body. That too, for elderly people, being on the floor for longer duration leads to numerous health oriented difficulties dryness, interior bleeding, Hypertension or even the concerned person may lose his life. Nearly 50% of the people may die within 6 months of fall.

Evidence-based strategies are used to avoid falls that includes physical work outs, Vitamin D complements and also fall risk assessments [3] in a consistent basis. Even though prevention attempts
in falls are still expected to happen for elderlies and that have be addressed at the earlier stage. A solution has been proposed by Personal Emergency Response [4] Systems for this problem. By a button press, clinical alarm systems will pave an approach for every individual to interact with an emergency centre. However, this approach remains hopeless if a particular person is insensible or incapable to make a button press. Recent studies state that around 85% of elderlies are not using their alarm to call for assistance after undergoing a fall.

Because of these hindrances of PERS,[5] passive monitoring solutions were projected to precisely spot the falls. Many solutions exist in the current scenario and most of them are related to external devices used by a person. On the other hand, technologies can be incorporated in the residence such as cameras, microphones and other relevant sensors.

Former fall detection literature surveys have covered the fall discovery and certain moral issues. Though, with the extensive variation and pure number of available systems, there is an urgent requirement to detect the falls in most accurate manner.

Fall discovery strategies empower a quick recognition and interference for the old aged people who have practiced a fall. This could undoubtedly minimize the physical and mental impairment initiated by a fall. People at risk, their care takers and their family members can be ensured about the real impact with the help of these technologies. These kinds of strategies will definitely support the people in health care sector to comprehend the exact scenario so that better medication can be started at the beginning.

The core objective of this paper is to examine the indication on fall detection strategies and to investigate their success rate. The next objective is to analyse the views and utilizations of all such devices by old aged people.

In this paper, the dataset is taken from https://jack-kelly.com/data/. The input dataset registers the power request from nearly five residences. [6] The power claim of whole house and the power claim of distinct appliances are recorded for every six seconds. In the resident number 1, 2 and 5 the complete house voltage and power source of 16 Hz was noted. The architecture diagram is represented in figure 1.

![Architecture Diagram](https://example.com/architecture.png)

**Figure 1. Architecture Diagram.**

2. Literature Review

Multi class SVM [7] is proposed for the data categorization. Upgradation on classification performance is focussed. But there is more scope for improvements- : Though dynamic attributes could be categorized in an effective way, still static attributes remain same. This leads to overlap in misclassification. This
necessitates the reconsideration in Human Activity recognition strategies. Certain drawbacks like battery backup and its practical applications have not been addressed.

The MC-HF-SVM [8] is an attractive method for use in medical applications like capturing the movements on smartphones. Maxing use of fixed point designs can be taken in activity recognition as it consumes minimum time, memory and power. When compared to traditional levels, better outcomes are obtained in this approach. By accumulating with fixed point calculation, this also generates a regularization method that enhances the performance of heterogeneous data.

The investigational outcomes authorize that even with a minimization of bits equal to 6 for demonstrating the learned MC-HF-SVM model parameter β, it is probable to substitute the ordinary MC-SVM. [9] This result carries optimistic inferences for smartphones because it could help to discharge system resources and decrease energy intake. A publicly available Activity Recognition can be taken while implementing various learning strategies.

Ambient Assisted Living (AAL) [10] schemes require comprehending the user’s situation that makes AR as a preferable module. Since falls are considered to be the serious issue among old aged people, AAL system covers the fall discovery aspect too. AR and FD is projected that have an objective to offer real time outcomes. Two wearable accelerometers are used in this AAL. In case of AR, a methodology covers the human actions that decides the performance of the system which results in highest level of accuracy.

To evaluate an ideal computational function and analyze pipeline that precisely identifies ADLs [11] and falls by deploying a wide-ranging dataset of gesture data composed from a smartphone. As an outcome, dual improved groups of attributes are extracted. One is related to the manual movement identification and another one produces notable good results in both movement recognition and also in fall discovery. Making use of brute force approach ignores the weak attributes. The utilization of autonomous datasets guarantees the strength of the outcomes, always within the boundary of each dataset. Properly classifying the 16 different activities that too in a minimum duration could be a major challenge.

ML for fall discovery and ADL [12] classification is proposed. The classification results are checked with respect to the events like falling, walking, walking upstairs, walking downstairs, sitting, standing, and lying. Acceleration signal is used to filter the novel features. The significance of the features and its optimistic impression on improving the presentation of the classifier is represented. Also the outcomes of ANN and Q SVM [13] are evaluated on real world datasets. Interior parameters of these strategies are examined with the help of training data. Later its results are evaluated using test data.

Even though numerous studies address the concept of fall detection with the help of sensors, still the performances of these strategies are insufficient since they raise high false alarms [14]. Combining the signals of various sensors could be a better choice to maximize the accuracy and to minimize the false alarms. This can be viewed in various perceptions such as data collection, transmission, sensor fusion, data analysis, safety, and confidentiality. The evaluation is done using the standard input datasets.

A highly reliable fall discovery mechanism is highly needed to help the elderlies. A machine learning [15] method is projected for fall discovery and for activity recognition on daily basis. It has been applied to test the activities falling, walking, walking upstairs and lying based on the acceleration and the angular velocity data. Time and frequency domain attributes were proposed and the significance of these features is represented.

A well-organized technique of discovering human movement for fall discovery by means of RGB [16] and Depth images from a cheap Kinect sensor. Indoor sensors were used to elucidate the movements of every individual. CNN model is projected with various arrangements of input images. The outcomes presented that the CNN proficient with related RGBD is the best method aimed at posture recognition. By means of the related education, the prototypical has helped from the better experience of the area of interest only, which eventually facilitated the model to choose the significant attributes during convolution from that region.
A framework is proposed for identifying events of everyday living to simplify the individuality of elderlies existing in the community, decrease hazards, then improves the excellence of life at home through using RGB-D cameras. Investigations shows that this strategy is highly reliable to point the actions linked to falling event and better happenings of everyday. RGBD camera-based framework is capable enough to handle lighting variations and posture dissimilarities, as well as offer a worthy result for privacy protection.

Proficiency and exactness are dual essentials that have to be considered whenever activity recognition is applied on a mobile device that too smartphone could be a better choice. The benefits are better degree of correctness and minimum computational rate. By taking 8 activities of 30 volunteers, an accuracy of 95% is attained. At the same time, the difficulties related to data discovery are optimized. Day-to-day movement checking and fall discovery scheme based on surface electromyography (sEMG) and plantar weight is proposed. Its outcomes demonstrations that this sEMG attains better accuracy. On the other hand, four sEMG and three plantar pressure sensor s are adopted to know the movement discovery and attained great recognition correctness. An attempt has to be made with minimum number of sensors.

3. Existing System

In existing system an inclusive review of conventional data mining difficulties like recurrent pattern extraction in the framework of ambiguous data can be initiated. Certain perceptions and problems rising from conventional sequential pattern mining and the extraction of indeterminate facts. Sequential pattern mining is operative for classifying time-based associations among medications and precisely forecasting the subsequent medication likely to be arranged for a patient. In fall detection an analysis has been made using the algorithms like KNN, ANN, and QSVM.

3.1. K-Nearest Neighbour (KNN)
The kNN classification is utilized to categorize the activities by means of proportion and variance of human body with restricted height and width. Time variance is more promising component to distinguish fall event action and lying down action. Critical time variation is attained after the analysis and checked by numerical premise check. By using the KNN classifier and the critical time variance, a fall incident discovery scheme is established to identify fall incident events.

3.2. Artificial Neural Network (ANN)
ANN is a computer organization intended by simulating biological NN. ANN has been adopted in several domains such as pattern matching, Data categorization and forecasting. ANN methodologies have been represented in the following figure.

An artificial neuron is an arrangement which enlarges an input parameter x by initializing a random load w, enhances it to b, and inputs it to an activation function f as shown in figure 2.
The investigational background was prepared as mentioned below. A sheet was placed on the mat which has the potential of gripping the fall impact. The subject to which the accelerometer was involved on the left wrist was asked to stand on the sheet. The fall was clearly induced by forcefully pulling the sheet. Such experimental setup is shown in Figure 3.

3.3. Quadratic Support Vector Machine (QSVM)
A novel quadratic kernel-free non-linear support vector machine (which is called QSVM) is presented. The problem of SVM optimization can be specified as below:

- Exploit the geometrical boundary to all the training facts with a functional margin better than a constant.
- The functional margin is equivalent to $W^T X + b$ - hyper plane equation for linear differentiation.
- The geometrical boundary is equivalent to $1\|W\|$ and constant = 1.
- In the view of non-linear data separation, a twofold optimization and a kernel matrix is adopted. Also a quadratic decision function is used to differentiate arbitrary data.
- The geometrical boundary is demonstrated to be equivalent to the converse of the norm of the gradient of the decision function. The functional margin is the equation of the quadratic function. QSVM is verified to be put in a quadratic optimization situation. There is no necessity to consider the twofold optimization and a kernel matrix in this regard.

4. Proposed System
In the Proposed work here develop the two new algorithms, collectively called FP-Growth algorithm, effectively avoids the problem of “best moving product prediction”, and when incorporated through the pruning and validating methods, accomplishes more healthier outcomes. Quick validating strategy is proposed enhance the speed of FP growth algorithm. Massive experimentation was applied on both real time and synthetic dataset to check the competencies of FP growth.

FP-Growth accepts the prefix-projection structure procedure in a new algorithmic setting, and successfully eludes the difficulties of “best moving product prediction”. The characteristics are summarized as follows:

- Dual general undefined sequence data models that are preoccupied from many real-life applications connecting indeterminate sequence data: the sequence-level uncertain model, and the element-level uncertain model. Transaction DB and Profit board are input to the system to determine possible extremely developed Item sets.
- Create UP-tree: FP-Growth algorithm is formed using discarding unfavorable global items and dropping global node utility. The approximate count generation process is shown in Figure 4.
The FP-Growth algorithm has various parameters as Node.name denotes name of the item and Parent Node.

After computing transaction function and transaction load utility, the itemsets with lesser utility than already mentioned minimum threshold utility are removed.

After organizing the adverse items the global node utilities is minimized. And nodes are implanted into UP tree by means of Fp-Growth algorithm. The local unpromising Item and node utility. Removing local unpromising items: Build restrictive pattern base of bottom item entry in header table. Retrieve the whole route related to that item CPB. Conditional UP tree created by two scans over CPB. The results of skip and complete in FP growth is shown in Figure 5.

Local unfavorable items detached using path utility of each item in CPB paths are organized in descending order. The rationalized path is introduced into conditional utility pattern tree with the help of reduce local node utility policy. Recognize potential high utility item sets and their utilities form Fp-Growth algorithm will eradicate the local unfavorable items and Diminish local node utility. Pruning methods and at quick confirmative method are established to advance the efficiency of FpGrowth algorithm, which is confirmed by widespread investigations.
5. Experimental Results

The correctness can be calculated using the formula given below. Accuracy
\[ \text{Accuracy} = \frac{TP}{TP+TN} \times 100\% \]

The true positive (TP) and true negatives (TN) are correct classification. A false positive (FP) occurs when the prediction goes wrong. In real time applications, classification techniques group the objects and images as well. The experimental outcomes are given in Table 1 and its comparison is demonstrated in figure 6.

Table 1. Results.

| ALGORITHM | ACCURACY |
|-----------|----------|
| FP        | 98.06    |
| KNN       | 81.02    |
| ANN       | 87.08    |
| QSVM      | 93.02    |

Figure 6. Accuracy values- Comparison.

6. Conclusion

There is an immediate requirement for fall discovery system that helps independent livelihood of old aged people. AML approach is projected for fall and ADL recognition. The outcomes of four different procedures are evaluated based on its accuracy value. These algorithms are adopted to identify the actions like falling, walking, walking upstairs, walking downstairs, sitting, standing, and lying based on the acceleration and the angular velocity data. The performance of the KNN, ANN, QSVM, and FP classification algorithms are evaluated on real-world acceleration data attained from communal repositories. The Fp-Growth method is used to enhance the overall performance with the aid of using lowering each the quest area and time with wide variety of candidates. The results have proved that the projected FP algorithm outperforms further three algorithms in terms of its accuracy values.
References

[1] Adhikari K, Bouchachia H and Nait-Charif H 2017 May Activity recognition for indoor fall detection using convolutional neural network. In 2017 Fifteenth IAPR International Conference on Machine Vision Applications (MVA) pp 81-84 IEEE.

[2] Anguita D, Ghio A, Oneto L, Llanas Parra F X and Reyes Ortiz J L 2012 Human activity recognition on smartphones for mobile context awareness. In Advances in Neural Information Processing Systems 26: proceedings of the 2012 conference pp 1-9.

[3] Anguita D, Ghio A, Oneto L, Parra X and Reyes-Ortiz J L 2013 April A public domain dataset for human activity recognition using smartphones. In Espasa 3 p 3.

[4] Ann O C and Theng L B 2014 November Human activity recognition: a review. In 2014 IEEE international conference on control system, computing and engineering (ICCSCE 2014) pp 389393. IEEE.

[5] Chatzaki C, Pediaditis M, Vavoulas G and Tsiknakis M 2016 April Human daily activity and fall recognition using a smartphone’s acceleration sensor. In International Conference on Information and Communication Technologies for Ageing Well and e-Health pp 100-118. Springer, Cham.

[6] Chelli A and Pätzold M 2018 September Recognition of falls and daily living activities using machine learning. In 2018 IEEE 29th Annual International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC) pp 1-7. IEEE.

[7] M. Suganya and H. Anandakumar, Handover based spectrum allocation in cognitive radio networks, 2013 International Conference on Green Computing, Communication and Conservation of Energy (ICGCE), Dec. 2013. doi:10.1109/icgce.2013.6823431. doi:10.4018/978-1-5225-52468.ch012

[8] Haldorai and A. Ramu, An Intelligent-Based Wavelet Classifier for Accurate Prediction of Breast Cancer, Intelligent Multidimensional Data and Image Processing, pp. 306–319.

[9] Devi S S and Shamugam A 2014 Hybridization of K-means and harmony search method for text clustering using concept factorization. International Journal of Advanced Research in Computer Engineering & Technology (IJARCET), 3 (8).

[10] Kabilan M, Monish S and Devi S S 2019 Accident detection system based on Internet of Things (IoT)-Smart helmet.

[11] Kozina S, Gjoreski H, Gams M and Luštrek M 2013 September Efficient activity recognition and fall detection using accelerometers. In International competition on evaluating AAL systems through competitive benchmarking pp 13-23 Springer, Berlin, Heidelberg.

[12] Nasution A H and Emmanuel S 2007 October Intelligent video surveillance for monitoring elderly in home environments. In 2007 IEEE 9th Workshop on Multimedia Signal Processing pp. 203-206. IEEE.

[13] Puthur J A and Devi S S 2019 IoT-based accident detection and prevention system with android application.

[14] Wang X 2020 Elderly Fall Detection Systems: A Literature Survey. Front. Robot. AI 7: 71. doi: 10.3389/frobt.2020.00071

[15] Xi X, Jiang W, Lü Z, Miran S M and Luo Z Z 2020 Daily activity monitoring and fall detection based on surface electromyography and plantar pressure. Complexity.

[16] Zhang C and Yuan Y 2012 RGB-D camera-based daily living activity recognition. Journal of computer vision and image processing 2 (4) 12.