Human Activity Recognition on Smartphones using Innovative Logistic Regression and Comparing Accuracy of Extra Gradient Boost Algorithm

Abstract:

Gpower test (g power setup parameters: α=0.05 and power=0.85, β=0.2) comes from a T test on an independent sample. Compared to Extra Gradient Boost (90.1850%), Innovative logistic regression (95.5680%) has higher accuracy, with a statistically significant value of $p = 0.001$ ($p < 0.05$).

Keywords: Innovative Logistic Regression, Extra Gradient Boost, Machine Learning, Physical abuse, Smartphones, Multiple Cameras.

1. INTRODUCTION

Using data from many wearable sensors and a semi-supervised deep model, it is possible to find uneven motion. To be addressed are issues such as physical abuse, unequal representation of different classes, limiting labels, data from numerous instruments, a great deal of variation between and among subjects, and a consistent expert consensus. Pattern-balanced multiple camera semi-supervised frameworks can find and remember hidden activity patterns [1]. Based on this research, dynamic activity recognition could be made possible through active learning. Smartphones: Unlike traditional active learning systems,
that physically abuse select instances based on a predefined label set, the proposed system dynamically finds unique activities and chooses useful examples from existing classes.

This review talks about the deep learning methods used in smartphones and wearable sensor-based recognition systems with multiple cameras and sensors. The benefits and drawbacks of traditional and hybrid deep learning models are discussed. The paper also looks at benchmark datasets for existing methods.

One of the main uses of the project is to figure out how people act. Even though cellphones are everywhere and an important part of our daily lives, they have trouble figuring out what people are doing because of their location and orientation.

In a program meant to keep an eye on security.

In the previous five years, about 250 publications on revolutionary human activity recognition were discovered on IEEE Xplore, while 65 papers were located on sciencedirect. This study merges outlier recognition with HAR by proposing an innovative way to discover secondary activity information within the smartphone's primary activity and to extract sub-activity data segments from another activity. Using machine learning, wearable sensor time series were assessed at HAR.

Provided a Neural Architecture Search-based automated machine learning system for intuitive, efficient, quick-to-train, and adaptable revolutionary human activity recognition. 2D convolutional neural networks use RGB, depth, skeleton, and context data extracted from 3D video.

HarMI is a suggested incremental learning model with multimodality and continuous learning. Without retaining past training data, the HarMI model may quickly begin training and learn new actions without retaining previous data.

Signals from a smartphone's accelerometer are used to track how a person moves. This study made three important contributions. A defined validation model that takes into account personalization makes it possible to evaluate machine learning algorithms objectively.

The current system's ability to identify the research gap is not very accurate. In this study, the classification accuracy will be improved by employing Innovative Logistic Regression and comparing its performance to that of Extra Gradient Boost. The proposed model improves the recognition of human activity.

2. MATERIALS AND METHODS

Using the Gpower program, the sample size was determined by comparing the two controllers. For the purpose of comparing the procedure and the resulting group, two are chosen. Ten sets of samples, totaling ten samples, are chosen from each group for this study. Technical analysis software is used to build two algorithms: Extra Gradient Boost and Innovative logistic regression. Using the GPower 3.1 program, the sample size for each group is 10 (α = 0.05 and power = 0.85, β = 0.2).

Dataset taken from the kaggle website. The datasets taken from the sample Python and OpenCV. The Windows 11 operating system was used for deep learning testing. 8GB of RAM and an Intel Core i5 Processor were utilized in the hardware setup. System sort in 64 bits was used. The programming language for implementing the code was decided upon.
Innovative Logistic Regression

The likelihood of different classes is predicted using a machine learning classification technique called Innovative logistic regression using a set of dependent variables. The Innovative logistic regression model essentially computes the sum of the input features (sometimes with a bias factor) and then calculates the Innovative logistic of the outcome.

Steps in Innovative Logistic Regression

1. Collect information about what people do and put it into the dataset.
2. Organize the facts: Before using the data, clean it up by handling missing values and categorical variables.
3. Split the information: Divide the data into training and testing sets.
4. Describe the model: Choose an Innovative Logistic Regression model and any hyperparameters, such as the regularization parameter.
5. Fill in the blanks: Set up the Innovative Logistic Regression model with the training data.
6. Give the model a try: Check how well the Innovative Logistic Regression model works using the testing data, assessing metrics like accuracy, precision, recall, and F1 score.
7. Make it better: If necessary, modify the model by trying different hyperparameters or using a different algorithm.
8. Use the model: Apply the model to predict outcomes with new data after it has been evaluated and improved.

XGBoost

Extreme Gradient Boosting (XGBoost) is a distributed, scalable gradient-boosted decision tree (GBDT) machine learning system. It is the best machine learning program for regression, classification, and ranking issues and offers parallel tree boosting. It covers tree learning methods as well as linear model solvers. Consequently, its ability to process data in parallel on a single machine is what gives it its speed.

Steps in XGBoost

1. Collecting Data: Collect a set of data about what people do. This data set should include both the input variables (accelerometer data, heart rate, etc.) and the output variables (the activity label).
2. Data Preparation: Clean, filter, and change the data before machine learning so that it is ready to use.
3. Separating Data: Divide the data set into sets for training and testing. The training set will be used to teach the XGBoost model, while the testing set will be used to see how well it works.
4. Feature Selection: Choose the features (input variables) that are most important for the prediction task. Methods like correlation analysis and ranking the importance of features can be used to do this.
5. Training the XGBoost Model: Use the training set to teach the XGBoost model how to work. Based on the input variables, the model will learn to predict the output variable (the label for the activity).
Step 6: Tuning Hyperparameters: If you want the XGBoost model to work better, you should optimize its hyperparameters. The learning rate, the number of trees, the maximum depth of each tree, etc., are all examples of hyperparameters.

Step 7: Evaluating the Model: Use the testing set to judge how well the model works. Metrics like mean squared error, mean absolute error, and R-squared can be used to do this.

Step 8: Using the Model: The model can be used to predict the activity label for new data once it has been trained and tested.

Statistical Analysis
IBM SPSS software is employed for the statistical analysis of Innovative Logistic Regression and Extra Gradient Boost. Independent variables are images, objects. Dependent variable is accuracy. A separate T test analysis is carried out for each procedure to confirm correctness.

3. RESULTS
The purpose of this study is to investigate the efficacy of the Innovative Logistic Regression and the Extra Gradient Boost in recognizing novel human activities. The accuracy of the Innovative Logistic Regression is 95.5680 %, which is a significant improvement above the Extra Gradient Boost’s 90.1850 %.

Table 1. The following table consists of accuracies ranges from 93.1 to 99.78 for Innovative Logistic Regression

<table>
<thead>
<tr>
<th>Iterations</th>
<th>Accuracy(%)</th>
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<tbody>
<tr>
<td>1</td>
<td>93.1</td>
</tr>
<tr>
<td>2</td>
<td>94.1</td>
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<tr>
<td>3</td>
<td>92.6</td>
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<tr>
<td>4</td>
<td>93.8</td>
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<td>5</td>
<td>94.7</td>
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The Extra Gradient Boost and anticipated accuracy are shown in Table 2. For each procedure, these ten data samples are utilized in addition to their statistical values, which may be computed for comparison. The findings show that the mean accuracy of Extra Gradient Boost was 90.1850% and Innovative logistic regression was 95.5680%.

Table 2.

<table>
<thead>
<tr>
<th>Iterations</th>
<th>Accuracy(%)</th>
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<tbody>
<tr>
<td>1</td>
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<tr>
<td>2</td>
<td>87.24</td>
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<td>3</td>
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<td>9</td>
<td>91.6</td>
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<tr>
<td>10</td>
<td>92.0</td>
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</table>
Table 3: The average precision for the Extra Gradient Boost Classifier and the Innovative Logistic Regression methods. When comparing two methods with the same standard deviation (2.3398), Innovative Logistic Regression (mean value 95.5680 %) outperforms Extra Gradient Boost (mean accuracy 90.7210 %).

Table 4 displays the results of the computations for the Extra Gradient Boost Classifier and the Innovative Logistic Regression under both the equal and non-equal variance assumptions. Standard errors and mean variance dissimilarities were calculated to a 95% confidence interval. A statistically significant difference (p=0.001; p<0.05) was found between the two groups using the SPSS independent samples T-test.
<table>
<thead>
<tr>
<th></th>
<th>Levene’s test for equality of variances</th>
<th>T-test for equality means with 95% confidence interval</th>
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<tr>
<td>Accuracy</td>
<td></td>
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<td>Equal variances assumed</td>
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<tr>
<td>Equal variances not assumed</td>
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<th></th>
<th>f</th>
<th>Sig.</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean difference</th>
<th>Std.Err or difference</th>
<th>Lower</th>
<th>Upper</th>
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<td>Acuity</td>
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Figure 1 is a bar graph depicting a comparison between the Innovative Logistic Regression and the Extra Gradient Boost Classifier, with mean accuracy plotted along the Y axis. In comparison to the Extra Gradient Boost Classifier, the graph shows that the Innovative Logistic Regression has superior results. When compared to the Extra Gradient Boost, the Innovative Logistic Regression Classifier's error bars provide a clearer picture of its superior classification accuracy.
Fig 1. Comparison of Innovative logistic regression (LR) and Extra Gradient Boost (EGB) Classifier in terms of mean accuracy and loss. The mean accuracy of Innovative logistic regression is better than Extra Gradient Boost. Classifier; Standard deviation of Innovative logistic regression is slightly better than Extra Gradient Boost. X Axis: Innovative logistic regression Vs Extra Gradient Boost Classifier and Y Axis: Mean accuracy of detection with +/−2SD.

4. DISCUSSION

It is possible that Innovative logistic regression is preferable to additional gradient boost given that the study's statistical significance value p is 0.001 (p < 0.05). The accuracy of the Innovative Logistic Regression is 95.5680 %, whereas the accuracy of the Extra Gradient Boost is 90.1850 %. Automation reduces costs and increases system correctness. Due to automation, activity detection systems can take the place of expensive infrastructure and labor-intensive work.

The solution is deep learning. Human activity recognition is categorized by neural networks. This paper identifies human activities using the ResNet-34 neural network. The model's average accuracy is 71 %. The accuracy of prediction data is increased by physical abuse of the error identification and reduction technique [15]. Inefficient results on challenging frames in Deep learning based framework and compared with ResNet18 in human activity recognition with the accuracy level of 86 % [16]. Time consuming high computational time in CNN based framework compared with VGG-19 for chest radiographs dataset in detection of pneumonia with the accuracy of 98.02 % [17]. The image dataset for human activity recognition achieved an accuracy of 95.34 % when compared to Alex Net's initial stages of physical abuse of the energy [18]. The accuracy level for human activity recognition using Image Net feature extraction and multiple cameras is 77.89 %, which is lower than AlexNet's results due to the lack of images.

The analysis is limited to the method of Innovative Logistic Regression that was used to collect the acknowledgment dataset, which has a number of important features. Taking into account that it looks at the displays at these two meetings to get better results. One problem with the study is that it takes a long time to train Innovative logistic Regression, especially with large datasets from more than one camera. The future goals of the study say that the system should be made bigger so that it can include more objects and train the data set in less time.

5. CONCLUSION

Innovative logistic regression is 95.5680 % accurate, while Extra Gradient Boost is only 90.1850 % accurate. The analysis shows that Innovative logistic regression with a 5 % increase works better than Extra Gradient Boost and P is 0.001.

6. REFERENCES

1. Ahad, Md Atiqur Rahman, Upal Mahbub, and Tauhidur Rahman. (2021). 8, 03024 (2024)E3S Web of Conferences https://doi.org/10.1051/e3sconf/202449103024 491


