



Assessment And Exploring Of Women's Safety Using Machine Learning Techniques

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Abstract: Women's safety is a critical concern in modern society, and leveraging machine learning (ML) technologies offers innovative solutions to enhance personal security. This paper explores the application of machine learning for real-time detection of dangerous or threatening situations, aimed at improving the safety of women. The proposed system integrates various techniques such as computer vision, audio analysis, wearable sensors, and natural language processing to detect potential risks, including physical assaults, verbal threats, and abnormal behavior. Machine learning models analyze real-time data, such as video feeds, audio signals, and motion patterns from wearable devices, to identify distress signals and trigger immediate alerts. In addition, geofencing and behavioral prediction models enable proactive monitoring of users' movements, sending notifications if dangerous situations are detected or if a user deviates from safe routines. While promising, the system faces challenges related to data privacy, accuracy, and real-time processing requirements. Despite these challenges, machine learning presents a transformative opportunity to enhance women's safety, offering efficient, scalable, and personalized protection through automated threat detection and immediate emergency response mechanisms.

Index Terms - Machine Learning, Artificial Intelligence, Natural Language Processing

INTRODUCTION

The application of machine learning (ML) in enhancing women's safety through real-time detection of threats. The proposed system integrates computer vision, audio analysis, wearable sensors, and natural language processing to identify potential risks such as physical assaults, verbal threats, and abnormal behavior. By analyzing real-time data from video feeds, audio signals, and motion patterns, ML models can detect distress signals and trigger immediate alerts. Additionally, geofencing and behavioral prediction enable proactive monitoring, notifying users of potential dangers. Despite challenges like data privacy, accuracy, and real-time processing, ML offers a transformative approach to women's safety through automated threat detection and rapid emergency response mechanisms.

Women's safety remains a critical concern in modern society, necessitating innovative technological solutions to enhance personal security. Machine learning (ML) offers a transformative approach by enabling real-time detection of threats and potential dangers. This paper explores the application of ML techniques to assess and improve women's safety through automated threat detection and response mechanisms.

The proposed system integrates multiple ML-driven technologies, including computer vision, audio analysis, wearable sensors, and natural language processing (NLP). These components work together to detect risks such as physical assaults, verbal threats, and suspicious activities by analyzing real-time data from video feeds, audio signals, and motion patterns. Additionally, geofencing and behavioral prediction models facilitate proactive monitoring, alerting users and authorities if unusual patterns or deviations from safe routines are detected.

Despite the promise of such an intelligent safety system, challenges remain, including data privacy concerns, accuracy limitations, and the computational demands of real-time processing. However, leveraging ML for women's safety has the potential to revolutionize personal security, offering scalable, efficient, and personalized protection against threats through automated risk assessment and emergency response mechanisms.

LITERATURE SURVEY

In [1] the design of this cutting-edge Internet-of-Things device is to collect data while enhancing the security and safety of women. The system includes GSM and GPS modules, a flex sensor, a digital camera, a buzzer sensor, and a Raspberry Pi. Women can easily and discreetly wear the compact device within their undergarments, providing both convenience and comfort.

In [2] they introduce a high-tech device for women's safety that uses pressure, heart rate, and temperature sensors to automate the emergency alert process. It autonomously identifies potential threats through outlier detection..

In [3] An IoT device paired with an Android application can significantly improve the safety of women while on the move. In the event of an emergency, the gadget can monitor the user's whereabouts in real time and notify volunteers and local police stations. Additionally, it can alert the user about the nearest safe zone. The device incorporates components like an Arduino Nano, GPS, GSM, Bluetooth, among others.

In [4] situations where a woman's safety is at risk, an IoT-powered safety device employs a fingerprint authentication system to ensure her protection and alert nearby individuals and authorities. The fingerprint verification detects a potential threat within a minute and instantly notifies others and the authorities if the device fails to receive a signal. Furthermore, we have designed a shockwave generator for personal defense, enabling women to defend themselves against attackers. The proposed system also includes additional features, such as the ability to send group messages and record audio.

In [5] the system functions as both an alarm and a security mechanism. When activated, it triggers a buzzer alarm to alert those nearby the user, who is wearing the smart device. The system utilizes GPS to determine the user's place and sends this data via SMS to emergency contacts and law enforcement using GSM and GPRS technology. Additionally, the device captures images of the attack and the surrounding area through a USB webcam, which are then emailed as an immediate alert to the alternative contact once the alarm button on the smart wearable device is pressed.

According to [6] create an automated method for heart attack prediction, researchers have proposed using deep neural network technology. We evaluated the accuracy of machine learning techniques using different datasets. The proposed method incorporated an automated data preprocessing technique to eliminate any anomalies from the system.

According to [7] they introduced the Talos hyperparameter optimization system to predict heart and cardiac diseases. Cardiac conditions represent a crucial area where deep neural networks can improve the accuracy of heart disease classification. Techniques such as SVM, Naive Bayes, and Random Forest exhibit different levels of performance in classification tasks. The Talos optimization method outperformed these other algorithms in classifying data from the UCI heart attack dataset.

In [8] a group learning system that used a CNN and one-way and two-way BiLSTM or BiGRU models was able to diagnose different heart diseases 91% of the time. This method utilizes data preprocessing & feature selection to enhance the show of the classifier.

Researchers in [9] the suggested method uses patient diagnostic narratives along with deep neural networks (RNNs), mainly the PPRNN model, and a learning algorithm to make better predictions about what will happen. The PP-RNN uses more than one RNN to look at different sets of diagnostic data from patients and guess when high-risk diseases will start.

In reference to [10], researchers have developed an innovative medical application based on cloud computing

and IoT to track and detect critical illnesses. In the training phase, the SVM classifier is trained using data from the validation set. We used real patient data for system testing to detect various illnesses and diagnose the presence of diseases.

METHODOLOGY

The challenging conditions confronting women today inspired the development of a safety gadget to aid the community in accomplishing their desired tasks. The program empowers women to overcome their fear and to navigate and oversee their responsibilities autonomously. We present an innovative technique for human activity recognition (HAR) using numerous sensors inside smartphones. We used an open-source dataset collection (UCI) that included several smartphone sensors for data acquisition. Subsequently, we used a machine learning technique to train the data. We used this model to forecast and assess the six daily tasks performed by individuals. We randomly divided the acquired dataset into two subsets, allocating 70% of the participants for training and 30% for testing. We partitioned the data into two segments, each suitable for independent use.

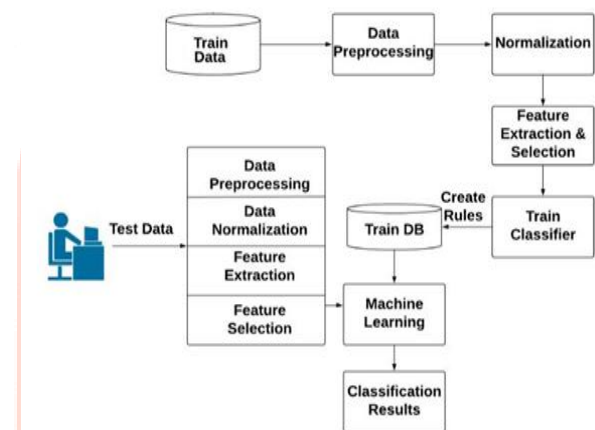


Figure 1: Proposed system

Module Data Collection

We gather data from a variety of sources, including UCI ML repository, Kaggle and several real-time data sources. Prior to executing the classification activity, the data must be pre-processed in order to enhance the outcome by addressing the missing values and removing the redundant features contained in the chosen dataset. In order to get the greatest results during the DM process, the dataset must be treated swiftly.

Pre-processing and normalization

There may be a lot of useless information and gaps in the data. Data preparation is carried out to handle this portion. Numerous data pre-processing techniques, such as data cleansing, data transformation, and data reduction.

Feature extraction and Selection

From the data input, this procedure retrieves a variety of features. The extracted features are then standardized using a feature selection threshold, which eliminates redundant and unnecessary features for training. The normalized data with relational characteristics is used to extract a variety of hybrid attributes, and training is carried out by selecting an optimization strategy. The hybrid method has been used for feature selection from fully extracted features—selecting the best quality increases classification accuracy. Many irrelevant features appear during the feature extraction, which need to eliminate when we choose the parts. The benefit of

this method is that it provides a respective feature selection for the individual feature set.

Classification:

After the module has been successfully executed, the selected features are given as input to the training module, which produces comprehensive Background Knowledge for the overall system. After we get the training model, we can feed the testing data into it and get the prediction of classification. The testing stage includes preprocessing of testing text, vectorization and classification of the testing text. The module testing evaluates the system's predictive performance using hybrid machine learning methods. This step assessed the system's performance using different datasets

Algorithm

Input: Test Dataset which contains various test instances TestDB-Lits [], Train dataset which is built by training phase TrainDB-Lits [], Threshold Th.

Output: HashMap < class label, Similarity Weight > all instances which weight violates the threshold score.

Step 1: For each testing records as given below equation

$$testFeature(k) = \sum_{m=1}^n (. featureSet[A[i] \dots A[n] \leftarrow TestDBLits)$$

Step 2: Create feature vector from $testFeature(m)$ using below function.

$$Extracted_FeatureSetx[t \dots n] = \sum_{x=1}^n (t) \leftarrow testFeature(k)$$

Extracted_FeatureSetx[t] holds the extracted feature of each instance for testing dataset.

Step 3: For each train instances as using below function

$$trainFeature(l) = \sum_{m=1}^n (. featureSet[A[i] \dots A[n] \leftarrow TrainDBList)$$

Step 4: Generate new feature vector from $trainFeature(m)$ using below function

$$Extracted_FeatureSet_Y[t \dots n] = \sum_{x=1}^n (t) \leftarrow TrainFeature(l)$$

Extracted_FeatureSet_Y[t] holds the extracted feature of each instance for training dataset.

Step 5: Now evaluate each test records with entire training dataset

weight

$$= calcSim (FeatureSetx || \sum_{i=1}^n FeatureSety[y])$$

Step 6: Return Weight

RESULTS

In order to determine the effectiveness of the proposed approach, a number of investigations covering a wide range of topics were carried out. A number of different machine learning algorithms, including NB, RF, Adaboost, ANN and J48.

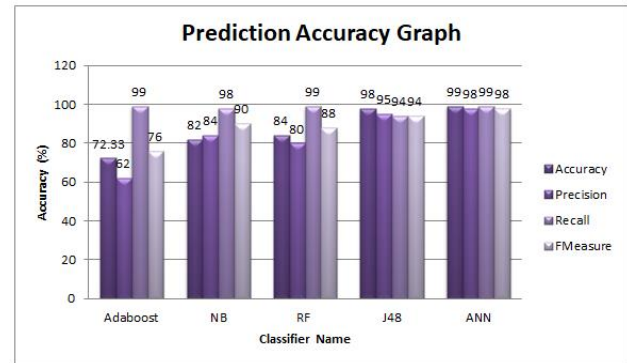


Figure 2: Comparative Analysis of Proposed ANN with Traditional ML

From figure 2, it is evident that the proposed hybrid machine learning algorithm used in this research is more accurate in predicting the disease than the machine learning (ML) Algorithms.

CONCLUSION

The evaluation and investigation of women's safety via machine learning methods provide a potential strategy for addressing and alleviating the issues of women's security in both urban and rural settings. Utilizing data-driven insights, we can detect and forecast possible danger areas, examine trends in safety-related occurrences, and provide actionable suggestions to politicians and law enforcement authorities.

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