International Journal of
INTELLIGENT SYSTEMS AND APPLICATIONS IN ENGINEERING
ISSN:2147-6799 www.ijisae.org Original Research Paper

Impact of Steady – State Genetic Algorithm and Internet – of – Things (IOT) on the Enhancement of Fall Detection System and Rehabilitation Gaming Exercises for Elderly People

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Submitted: 06/06/2022 **Accepted:** 10/09/2022

Abstract: Old age is inevitable. Fall in elders is one of the important crises which leads them to severe injuries and also causes mortality sometimes to them. There is an urgent need for the development of fall detection system every - were throughout the world. There is tremendous growth in the medical field to save the elders from these disasters. Presently, IOT occupies an important place in the life of elderly people. In order to prevent the problem of fall detection in elders, we use Kinect sensor and IOT devices. Our approach in this work from different angles includes data collection, data transmission and data analysis. The performance of the rehabilitants is estimated through the ability of the performer to achieve the rehabilitation goal of the individual. While playing rehabilitation gaming exercises with the help of Kinect an IOT device, we get parametric values test 1, test 2 and test 3 of each patient through which we can calculate certain classifiers which is used for comparing the F1 – weighted average of steady state genetic algorithm with that of some of the supervised machine learning algorithms like KNN, logistic regression and MP – CNN. The proposed algorithm is applied on an UT – Kinect dataset to check its performance. We can make use of UT – Kinect dataset to recognized depth sequence. Single stationary Kinect Xbox 360 is utilized to captured videos. Each patient is asked to perform the action three times and thereby three channels are recorded. The three channels are RGB, depth and skeleton joints and are synchronized. The rate of frame is 30 f/s. In this paper, we analyze Logistic Regression and Steady – State Genetic Algorithm (SSGA). We prove in this paper, the F1 – weighted average of SSGA (84.2) is higher than other supervised machine learning algorithms like KNN (69.9), Logistic Regression (75) and MP – CNN. (78.6)

Keywords: *SSGA, IOT, 2×2 confusion matrix, 3×3 confusion matrix, Binary classification method, MIRA, RGB.*

I. Introduction

Internet of Things (IOT) is a current technology with the potential to alter or replace the various methods of classical medicine and improve health care. Devices of IOT gives accurate measurements and carry out a specific action based on the measurement results. The available results of measurement is obtained through internet and in electronic form. IOT is a very big network. Smart devices such as driverless cars, fitness devices, home security equipment etc. are used with IOT. Sensors are used in IOT devices which gathers data's and these data's are processed and utilized in some applications. Sensor consist of energy modules, power management modules, RF modules and sensing modules. The sensing modules senses through assorted active and passive measurement device. Kinect is an RGB – D sensor provides synchronized color and depth images. It is an input device for the Xbox game console. This device has depth sensing technology which is extended widely for doing rehabilitation gaming exercises at home. The smart technologies such as sensor calibration, human skeletal tracking and facial – expression tracking are encoded in the Kinect. In twentieth century, logistic regression is used in biological sciences. Then it finds its plays in various social science applications. It belongs to supervised machine learning algorithm. This algorithm is utilized to predict the categorized dependent variables. It is similar to linear regression. The only difference is linear regression solves regression problems, whereas logistic regression solves classification problems. Logistic regression is significant because it provides probabilities and classifies numerous new data's using continuous and discrete datasets. A genetic algorithm is a search heuristic that imitates the process of natural selection. We use

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selection operator in our method. This algorithm functions with a population of individuals, thereby it increases its fitness function. It is by fitness function we assume the better function of an individual in the present environment. To create a game, we use genetic algorithms. We select unity as our game engine and implement our own genetic algorithms framework. It is by rehabilitation one can recover from surgical with the joint diseases. After recovered from the surgery, rehabilitation should be given to strengthen the musculoskeletal conditions. It is very important to participate in the rehabilitation programs. It is vital to give physical therapy. Giving rehabilitation in the clinic is not practically and economically possible to all. Under the direction of physician, rehabilitation programs can be done from the home. It is from the literature reports we come to know that more than 95% of all treatment cured in a home – based setup. Rehabilitants are advised to report the physician about their progress at regular intervals of time. The rehabilitants are motivated to do the exercises regularly and appropriately so they can be recovered quickly.

II. Literature Survey

Liang et.al [1] says that genetic algorithm and neural network are the energetic algorithms and they are used for making movements in the applications of IOT. The movements in the IOT applications faced a lot of problems solutions based with genetic algorithm is used to control the movements of objects in the application of IOT.

Z. Shen et.al [2] incorporated genetic algorithm, for the IoT application within organizational structure. The implementation of the genetic algorithm in the organization where found to be better quality compared with the other conventional techniques.

Y.Zhang et.al [3] implemented the genetic algorithm for the IoT intrusion detection system.

Hussain et.al [4] proposed a genetic algorithm for the IoT environment for smart homes. The algorithm is effective application for the smart homes in the developing countries.

H.Wang et.al [5] developed a IoT application integrated with the genetic algorithm for the configuration of IoT base station spatial features.

Jorge Araque et.al [6] says that the synthesis of a slider – crank mechanism, as an instrument for the rehabilitation of knees. This is carried out through software based on digital image processing. Subsequently, a set of optimal solutions was obtained, applying the technique of genetic algorithms.

Junya Kusaka et.al [7] presented a method for the joint angle estimation with the rehabilitation of the Kinect sensor evaluation. The estimation is based on the hemiplegia of the patient before and after rehabilitation to estimate the motion range using genetic algorithm.

Ewa Lach et.al [8] says that, a new adaptation to minimize the genetic algorithm to estimate the game setting based on the player in the game. Through analysis it is estimated that human player has the reduced training process as minimal as possible.

Gabriel Danciu et.al [9] proposed a unsupervised segmentation of image with the RGB-D camera. The developed method utilizes the genetic algorithm for the homogeneity optimization for the segmentation of the image region depth estimation.

Kleber De. O. Andrade et.al [10] says that, genetic algorithm-based game theory estimation using the optimization strategy model. The developed model incorporates the meta-profile user with the created developed for the estimation of the game experience in the different user in the virtual environment.

Diana Yacchirema et.al [11] proposed an IoT based system for identification of elderly falls within indoor environment. The computation is based on the taking the advantage of the minimal power utilization in the wireless sensor network, big data, smart devices and cloud computing. In this scenario, 3D accelerometer us embedded with the wearable 6LOWPAN involved in collection of the data based on the elderly people movement in the real time scenario.

Andrew Blake et.al [12] developed a method to compute the positioning of the body joints with the 3D point in the single depth images without any temporal information.

Change Tu et.al [13] says that the manner of walking and gait are important features to identify and diversion of various tasks. Their method functions based on the consideration of the joint motion trajectories in the 3D human skeleton using Kinect sensor.

Erik Acorn et.al [14] examined the functions to estimate the human movement through machine learning model for the order identification those are compared with the elderly people.

Xavier Baro et.al [15] portrays that the frame works for human gestures and reorganization of human action are based on the primitives of temporal gestures.

III. Development of Fall Detection System in Elders Using Kinect and IOT Device

The fall detection system of elders consists of following components

1. A device those are wearable.
2. A network for the wireless communication.
3. A gateway for smart IoT and
4. Cloud services.

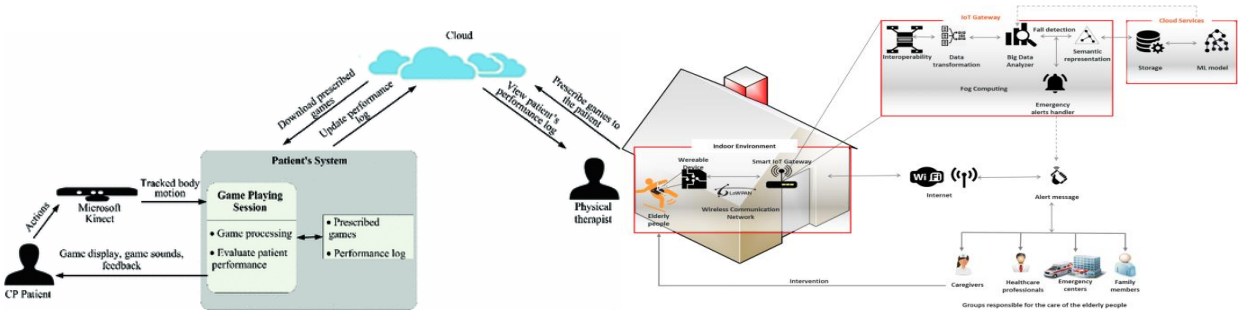


Figure 1- IOT device used for detecting fall in elders.

These components occupy an important role in fall detection of elders.

1. **A wearable Device:** There are three modular blocks in the prototype of wearable device. They are
   - ✓ NUCLEO – L152RE with a sensor expansion board.
   - ✓ NUCLEO – L152RE is connected with an ARM 32 – bit with digital signal processing with low power and low voltage operation.
   - ✓ There are many tiny – ultra low – power in the sensor board. The motion sensor integrated with MEMS minimizes the data motion capturing information about adult falling or performing daily activity. The accelerometer in 3D-axis comprises of the acceleration range (±2/±4/±8g) in full-range.
2. **Wireless Communication Network:** The communication between the devices for wireless and gateway for smart IOT to construct IPV6 wireless technology. 6LOWPAN comprises of technology to provide compatibility, connectivity and inter-operability. The wireless sensor network offers minimal cost and requirement compared with the other Wi-Fi and Bluetooth technology. Those network provides the significant advantage of higher mobility, address space, deployment and maintenance.
3. **Smart IOT Gateway:** Smart IOT gateway helps in the detection of fall in elders. It has four modules. They are
   - ✓ **Interoperability**
   - ✓ **Data Transformation**
   - ✓ **Analyzer for Big Data**
   - ✓ **Handler for the Emergency Alerts**
4. **Cloud Services:** Presently, cloud technology has been utilized for the storage, computation, software platform and infrastructure for computation for different application. It is by adoption of the cloud services and content for the discard buying time and cost to handle hardware for installation and software maintenance. The fall information is received by the cloud services from smart IOT gateway and stores in the mango DB. If the fall occurs, the model is created again and trained in the cloud. There are many advantages while using IOT devices. They are
   - ✓ The system reduces the elderly people death
   - ✓ The developed system is effective in relieving tension for the elderly people caretakers
   - ✓ The system minimizes the amount of time spent by the caretakers all the time
   - ✓ The cost of the system is minimal due to cheaper components availability
   - ✓ The developed system is providing the first aid alternatively immediately.

Kinect Hardware: In the beginning, Kinect was used as a motion-controlled game playing service. After that it was used as a new version for windows.

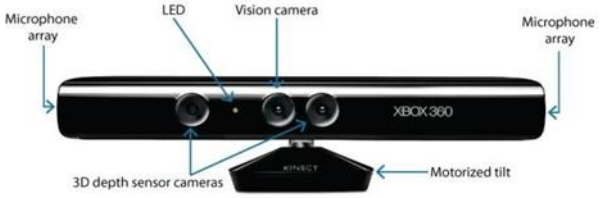


Figure 2- Kinect Xbox 360.

Kinect Xbox 360: The Kinect is the sensor part with hardware components consists of the RGB camera, depth sensor, motorized tilt and multi-array microphone. The deployed sensor involved in provision of capturing full body in 3D, voice and facial recognition. The IR projector is implemented in depth sensor and IR camera in devices comprises of the monochrome semiconductor. The prime sense is performed with the implementation of the depth sensing technology. The IR laser is emitted from the IR projector with the grating diffraction and set as IR dots. However, those dots are not visible in the 3D scene but seen through IR camera. The relative translation pattern in the left-right is offered as the point depth.

Kinect Software: Microsoft Kinect offers free downloadable software called as Kinect development library tool. Now we can get some other tools in the market which includes open NI, Microsoft Kinect SDK and open Kinect. Open NI is called as NITE and its highest version is 2.2. The current version of SDK released by Microsoft is 2.0. Open Kinect tool software is free. Open community of Kinect people maintained by open-source library. The

large number of people use open NI and Microsoft SDK. The Microsoft SDK (version 2.0) can be used only for windows. Open NI (version 2.2) is a multiplatform and is used as a source tool. Kinect is able to capture four types of images by using the above-mentioned software such as RGB, depth, infrared and skeleton.

IV. Logistic Regression Algorithm

The logistic regression is classified under supervised machine learning algorithm. We use binary classification method in this algorithm. Sometimees controversy appear between regressions and classification, the main attention is on logistic refers to logistic function. It is considered to the an effective algorithm for classification. It is broadly used in the task of binary classification. The logistics regression model is similar to that of linear equation which uses logistics function based on consideration of logs odds to perform binary classification.

It occupies an important role in the data preparation activities and thereby information are analyzed. With logistics model prediction is performed for the dependent variables to examine the relationship between one or more independent variables. Logistic regression is used mainly because it is easily to setup and thereby train other deep laerning algorithms and artificial intilligence applications. It is also used at the time when various outcomes denoted by the data are lineraly separable.

Algorithm 1. Logistic Regression Algorithm Pseudo code

Feature scaling ((1, 1) = TP, (0, 1) =FP, (0, 0) = TN, (1, 0) = FN)

From bouncingball. Preprocessing import standardscaler

sc_x = standardscaler ( )

sc_y = standardscaler ( )

sc_z = standardscaler ( )

x _train = sc_x. fit_ transform (x_train)

y _train = sc_y. fit_ transform (y_train)

z _train = sc_z. fit_ transform (z_train)

x_test = sc_x.transform(x_test)

y_test = sc_y.transform(y_test)

z_test = sc_z.transform(z_test)

Fitting logistic regression to RGB_D dataset

from sklearn.linear_model import logistic regression

classifier = logistic regression ( )

classifier.fit (x_train, y_train, z_train)

pedicting the test set result

correct class_prediction classifier.predict(x_text, y_text, z_text)

Making the actual class and our prediction

from sklearn.metrics import TP, FP, FN, TN

prediction = (TP, FP, FN, TN)(x_text, y_test, z_test)

Implementation Steps in Logistic Regression: To implement the logistic regression using visual studio 2010 (ultimate). We must follow the following steps

Step1: Pre – Processing Data's.

Step2: The training set is fitted with Logistic Regression.

Step3: The test results are predicted.

Step4: Test actual and predicted value of the result.

Step5: The test set result is visualized.

Binary Classification Method: Binary classification is a form in which predicted categorical varaibles are processed. It is basically a kind of prediction. The output is resulted into two classes. The examination comprises of the different classes either positive/negative, 1/0 or true/false.

TP = Correctly predicted positive (1) class.

FP = Predict negative (0) class as positive.

TN = Correctly predict negative (0) class.

FN = Predict positive class (0) as negative.

Application	Correct Class	Our Prediction	Result
True Positive	1	1	TP
False Positive	0	1	FP
True Negative	0	0	TN
False Negative	1	0	FN

Table 1. Actual and Predicted Class of an Observation.

V. Genetic Algorithm and its Types

Genetic algorithm is the class of optimization technique based on principle characteristics of the natural selection and genetics. It is used in identification of the near-optimal or optimal solution for the difficult problem those are lifetime problem. It has been used to solve optimization problem adopted in machine learning models.

Figure 3- Process of Optimization.

The process of optimization involved in provision of better solution. At any instances, it is defined as set of inputs to derive the output sets. Optimization involved in finding optimal input value to derive the "best" value in output. The definition of the best is varies in mathematical term based on the problem to problem referred to maximize or minimize the objective function for the different input parameters. The det of possible solutions or values are based on the consideration of the search space. In those the search space are based on the point set to derive the optimal solution. The scenario in the optimization is to derive the set of point in the search space.

Genetic algorithm is belongs to the subset of large computation branch for the evolutionary computation process. In case of genetic algorithm, the defined problem possible solutions are computed. The optimization solution comprises of the mutation and recombination process to produce the new children and repeated over the different generation. Every individual in the population are evaluated and assigned with the individual fitness function which has higher possibility to mate and yield the individual "fitter". The four types of the genetic algorithm are defined as follows:

1. Generational Genetic Algorithm.
2. Steady – State Genetic Algorithm.
3. Steady – Generational Genetic Algorithm.
4. (μ + μ) Genetic Algorithm.

We propose **Steady – State Genetic Algorithm (SSGA)** in this paper. It will be very easy to implement IOT in SSGA. We consider in this paper dynamic environments in which different noise factors in the data of time series. The method of optimization is very easy in real – time processing. Optimal solution can be adapted easily in the dynamic environments. So, we can apply SSGA as prolonging model of generation. SSGA is an Optimization evolutionary method using operators such as selection, mutation and crossover. We are using here **selection operator** for our research work.

It is by using **selection operator** select two parents. Encoding is decided. Then decide to make selection. Select individuals from the population to create offspring for the forthcoming generation and find the number of offspring's each will create. The aim of selection is to stress fitter individuals in the population to hope the offspring will have higher fitness.

Algorithm 2. Steady State Genetic Algorithm Pseudo code

P ← generate a physiotherapy exercises of individuals randomly.
While stopping criterion has not been met.
Precision ← tournament_ selection (P)
Recall ← tournament_ selection (P)
TP, TN, FP, FN ← with probability select_ rate selection precision, sensitivity. TP ← select TP
TN ← select TN
FP ← select FP
FN ← select FN
Test 1 + Test 2 / Average ← get the two highest fitness physiotherapy exercises out of precision, Recall, TP, TN, FP, FN
Average **85 and above** = TP
Average **80 <=84** = FP
Average **75<=79** = FN
Average **below 74** = TN

Advantages of Steady State Genetic Algorithms

1. It does not require any information derivation
2. It is faster and more efficient than the traditional methods
3. Has excellent capabilities for parallel operation
4. Optimize the multi-objective problem in continuous and discrete operation
5. Provides the excellent solution and not only provides the single solution
6. Always provides the excellent solution to the problem which is better over the time.
7. It is effective while search space is large and number of parameters involved

PID	Ball Color	Test 1		Test 2		Test 3		Total Average	Average
		Seconds	Value	Seconds	Value	Seconds	Value		
001	Red	0.40	91	0.41	92	0.41	95	278	92.66
002	Blue	0.43	81	0.41	84	0.45	83	248	82.66
003	Blue	0.49	75	0.43	80	0.49	79	234	78
004	Green	0.41	94	0.40	95	0.47	91	280	93.33
005	Yellow	0.44	81	0.40	83	0.45	85	249	83
006	Red	0.50	93	0.45	92	0.43	91	276	92

007	White	0.49	95	0.48	91	0.42	92	278	92.66
008	Red	0.47	86	0.42	90	0.41	87	263	87.66
009	Blue	0.50	90	0.43	86	0.48	88	264	88
010	Green	0.40	91	0.40	93	0.47	92	276	92
011	Yellow	0..40	85	0.50	81	0.48	83	249	83
012	Yellow	0.42	85	0.46	81	0.49	84	250	83.33
013	Red	0.41	87	0.47	90	0.47	88	265	88.33
014	Red	0.45	76	0.49	79	0.49	80	235	78.33
015	Red	0.48	82	0.50	84	0.41	81	247	82.33
016	Red	0.46	88	0.42	86	0.43	90	264	88
017	Blue	0.49	76	0.41	79	0.44	77	232	77.33
018	Blue	0.50	82	0.45	84	0.47	81	247	82.33
019	Yellow	0.41	93	0.46	94	0.47	91	278	92.66
020	Yellow	0.41	77	0.43	78	0.42	80	235	78.33

Table 2- UT – Kinect Dataset.

Medical Interactive Recovery Assistant (MIRA) Method: This is a software platform which helps the patient to perform physiotherapy gaming exercises more interestingly and thereby patients easily recovered from injuries. This software is clinically built for interactive games. Kinect sensors are used in MIRA to track the patients while doing their rehabilitation exercises at home. The depth sensing technology can tracks the patient to determine if the patient is doing the exercises exactly as prescribed by the physiotherapist. The therpy programs are deliverd through a series of games and thereby the patient can easily be recoverd within a short period of time. The games involved in MIRA platform caters the needs of the patients. The patient feel easy and confortable while performing the rehabilitation gaming exercises.

1. **TP** = The data instances those are positive the algorithm correctly classified instances are stated as True Positives.
2. **FN** = It is stated as False negative where the labels are classified wrongly or as negative.
3. **TN =** This is termed as True Negative in which negative instances are correctly labelled as the negative.
4. **FP** = In False positive the instances those are predicted as positives.

VI. Multi – Path Convolutional Neural Network (MP – CNN) Algorithm

Multi – Path Convolutional Neural Network is used for recognizing rehabilitation exercises. In MP – CNN, Kinect Xbox 360 sensor is used for implementation. They are two novel components in MP – CNN. They are D – CNN and S – CNN. A vivid description of MP – CNN is published under the title "**Analysis and Prevention of Disasters Faced by the Elderly Population from Fall Events by Tracking Skeletal System Using Multi - Path Convolutional Neural Network (MP – CNN)**" in "**Engineering Applications of Artificial Intelligence**" journal.

1. **TP** = TP stated as non-fall in which all instances are correctly identified as the class of non-fall.
2. **FN** = FN stated as non – fall in which the instances that are not detected as the correctly classified instances as non – fall class.
3. **TN** = TN stated as non – fall where instances in the two different classes the not detected as the class of non-fall.
4. **FP** = FP of non – fall where all instances in the classes are wrongly detected as the class of non-fall.

3×3 Confusion Matrix Method: On the basis 3×3 confusion matrix, the prediction columns and the rows are be the actual value. Correct predictions are given by the main diagonal. The actual values are cases and the predicted model are the same?

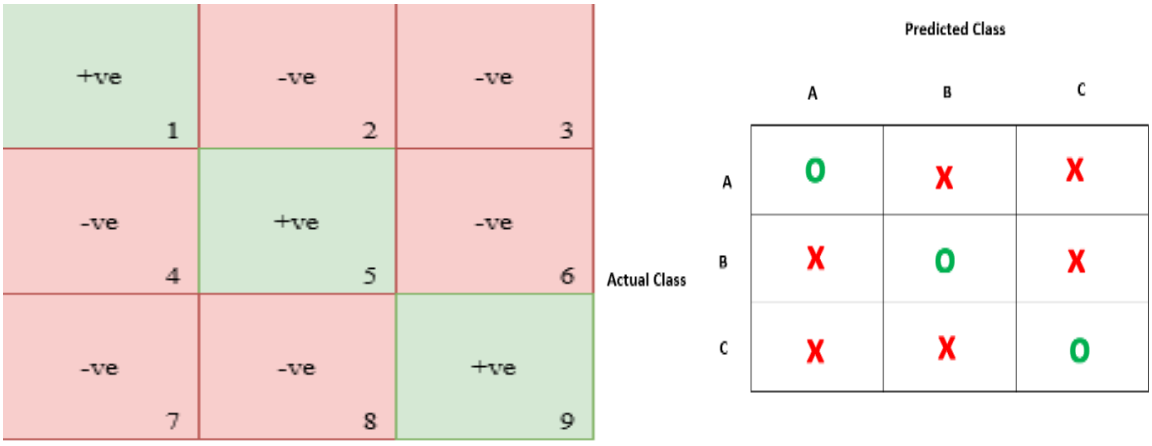


Figure 4- 3×3 Confusion Matrix.

VII. K - Nearest Neighbor Algorithm

1. **TP** = TP are correctly predicted positive samples.
2. **FP** = FP are negative samples predicted by the network positive samples.
3. **TN** = TN are negative samples correctly predicted.
4. **FN** = FN are positive samples incorrectly predicted as negative samples.

2 × 2 Confusion Matrix Method: Based on 2 × 2 confusion matrix, the target variables consists of two values. They are positive or negative. The column stands for actual values of the target variable. The rows stands the predicted values of the target variable.

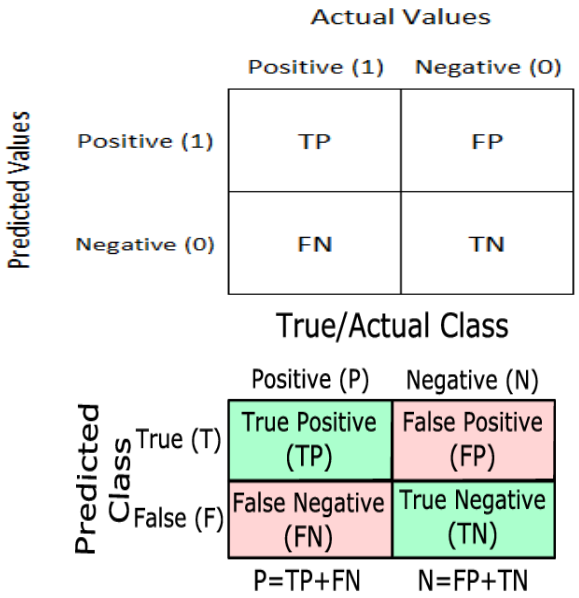


Figure 5- 2 × 2 Confusion Matrix.

VIII. Result and Discussion

We use UT - Kinect dataset for SSGA, KNN, LR and MP – CNN in this proposed system. We use Kinect Xbox 360 for getting depth data. The sampling rate for the acquiring Kinect data is 30fps. Every depth map has a dimension of 480 × 640. Kinect Xbox 360 is installed in front of the scene at a distance of 1m from the ground level to get the data. We get totally 500 video sequences of UT - Kinect dataset. The classifiers of Steady State Genetic Algorithm, LR, MP – CNN and KNN are calculated with the help of TP, TN, FP and FN by using following formulae

$$\text{Accuracy} = \frac{TP+TN}{TP+TN+FP+FN} \times 100 \quad (1)$$

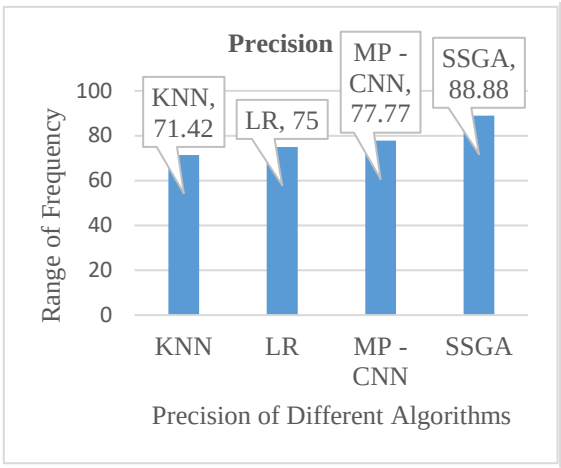
$$\text{Precision} = \frac{TP}{TP+FP} \times 100 \quad (2)$$

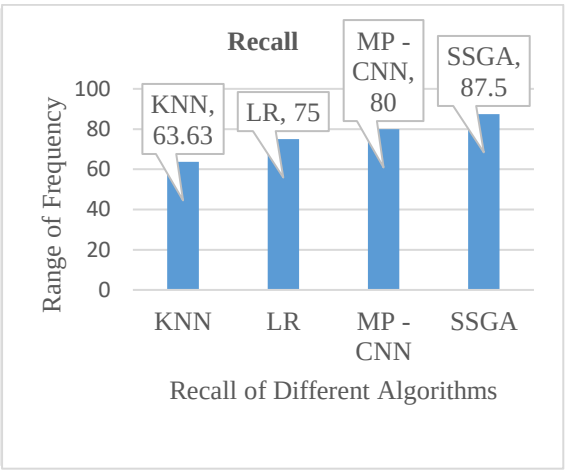
$$\text{Recall} = \frac{TP}{TP+FN} \times 100 \quad (3)$$

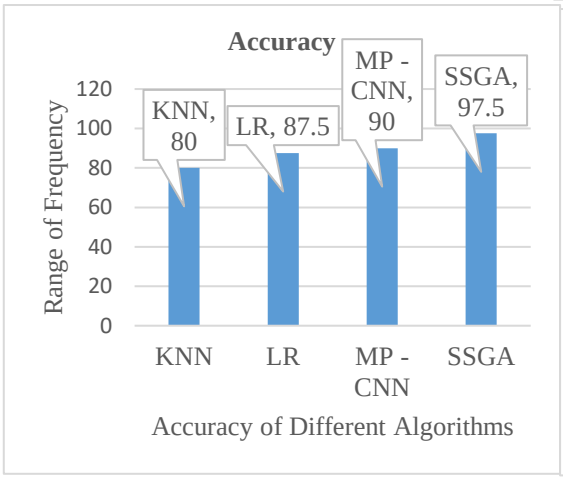
$$F1 = 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision}+\text{Recall}} \quad (4)$$

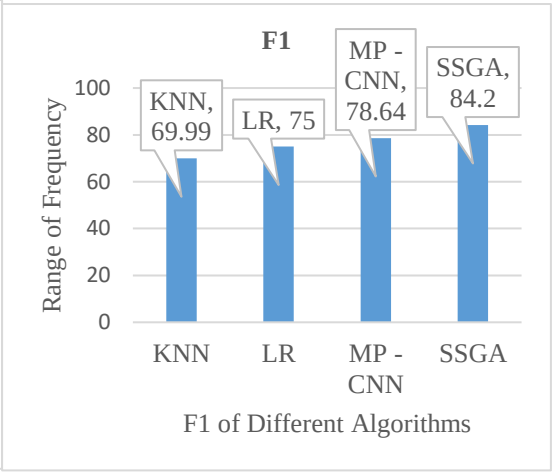
S.no	Algorithm	TP	FP	FN	TN
1	KNN	7	2	4	7
2	LR	6	2	2	10
3	MP - CNN	5	2	1	12
4	SSGA	8	1	2	9

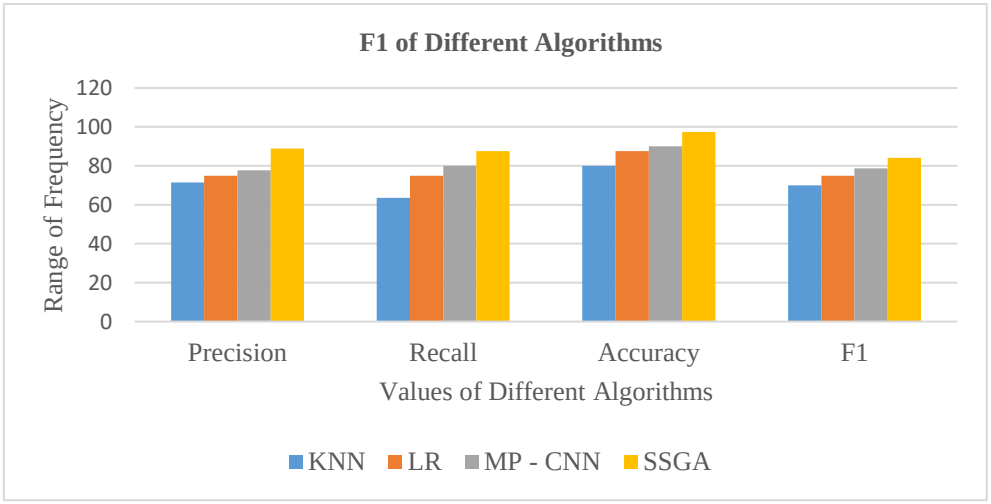
Table 3. Values of Algorithms.











The above-mentioned graph exhibits the parameters of different algorithms such as KNN, Logistic Regression, MP – CNN and Steady State Genetic Algorithm. The F1 value of KNN is 69.99. The F1 value of Logistic Regression is 75. The MP – CNN has 78.64 as F1 – value and the F1 – weighted average value of Steady State Genetic Algorithm is 84.20. By analyzing the F1 – weighted average of KNN, Logistic Regression, MP – CNN and Steady State Genetic Algorithm we come to a conclusion that the F1 – weighted average of Steady State Genetic Algorithm is higher than another algorithm. So Steady State Genetic Algorithm is better than KNN, Logistic Regression and MP – CNN Algorithms.

IX. Rehabilitation Games for Elders using Kinect an IOT Device

We can use the concept of game in the process of rehabilitation. The concept we use offers potentiality to the elders. The gaming concept should be a fun, motivating and challenging therapy. The main aim of using Kinect is giving home – based rehabilitation games to elders which could help the elderly person by doing correct execution of movements and stimulates them

through interactive elements of digital games according to the procedure of the physiotherapist. We can make use of Kinect which co – ordinates movements of the user using the method of skeletal tracking. The main aim of the gaming exercise is collecting points for every movement. After the completion of physiotherapy by the elders, the conditions of the elderly persons are monitor by a development chart.

Technologies: The Rehabilitation using Kinect based Games (REAKING) platform use Kinect Xbox 360 sensors to get the movements of the user's which adds a module game to practice the body of the users.

The following hardware and software used for REAKING are

1. A Microsoft Kinect sensor Xbox 360, which includes a power hub and USB cabling.
2. A PC with Microsoft windows V8 or later with the Kinect drivers installed and the next recommended.
3. 32 – Bit (× 32) processor.
4. 4GB memory (at least).
5. Physical dual – core 3.1 GHZ (2 logical cores per physical) or faster processor.
6. USB 3.0 controlled dedicated to the Kinect for windows V1 and V2 sensor.
7. DX11 capable graphics adapter.

Important Features: REAKING consists of two types of games which comprises of various kinds of exercises.
The game is designed to the skill of the patient in order to avoid his frustration. At the time of during exercises the patients are provided certain feedback, so that it will be more useful to the patient. There is different orientation for different exercises, the patients are allowed to play games in the same way as it should be seen by patient in the pc, TV and slide projector. The motion capture device makes the patient more independent and minimize the costs, since the physiotherapist should not present in the scene. These motion capture device gives accurate data's of from different angles of joints.

New therapies are designed for different patient's depends upon the personal situation. The patient is advised simply to enter his or her name in the system in order to download the particular session programmed. The aerobic games are designed in such a way that it should increase the aerobic capabilities of the patients. The patients are advised to walk in front of the Kinect along various landscapes. The system instructed them when they raise them speed and when they should stop. In the second type, the games are designed to develop the muscular strength. In this type sceneries are designed along the coastal areas, in order to make the patient to see beautiful views and relaxing sounds at the time of training. The number of exercises done by the patients are counted by the system.

Bounce the Ball (A Gaming Exercises): While playing this gaming exercise the patient is advised to stand before the Kinect. Many colorful balls are coming downwards. The patient is instructed by the physiotherapist to strike the particular colorful ball by the user's hands to a particular direction. Marks will be appeared on the screen if the patient strikes the ball correctly. The task of the game is to hit the blue ball to a particular direction continuously till the particular point comes in the frame then the game is stop. If the patient fails to reach the particular point, he is advised to repeat the game. This exercise practices the patient planning and coordination. At the end of the session the total active time and the number of hands touches the ball within the time is visualized.

Our research consists of tools such as Microsoft Kinect Software Development Kit (SDK) and visual studio C# 2010 ultimate. Application Programming Interfaces (APIs) is offered by the SDK and it is supported by the Microsoft Kinect drivers. Audio and video data streams are controlled by the APIs and skeletal tracking of the players is done by the Kinect sensors and the same is viewed by the windows environment. The SDK of Microsoft Kinect has been used to create specific body gestures based on the Kinect motion sensors. This enables us to define appropriate gestures, so that the doer has to perform the commands of the bouncing ball game. In case, the doer forgets a gesture of a command, the system will show the exact position of the body joints against the current body joint's position. The SDK of the Kinect tracks the features of the skeleton of one or two players. The main objective is to modify the bouncing ball game, that is controlled by voice commands and convert it to a gesture controlled instead. The under mentioned pseudo code identifies the gestures of the players and by using a "switch – case" block will give the suitable action to the game – play as per the identified gesture.

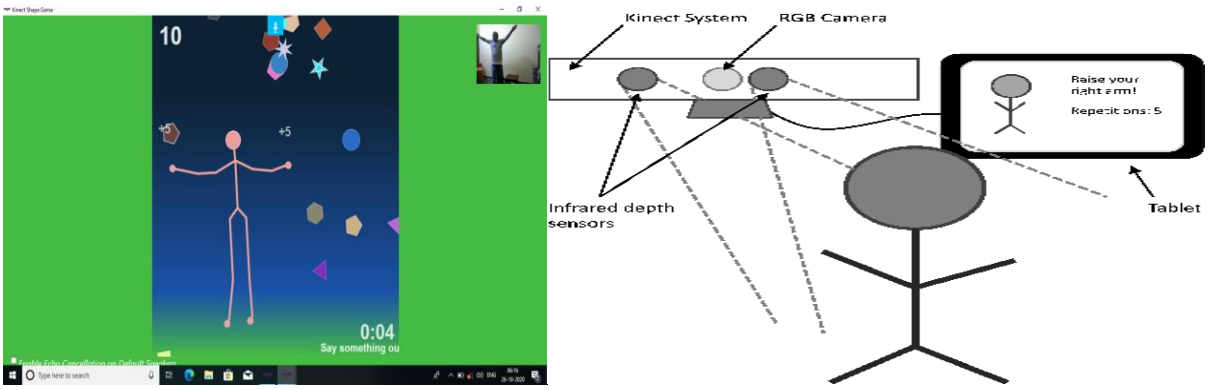


Figure 6- Kinect Monitoring Physiotherapy Activity.

Switch (shapes)

{

Case X.GestureCategory == Actions

{

Set falling Things. Actions to Recognized_ Actions
break;

}

Case Y.GestureCategory == Colors

{

Set Colors to Recognized_ Colors break;

}

Case Z.GestureCategory == Measurements

{

Set falling Things. Measurements to Recognized_
Measurement's break;

}

}

We propose a genetic – algorithm for gesture recognition. We form a database of a number of gesture genetic algorithm to this game, gestures can be any geometrical shape. The system accepts the genetic algorithm and exhibits that they are the defined range of tolerance around the shape of exact coordinates. The recognizer class uses the list of gestures of genetic algorithm. Each of these genetic algorithms is a class that provides the coordinate of states of the gesture. We consider in this method, the joints in the spine of the defined skeleton as zero coordinates. So, all the states co – ordinates with relative to the spine joint. Here in this case, various people with various heights do not have to reach the specific coordinates for each state. The independently of time shall be mentioned as a benefit of this method. The user can accomplish the gesture quickly or slowly. The system will be reset after a particular period of time.

X. Conclusion

In order to improve the health of elderly people IOT applications play a vital role. Moreover, many devices based on IOT arrives in the market presently. This paper proposes Logistic Regression and a new Steady State Genetic Algorithm which can be used in doing rehabilitation gaming exercises for elders at home. The improved Steady State Genetic Algorithm uses selection operator which can also be applied in IOT applications. The proposed Steady State Genetic Algorithm can be implemented by using a programming language and the results are evaluated. The complexity of the Steady State Genetic Algorithm can be checked and compared with another supervised machine learning algorithm. We applied enhanced Steady State genetic operator in this work, so that we can obtain better results. The fitness calculation for the Steady State Genetic Algorithm is decided by getting the average values of test 1, test 2 and test 3 using Kinect Xbox 360. It is proved in this paper that SSGA is better than other supervised machine learning algorithms like KNN, LR and MP – CNN.

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