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# Model for Predicting Cardiac Health using Deep Learning Classifier

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***Abstract*— Data mining in medical domain is the most active research area and mainly concerned of discovering hidden pattern and features within data, deep learning involves mainly a neural network with large number of hidden layers for difficult machine learning task. Data mining includes deep learning and would help to make sense from data. In this research paper a model is generated by using deep learning classifier for correct classification of heart disease. For this study data was collected by retrospective method. It includes 9 attributes (including predictive attribute) and 209 instances. This paper firstly identified that the people having diabetes and hypertension are the most dominant category of heart patients, secondly classification was done by comparing old data mining algorithm with deep learning and this paper also shows the comparative analysis of different types of neural network with deep learning algorithm. The statistical testing result indicated that the maximum accuracy of 71.4% was achieved using deep learning, parameters like precision, recall/sensitivity, specificity, F measure were calculated for further investigation. Model was generated using RapidMiner version 8.2.**

***Keywords*— *Data mining, Deep learning, MLP (Multi-layer perceptron), Cardiac Health, Machine Learning, Heart disease, Predictive modelling***

## I. Introduction

Good health is the most valuable and greatest blessing for human being. When the body is free from any kind of disease and mind is vacate from all kind of worries and anxiety one can achieve a good health, taking care of health is very important. This paper concerns about cardiac health of human, approximately 6,10,000 people die every year because of heart disease in united states and major factor responsible for heart problem is choice of lifestyle, it includes poor diet, physical inactiveness, obesity, excessive alcohol consumption etc [1]. Two more major factors identified in this paper are people who suffers from diabetes and having problem of hypertension are at the higher risk for heart disease.

Types of heart problem considered in this work are heart failure and different types of cardio vascular diseases. Heart attack is caused when the blood flow to a part of the heart is blocked, it occurs because coronary arteries which supplies blood to the heart become thick and hard from fat, cholesterol and other harmful substances commonly called plaque, this plaque dies the heart muscle and may permanently damage the heart [2]. Cardiovascular disease includes cardiac arrhythmia and other heart valve problem. Cardiac arrythmia is a condition in which abnormal rhythm of heart beat occur, abnormality of heart rhythm means either the heart beats too fast or too slow and heart valve problem occurs when the heart valve doesn't open enough to pass the blood through it and is also called stenosis [3].

This paper provides an insight about classification algorithms used for cardiac health prediction. Dataset chosen for predictive modelling has been collected from retrospective method from SRHC Govt Hospital, Delhi. In this work knowledge discovery in database (KDD) steps were followed. This study used the discretization and binning approach to pre-process the data in order to identify diabetic and hypertension patients who are at a higher danger of heart problems. Diabetic and hypertension patients were discovered using the correlation ranking method. A comparative analysis has been done to evaluate the performance of best performed classification algorithm. The examined classification techniques are as follows: Naïve bayes, generalized linear model, logistic regression, deep learning method, decision tree, gradient boosted trees, MLP and voted perceptron algorithm. After comparing above mentioned algorithms we found deep learning method outperformed with the accuracy of 71.4%, misclassification rate 28.6%, recall/sensitivity 72.2%, precision 65.0%, specificity 70.8%, F measure 68.4% and generated a predictive model using deep learning. For these efforts, RapidMiner version 8.2 is used.

This study also includes the below mentioned research issues on disease prediction..

a) Does the single classification algorithm for disease prediction always gives optimal result in any data set?

b) What is deep learning and how it is different from MLP?

c) Is there any significant difference in accuracy between widely used old classification algorithms and deep learning algorithm?

## II. Related Work

In this section research work of various researchers in field of predictive modeling of disease dataset is presented.

Cheng- Hsiung Weng et al.[4] investigated the performance of individual classifiers in ensembled and single classifiers using different neural networks for predictive modeling. With a significant difference of 0.0119, the ensembled classifier showed improvement than the individual classifier.

K. Saxena and R. Sharma[5] established a framework for accurate disease prediction, and the dataset used in this study came from the UCI machine learning repository. Knowledge extraction based on evolutionary evaluation ,KEEL was used in the experimental investigation and attained an efficiency of 86.7 percent.

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M. Akhil Jabbar et al.[6] devised an effective associative classification method based on a genetic approach, which reached an accuracy of 88.9%. They compared their findings to those of J4.8, nave bayes, GNP, and NN.

A fuzzy expert system for diabetic decision assistance was introduced by Chang-Shing Lee and Mei-Hui Wang[7]. They created a semantic decision support agent and a five-layer fuzzy ontology system that includes a knowledge layer, a group relation layer, a group domain layer, a personal relation layer, and a personal domain layer (SDSA). C++ Builder 2007 was used to implement the proposed FDO-based fuzzy expert system.

Eugene Pretorius et al.[8] established a pediatric population cardiac computer aided auscultation system and proposed a new algorithm with 94 percent specificity and 91 percent sensitivity using signal processing techniques and an ensembled neural network classifier for the development of such decision support system. The CAA algorithm was used to create a low-cost solution.

Amir Hussain et al.[9] established a machine learning-based prognostic system using a hybrid approach that is based on ontology-driven methods and clinical rule-based engines. Their model detects chest pain in cardiac patients, and they used two case studies of heart disease and breast cancer to validate the model.

After pre-processing the dataset, Abhay Kishore et al.[10] suggested a heart attack prediction system employing a deep learning classifier, especially a RNN, using 270 records. The data for the trials came from the UCI machine learning repository. Theano, a library to perform operations on GPU is used to optimise the RNN, which is implemented in Python.

## III. PROPOSED FRAMEWORK FOR MODEL GENERATION

In this section, we discuss about Artificial Neural Network (ANN), Deep Learning Concept and detailed framework for generating predictive model.

*What is Neural Network and how it works?*

Neural Network works in the same way as human brain works. It imitates a process occur in human nerve cell with electrical signals, the electrical signal travels along the body of neuron to it's terminal called axon and further interaction with neighbouring neurons is done by synapses and dendrites [11]. ANN is composed of multiple nodes and it works on the concept of neural network explained above. In ANN each node takes an input data value and perform operations on data values with the help of link associated with weights and finally the output generated, output of each node is called its activation [12]. ANN needs to be trained by learning strategies. There are different learning strategies available like supervised learning: It uses training data to link between input and output and the model generated can be used on new data with some accuracy, unsupervised learning: It does not use the output data most of the algorithms of unsupervised learning are used for pre-processing or pre-train the supervised algorithms and reinforcement learning: It finds the best way to earn the greatest rewards means it recognise the best action in every possible ways and provides the optimal solution and it is useful in solving control optimization problem [13,19,20].Figure 1 represents simple Artificial Neural Network topology.

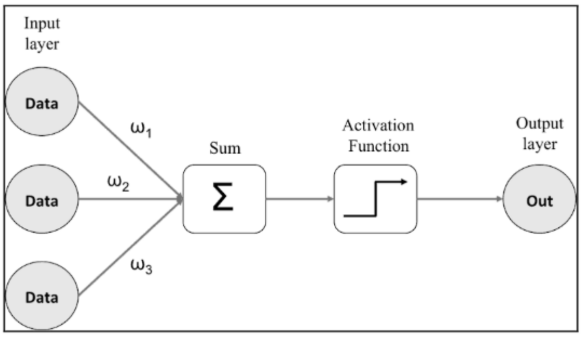


Fig 1. An ANN topology representation

*What is Deep Learning and how it is different from MLP?*

Some complex ANN has many layers and very large number of interconnecting nodes. These complex networks are designed for prediction and learning of abstract concepts, multi-layered algorithms used for the purpose are called Multi-layer perceptron (MLP) which is extensively used in Deep Learning [14]. Deep learning is not really different from MLP but arguably one type of deep learning i.e. back propagation, before the concept of deep learning researchers did not have widespread success in training a network with more than 2 layers. Lot of multiplication involves for the networks containing more than 2 layers, deep learning proposed a different initialization strategy by introducing series of single layer networks which does not suffers from exploding gradients. Single layer autoencoder initializes each hidden layer and a SoftMax classifier used as an initializing parameter for output layer of deep MLP, so one can easily train gradient decent techniques without exploding/vanishing gradients [15,18].

*Does a single classification algorithm provide optimal results?*

Disease prediction is a very critical topic and selection of appropriate algorithm for each data set is a major task. This paper provides an insight about deep learning classification algorithm by applying various test on multiple algorithms. The term 'best' algorithm depends on the application that you are developing, here in this paper after comparing various classification algorithms we found deep learning provides an optimal result but there is always a possibility to improve the algorithm by hybridisation process and this is our next goal to achieve.

A complete workflow is represented in Figure 2, data set used in this research work was collected by retrospective method from SRHC Govt Hospital, Delhi. Data set contains 9 attributes and 209 instances, attributes required for model generation are as follows: Gender: 0- Male and 1-Female, Total Cholesterol level: calculated in mmol/l, Triglyceride level: calculated in mmol/l, Haemoglobin: calculated in g/l, Hypertension measured by bpm (Systolic and diastolic patients come under this category): 0- normal bpm and 1-abnormal bpm, Diabetes: 0-non-diabetic patient and 1-diabetic patient, Low density lipoprotein: calculated in mmol/l, High density lipoprotein: calculated in mmol/l, Heart Disease (Predictive attribute). Correlation ranking method was used for attribute evaluation and identified diabetic and hypertension patients are at high risk of heart disease.

=== Attribute Selection on all input data ===

Search Method:

Attribute ranking.

Attribute Evaluator (supervised, Class (nominal): 9 Heart Disease):

Correlation Ranking Filter

Ranked attributes:

0.3036 1 Gender

0.2929 6 diabetes

0.2288 5 Hypertension

0.1625 7 LDL

0.1234 2 TC

0.1032 4 Haemoglobin

0.0657 3 TG

0.0534 8 HDL

Selected attributes: 1,6,5,7,2,4,3,8: 8

After data collection, data was refined by changing predictive attribute from categorical to nominal. Missing values were handled by using Replace Missing Value operator in Rapid Miner and further pre-processing was done by binning method. In the next step model was trained by single 10-fold cross validation technique. In which data was divided into training det and test data set. On the basis of various evaluation parameters like accuracy, misclassification rate, area under the curve, precision, recall, F measure, sensitivity, and specificity, results were compared between various machine learning classification techniques and deep learning classifier. After analysing all these parameters, we found deep learning classifier provided us optimal results.

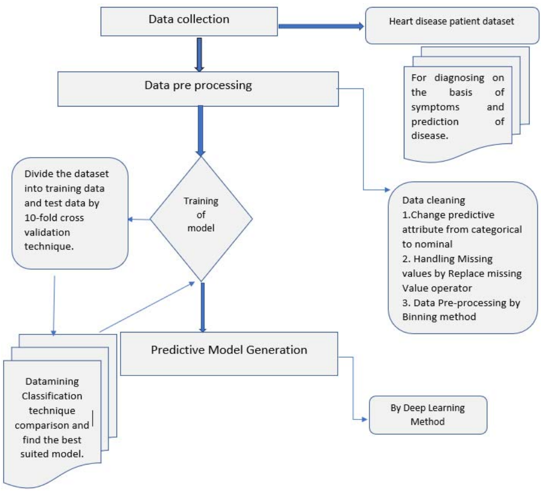


Fig 2. Proposed Model for Predicting Cardiac Health using Deep Learning Classifier

The framework described above provided a complete workflow of the research presented in paper.

## IV. Evaluation Criteria

After model construction, It's crucial to assess the model's effectiveness using test data since it gives an impartial estimate of error creation.. For this paper, predictive model was evaluated by utilizing different classification algorithms comparison, comparison was done between old classification techniques and deep learning technique. Further in this work a comparison was done between different types of neural network with deep learning method to justify why deep learning provided the maximal accuracy as compare to other neural network classifiers.

The best and the foremost useful method for such analysis is confusion matrix, it recognizes how well a classifier works. True Positives (TP) are the most fundamental terms utilised in this matrix: Positive records that have been accurately labelled by the classifier are referred to be TP. False positives (FP) are negative records that the classifier mistakenly labels. False Negatives (FN) are positive records that have been labelled wrongly by the classifier. True negatives (TN) are a type of negative that exists in the real world. The incorrect or negative records that are accurately labelled by the classifier are referred to as TN. Table 1 shows a confusion matrix of two class labels.

TABLE I CONFUSTION MATRIX

| ***Actual Class*** | **Predictive Class** | |
|---|---|---|
| | **Class1(Positive)** | **Class2(Negative)** |
| ***Class1(Positive)*** | True Positives (TP) | False Negatives (FN) |
| ***Class1(Negative)*** | False Positives (FP) | True Negatives(TN) |

By using this matrix different measures useful for model evaluation is identified. In this study measures identified are as follows:

Accuracy: A classifier's accuracy is expressed as a percentage for a particular set of test data. It is the evaluation of successfully identified test records by the classification model. This measure is calculated using formula

$$\text{Accuracy} = \frac{\text{TP} + \text{TN}}{\text{TP} + \text{TN} + \text{FP} + \text{FN}}$$

Classification Error: This is also called misclassification rate and is also measured in percentage. It is the measurement of test records that are incorrectly classified by the classifier. This measure is calculated using formula

$$Classification\ Error = \frac{FP + FN}{TP + TN + FP + FN}$$

Sensitivity and Specificity: These are the two methods for determining the classifier's accuracy. Sensitivity is also known as true positive rate , which refers to the percentage of positive records that are classified correctly, so while specificity is known as true negative rate, which refers to the percentage of negative data that are correctly identified. These measures are calculated using formulas

$$Sensitivity = TPR = \frac{TP}{TP + FN}$$

$$Specificity = TNR = \frac{TN}{TN + FP}$$

Recall and Precision: Recall is referred as TPR and similar as sensitivity, measures positive fraction of record which are classified correctly. The percentage of relevant records among the recovered instances is known as precision. These measures are calculated using the formulas

$$Recall = TPR = \frac{TP}{TP + FN}$$

$$Precision = \frac{TP}{TP + FP}$$

F measure: It is the measurement of effectiveness which is calculated by weighted average of recall and precision. This measure is calculated using formula

$$F\ measure = \frac{2 * Recall * Precision}{Recall + Precision}$$

Area under the curve (AUC): AUC is the area under ROC curve, predictions are sorted by score from highest to lowest before calculating the area under curve (AUC). Receiver operating characteristics curve (ROC) curve is then plotted in accordance of that. This measure is calculated using formula

$$AUC = \frac{AUC(Optimistic) + AUC(Pessimistic)}{2}$$

These measures were calculated to identify better classifier among all, results obtained using these formulas are presented in next section.

## IV. EXPERIMENTAL RESULTS

Various experiments were done in this part to examine the performance of various classifiers. Rapid Miner version 8.2 was used to implement them.

First, several classifiers were compared on the basis of above discussed performance measures. Analysis depicted in Table 2, here we can clearly see maximum accuracy of 71.4% achieved by deep learning classifier. Other performance parameters of deep learning classifier having values as follows: classification error 28.6%, AUC 0.729, precision 65.0%, recall/ sensitivity 72.2%, F measure 68.4% and specificity 78.8%. Secondly in Figure 3-line chart comparison was done between deep learning classifier and other neural networks like MLP and voted perceptron. Further a bar chart comparison of all classifiers is shown in Figure 4.

TABLE II COMPARATIVE ANALYSIS OF VARIOUS CLASSIFICATION ALGORITHMS

| *Classification Algorithm* | *Accuracy* | *Classification Error* | *AUC* | *Precision* | *Recall* | *F Measure* | *Sensitivity* | *Specificity* |
|---|---|---|---|---|---|---|---|---|
| *Naïve Bayes* | 69.0% | 31.0% | 0.713 | 64.7% | 61.1% | 62.9% | 61.1% | *75.0%* |
| *Generalised Linear Model* | 61.9% | 38.1% | 0.678 | 57.1% | 44.4% | 50.0% | 44.4% | *75.0%* |
| *Logistic Regression* | 64.3% | 35.7% | 0.678 | 60.0% | 50.0% | 54.5% | 50.0% | *75.0%* |
| *Deep Learning* | 71.4% | 28.6% | 0.729 | 65.0% | 72.2% | 68.4% | 72.2% | *70.8%* |
| *Decision Tree* | 64.3% | 35.7% | 0.545 | 100.0% | 16.7% | 28.6% | 16.7% | *100.0%* |
| *Gradient Boosted Trees* | 66.7% | 33.3% | 0.789 | 62.5% | 55.6% | 58.8% | 55.6% | *75.0%* |
| *MLP* | 65.07% | 34.92% | 0.667 | 64.7% | 65.1% | 64.6% | 64.7% | *74.7%* |
| *Voted Perceptron* | *56.93%* | *43.06%* | *0.510* | *32.4%* | *56.9%* | *41.3%* | *56.9%* | *100%* |

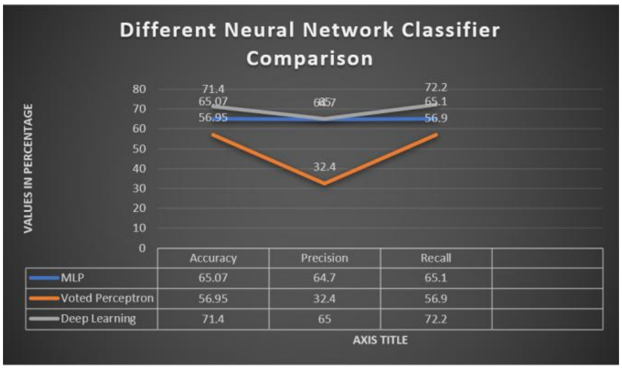


Fig 3. A Line Chart Comparison of different types of Neural network classifiers with Deep Learning

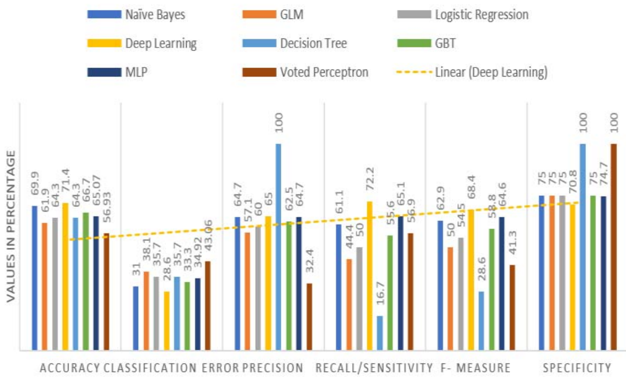


Fig 4. A Bar Chart Comparison of all classifiers

Firstly, we uploaded the data in Rapid Miner Model generation by selecting the predictive attribute i.e. Heart disease containing categorical values Yes/No, having 90 entries of Yes and 119 entries of No. Further we map the classes to new values. All 9 attributes are selected for input in model.

**Model Metrics are as follows:**

Model Metrics Type: Binomial
Description: Metrics reported on full training frame
model id: rm-h2o-model-deep_learning-367283
frame id: rm-h2o-frame-deep_learning-494455
MSE: 0.1472989
R^2: 0.39941242
AUC: 0.88099414
Log loss: 0.45732826

**CM: Confusion Matrix (vertical: actual; across: predicted):**

| | No | Yes | Error | | Rate |
|---|---|---|---|---|---|
| No | 70 | 25 | 0.2632 | = | 25 / 95 |
| Yes | 8 | 64 | 0.1111 | = | 8 / 72 |

Totals 78 89 0.1976 = 33 / 167

**Gains/Lift Table (Avg response rate: 43.11 %):**

Deep Learning - Model

| Group | Cumulative Data Fraction | Lower Threshold | Lift | Cumulative Lift | Response Rate |
|---|---|---|---|---|---|
| 1 | 0.01197605 | 0.973131 | 2.319444 | 2.319444 | 1.000000 |
| 2 | 0.02395210 | 0.964848 | 2.319444 | 2.319444 | 1.000000 |
| 3 | 0.02994012 | 0.950341 | 2.319444 | 2.319444 | 1.000000 |
| 4 | 0.04191617 | 0.945903 | 2.319444 | 2.319444 | 1.000000 |
| 5 | 0.05389222 | 0.929277 | 1.159722 | 2.061728 | 0.500000 |
| 6 | 0.10179641 | 0.891359 | 2.029514 | 2.046569 | 0.875000 |
| 7 | 0.14970060 | 0.866225 | 2.029514 | 2.041111 | 0.875000 |
| 8 | 0.20359281 | 0.818797 | 1.804012 | 1.978350 | 0.777778 |
| 9 | 0.29940120 | 0.760109 | 2.174479 | 2.041111 | 0.937500 |
| 10 | 0.40119760 | 0.613941 | 1.091503 | 1.800166 | 0.470588 |
| 11 | 0.50299401 | 0.536596 | 0.955065 | 1.629134 | 0.411765 |
| 12 | 0.59880240 | 0.429493 | 1.159722 | 1.554028 | 0.500000 |
| 13 | 0.70059880 | 0.296879 | 0.272876 | 1.367877 | 0.117647 |
| 14 | 0.79640719 | 0.224089 | 0.434896 | 1.255639 | 0.187500 |
| 15 | 0.89820359 | 0.117409 | 0.000000 | 1.113333 | 0.000000 |
| 16 | 1.00000000 | 0.024648 | 0.000000 | 1.000000 | 0.000000 |

| Cumulative Response Rate | Capture Rate | Cumulative Capture Rate | Gain | Cumulative Gain |
|---|---|---|---|---|
| 1.000000 | 0.027778 | 0.027778 | 131.944444 | 131.944444 |
| 1.000000 | 0.027778 | 0.055556 | 131.944444 | 131.944444 |
| 1.000000 | 0.013889 | 0.069444 | 131.944444 | 131.944444 |
| 1.000000 | 0.027778 | 0.097222 | 131.944444 | 131.944444 |
| 0.888889 | 0.013889 | 0.111111 | 15.972222 | 106.172840 |
| 0.882353 | 0.097222 | 0.208333 | 102.951389 | 104.656863 |
| 0.880000 | 0.097222 | 0.305556 | 102.951389 | 104.111111 |
| 0.852941 | 0.097222 | 0.402778 | 80.401235 | 97.834967 |
| 0.880000 | 0.208333 | 0.611111 | 117.447917 | 104.111111 |
| 0.776119 | 0.111111 | 0.722222 | 9.150327 | 80.016584 |
| 0.702381 | 0.097222 | 0.819444 | -4.493464 | 62.913360 |
| 0.670000 | 0.111111 | 0.930556 | 15.972222 | 55.402778 |
| 0.589744 | 0.027778 | 0.958333 | -72.712418 | 36.787749 |
| 0.541353 | 0.041667 | 1.000000 | -56.510417 | 25.563910 |
| 0.480000 | 0.000000 | 1.000000 | -100.000000 | 11.333333 |
| 0.431138 | 0.000000 | 1.000000 | -100.000000 | 0.000000 |

Status of Neuron Layers (predicting Heart Disease, 2-class classification, Bernoulli distribution, Cross Entropy loss, 3,102 weights/biases, 41.7 KB, 1,670 training samples, mini-batch size 1):

| Layer | Units | Type | Dropout | L1 | L2 | Mean Rate | Rate RMS | Momentum | Mean Weight | Weight RMS | Mean Bias | Bias RMS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | Input | 0.00 % | | | | | | | | | |
| 2 | 50 | Rectifier | 0.00 % | 0.000010 | 0.000000 | 0.003490 | 0.002522 | 0.000000 | 0.007937 | 0.188871 | 0.486573 | 0.029388 |
| 3 | 50 | Rectifier | 0.00 % | 0.000010 | 0.000000 | 0.008394 | 0.012422 | 0.000000 | -0.003554 | 0.139765 | 0.992636 | 0.013785 |
| 4 | 2 | Softmax | | 0.000010 | 0.000000 | 0.001502 | 0.000969 | 0.000000 | 0.042453 | 0.435169 | 0.000000 | 0.005956 |

This section of the output includes scoring history tables with statistics progress of the algorithm, duration, training speed, epochs, sample sizes and gradual optimization of performance metrics.

Scoring History:

| Timestamp | Duration | Training Speed | Epochs | Iterations | Samples | Training MSE | Training R^2 |
|---|---|---|---|---|---|---|---|
| 2018-06-19 12:54:00 | 0.000 sec | | 0.00000 | 0 | 0.000000 | NaN | NaN |
| 2018-06-19 12:54:00 | 0.163 sec | 2420 rows/sec | 1.00000 | 1 | 167.000000 | 0.18234 | 0.25654 |
| 2018-06-19 12:54:01 | 0.229 sec | 2609 rows/sec | 2.00000 | 2 | 334.000000 | 0.18465 | 0.24712 |
| 2018-06-19 12:54:01 | 0.254 sec | 3408 rows/sec | 3.00000 | 3 | 501.000000 | 0.18213 | 0.25740 |
| 2018-06-19 12:54:01 | 0.277 sec | 4098 rows/sec | 4.00000 | 4 | 668.000000 | 0.17880 | 0.27098 |
| 2018-06-19 12:54:01 | 0.302 sec | 4562 rows/sec | 5.00000 | 5 | 835.000000 | 0.15536 | 0.36656 |
| 2018-06-19 12:54:01 | 0.324 sec | 5035 rows/sec | 6.00000 | 6 | 1002.000000 | 0.15827 | 0.35466 |
| 2018-06-19 12:54:01 | 0.341 sec | 5514 rows/sec | 7.00000 | 7 | 1169.000000 | 0.14850 | 0.39450 |
| 2018-06-19 12:54:01 | 0.363 sec | 5834 rows/sec | 8.00000 | 8 | 1336.000000 | 0.17280 | 0.29542 |
| 2018-06-19 12:54:01 | 0.383 sec | 6159 rows/sec | 9.00000 | 9 | 1503.000000 | 0.19034 | 0.22391 |
| 2018-06-19 12:54:01 | 0.406 sec | 6398 rows/sec | 10.00000 | 10 | 1670.000000 | 0.14730 | 0.39941 |

| Training LogLoss | Training AUC | Training Lift | Training Classification Error |
|---|---|---|---|
| NaN | NaN | NaN | NaN |
| 0.53744 | 0.79854 | 2.31944 | 0.26347 |
| 0.54711 | 0.80190 | 2.31944 | 0.23952 |
| 0.54858 | 0.82354 | 2.31944 | 0.25749 |
| 0.53295 | 0.84825 | 2.31944 | 0.19760 |
| 0.47563 | 0.84927 | 2.31944 | 0.24551 |
| 0.47838 | 0.86096 | 2.31944 | 0.20958 |
| 0.45909 | 0.86550 | 2.31944 | 0.21557 |
| 0.50676 | 0.86579 | 2.31944 | 0.22754 |
| 0.55194 | 0.87792 | 2.31944 | 0.19760 |
| 0.45733 | 0.88099 | 2.31944 | 0.19760 |

From the following output we can clearly see the metrics of model performed on training set. The values of MSE, Logarithmic loss and R squared are closer to 0 and AUC is much higher. Thus, the overall accuracy of model is good and correctly predicts the classes by 71.4% of accuracy.

Lift chart representation is shown in figure 5, it is the graphical representation of improved data mining model, it measures the changes with the help of lift scores [16]. It plots the discretized confidence value of given example set and model, Its major goal is to calculate the ratio between the result produced with the aid of the system and the conclusion acquired without support of the system by randomly selecting chosen data. [17].

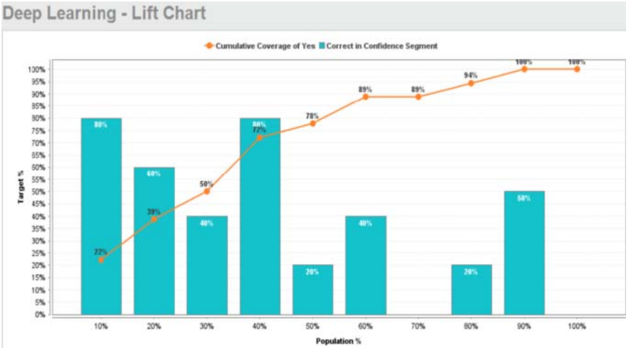


Fig 5. A graphical representation of improved data mining model

## V. CONCLUSION AND FUTURE SCOPE

Chronic diseases may be avoided by working closely with healthcare practitioners, scientists, and domain specialists, and the suggested approach aided research by accurately identifying cardiac patients. The following are the study's primary contributions; firstly, data set of cardiac patients was collected by retrospective method from SRHC govt hospital, Delhi. Collected data contained some missing values and irregularities so data was treated for refinement by pre-processing using binning method. Secondly, we compared the performance of different classifiers with deep learning classifier on different parameters of evaluation like accuracy, precision, recall, sensitivity, specificity and F measure, evaluation identified that optimal results were achieved by deep learning algorithm. Further the performance of deep learning classifier was compared with MLP and voted perceptron and finally the implementation is done in Rapid Miner version 8.2.

This paper has developed a predictive model by deep learning classifier for diagnosing heart disease, the findings were only presented in the context among one set of disease data. As a result, creating a comparable model for a different illness data set or in a different domain is also doable, as well as modification in proposed model by hybridization with related machine learning mechanism may further improve the accuracy.

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