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# Conjecturing Herd Life and Milk Yield

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***Abstract*—acrucial prospect of knowing any neural system is the power to gain knowledge through experience and to accommodate new situations. This research, investigates the usage of back-propagation Artificial Neural Networks (ANN) (an artificial intelligence framework) way to represent and predict the herd lifespan and total milk yield in prerecorded dairy cattle herds in India. Such conjecture is really a prerequisite to selection of cattle that has prolonged herd life and abundant milk yield in her life time which eventually results in optimal breeding strategies, improved annual hereditary progress and boost in the gain from the dairy business.**

**Data comprising 2972 lactation records produced by the 977 cows sired by 104 sires were employed to predict the herd lifespan and total milk yield by making use of computer Neural Networks (NN). MATLAB software was adopted for NN analysis. Cows which have completed one or more lactation were considered within this study.**

**Various ANN were patterned and the finest performing number of hidden layers as well as neurons and training algorithms retained. The overall performance of the ANN framework in simulating cow's performance was compared with factual information as prerecorded by the observational activity.**

**Usually much more precise conjecture values can be acquired with a neural network approach. This approach implies a non-linear relationship is out there among the dependent and independent variables inside the data and these are discovered through the hidden layer of NN. Hence conjecture results convey that the particular artificial neural networks models found in this research have the potential of conjecturing forthcoming performance as well as herd life of cows on the fundamentals of primitive reflection traits.**

***Keywords—Artificial neural networks, dairy cows, herd life, milk yield, back propagation, conjecture, nntool.***

## I. INTRODUCTION

In India, the dairy sector exists being an essential way to obtain rural employment as well as income. In 2001, Indian dairy industry arrived at second place in world after United States of America, having a production amount of 84 million tons. The development of dairy industry throughout previous three decades has been remarkable, at more than 5% per year. However in current scenario the production of milk still lesser as compared to the consumption by our own burgeoning population and also Indian dairy industry features an extremely modest part within international market despite that India is actually world's largest milk producer. India utilizes nearly 100% of its own production. Therefore the dairy industries need to focus on the improvement of productiveness of milk yield and herd life.

India is wealthy in its livestock wealth. It accounts for nearly 15.8% of the world cattle population and more than half of the world buffalo population and their milk accounts for 21% of agricultural production of India. But still we are facing a really tough challenge of short herd life as well as low milk yield production of cattle. We can achieve long herd life and high milk yield using cross breed technology. We can achieve improved genetic material primarily through crossbreeding of cattle. It is essential for animal geneticists to spot and keep financially lucrative animal genotypes (and genes) and also to incorporate genotype interaction together with on-farm production and environmental difficulties that affect the hereditary potential of food animals.In developed nations there is noticeable enhancement in livestock production, whereas in developing nations enhancements in livestock production have usually been insufficient. One of the primary restricting aspects has been the possible lack of genetically improved animals, a reflection associated with ineffective breeding plans, if any. The key goals regarding developing breeding plans are the elevated rates of genetic improvement as well as the reduced rate of inbreeding. By promoting genetic improvement in the household cattle, animal geneticist's farthest objective would be to create breeding plans that enhance selection as well as mating strategies, beneath the best population structure. Selecting cows for breeding which are excellent in growth and milk production; exhibit increased disease resistance; or have other desirable traits has revolutionized livestock production.

Our study will be beneficial in this field through conjecturing herd life along with the life time milk yield of cows in dairy sector on that basis we are going to pick the best performing cow from the dairy herd. The research topic "CONJECTURING HERD LIFE AND MILK YIELD" on which we worked predicts the actual values of 'Herd life' and 'Total milk yield' of dairy cows. Herd life is the life associated with cattle in years by which cattle are useful regarding dairy industry and lives within dairy herd whereas Total milk yield is the quantity of life time milk in litres that a specific cow gives in their herd life. In this research we used the artificial neural networks to predict the actual values

as the tool of data mining. The pre-recorded data of no. of cows tend to be complicated and also non-linear in nature. These data must be accumulated in a structured form. This accumulated data could be then integrated as well as managed to create a dairy information program.

The primary aim of the study carried out is to generate as well as examine the utilisation of the neural networks for conjecture of herd life as well as life time milk yield in dairy cattle. Developing an efficient milk industry's research and development (R&D) plan will be equally a predictive issue plus an optimisation issue. Whenever models tend to be of nonlinear character, artificial neural networks (ANN) have been discovered being resistant to both the noises and ambiguity in information caused by environmental impacts. Artificial neural network (ANN) is really an enormously parallel dispersed model comprised of simple processing units (neurons) that has the capacity to discover functional dependencies from information. This resembles the mind in two aspects:

- First one, Knowledge is actually obtained from the network by looking at the environment.
- And second one, Interneuron link advantages, referred to as synaptic weights, are utilized to maintain obtained knowledge.

The process accustomed to execute the learning method is termed as learning algorithm, the particular function of which would be to customize the synaptic weights with the network within a tidy trend to achieve the preferred design objective. Every neuron is a straightforward processing unit that gets several weighted data, sums all of them with a bias as well as computes an end result to be handed down. The particular function of which neuron makes use in order to compute the end result is termed as activation function. The most frequent structure is actually multilayer perceptron (MLP). These kinds of networks certainly are a feed forward network in which the neurons are usually organized within a number of hidden layers. Each and every perceptron in a single layer is actually linked to each and every perceptron around the following layer; therefore facts are continuously "feed forward" in one layer to another.

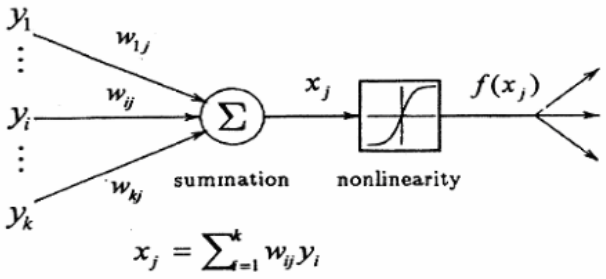


Figure 1: Graphical representation of a Single neuron

Simply by changing the amount of nodes within the hidden layer, the amount of layers, and also the amount of input as well as output nodes, it's possible to move points inside arbitrary dimensional space directly into an arbitrary amount of groups. The particular network discovers concerning the feedback by an active procedure for modifying the actual weights as well as the actual bias. This technique is named supervised learning and also the algorithm utilized is termed as learning algorithm.

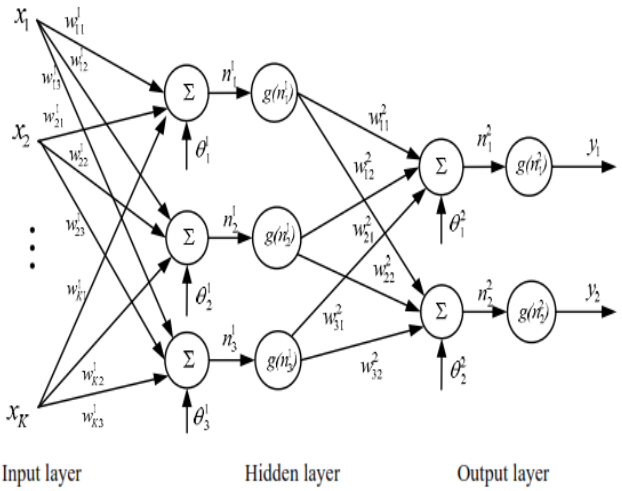


Figure 2: Schematic representation of a multilayer perceptron with one hidden layer

## II. MATERIALS AND METHODS

In this study we've utilized MATLAB 7.10.0.499 (R2010a) software program of 64 bit version, license date February 5, 2010 and license number 161051. MATLAB software program has been set up in windows 8 operating system, and the data associated with cows had been pre-recorded within national dairy research Institute was adopted as database.

### *A. Description of collection and processing of database*

The current analysis had been performed on Karan Fries breed of cows maintained and taken care at National Dairy Research Institute (NDRI), Karnal Haryana (India). The information utilized in our analysis has been accumulated through pedigree registers, calving accounts and health reports. An overall total of 2971 lactation data associated with 975 cows sired through 104 breeders had been applied. Cows which have finished a minimum one lactation have been considered within this investigation. From these records to calculate the actual herd life as well as overall life time quantity of milk we had utilized various cows data, and regarding which we developed artificial neural networks as well as information of cows had been trained, tested and verified. The various records we have employed for herd life and overall life time milk quantity conjecture are: Age on first calving (AFC), Calving interval, Overall milk sum in first lactation, Productive herd life, and total Lifetime milk yield. Herd life is living period of cows by which cows are beneficial for dairy sectors. This is actually the time period of cows by which cows provide milk in good volume after that time period volume of milk reduces and the milk yield is actually, that cows gives in their life span; and we have to conjecture these values.

### *B. Research Methodology*

One method regarding exactly how we can predict the actual Herd Life and Overall volume of milk of dairy cows is actually through implementing ANN. This technique makes use of (nntool) case within MATLAB software program to train, to test and also to verify the neural network. EXCEL

computer software was adopted regarding input data regarding.

1) *Herd life conjecture utilizing ANN:* In this study we've utilized graphical user interface (GUI) to develop ANN. This particular user interface enables us for the following phases:
   - A graphical user interface is utilized for neural networks tool kit (nntool); this kind of user interface permits us to develop networks.
   - For the following phase we need to feed data to the GUI, this kind of data is known as input data, whether data which is wanted data is known as output data.
   - Right after adding the data trigger the weights, generate, train, as well as simulate networks.
   - Extract training outcomes and developed networks from GUI to command line workspace.
   - Save the various parameters extracted to the workspace.

Regarding herd life conjecture to spread out Network/Data Manager windowpane we write nntool after the GUI Network Data Manager windowpane comes and working, we are able to import the input and target data, develop a network, look at network, train network, simulate feedback to network and also to export the end results to the workspace. In the same way, we are able to transfer data in the work environment in order to use within the GUI. Regarding herd life conjecture we've developed network, and also trained network along with following parameters:

*a) Training algorithms:* To calculate herd life we've employed feed forward back propagation (FFBP) network type algorithm for network training. Back-propagation neural networks (BPNN) are typical network structures. The actual input-output sets are utilized to train any network until the network can easily approximate the function.

*b) The most effective function:*Various functions along with constant structures (2-10-1) had been studied utilizing the tansig transfer function within the input layer as well as purelin transfer function within the output layer regarding the final results training function was trainlm, adaption learning function was learngd and performance function was mserg.

*c) The most effective network structures:*The most effective structures have been computed through screening various numbers of neurons within the hidden layer. Usually, one or two hidden layers with 10 as arbitrary no. of neurons are utilized which can be adequate in order to estimate herd life conjecture.

*d) Training:*Within this portion, data composed of 2 types of details, age at first calving (AFC) regarding cows in days, and the Calving interval, had been utilized.

*e) Verifying:*Within this program, time stop of computation was implemented along with five types of data to discover the network architecture function which was not utilized in training. Verifying data have got examined in the different order of training and also continued whenever the error decreased in the verifying.

*f) Testing:*
   - Four types of data had been implemented for the particular testing procedure right after training and verifying.
   - Open up the Network Data Manager and then click on Export.
   - Choose Network1 within the variable listing of the Export or Save windowpane and then click on Save.
   - This can lead to the Save to some MAT file windowpane. Save to some file Network1 or any other title we just like.

2) *Milk yield conjecture utilizing ANN:*In this study we've utilized graphical user interface (GUI) to develop ANN. A GUI is utilized for neural networks tool kit (nntool). This particular user interface enables us for the following phases:
   - Initially we need to load the particular Excel documents to the MATLAB workspace.
   - Open up the GUI to generate networks for input as well as target data making use of nntool.
   - Feed input data and target data in GUI through adding from workspace.
   - Trigger the weights, develop as well as train the network, and also simulate networks.
   - Following simulating, extract the training final results through the particular GUI to the command line work environment.
   - Save the actual generated factors to the work environment from GUI.

Regarding milk yield conjecture we've developed network, and furthermore trained the particular network together with following variables:

*a) Training algorithms:* The back propagation had been adopted for network training. Back propagation neural networks (BPNN) tend to be most frequent network architecture [8]. BPNNs are usually training sets of rules in the monitored trend. The particular input-output couple pairs are employed to train network till network can rapidly approximate any function.

*b) The most effective function:* Diverse functions with assorted number. of architecture have been researched, by implementing Tansig transfer function inside the first hidden level and also Purelin function with second hidden level we acquired ideal results.

*c) The most effective network architecture:* The best structures had been determined simply by screening a diverse quantity of neurons inside the hidden layer. Typically, one or even two hidden layers along with arbitrary large figures of neurons could be enough to be able to estimate any kind of function. The actual minimum quantity of neurons within present research is five. The specific performance function SSE was chosen to ascertain minimum error. The particular LEARNGDM adaption learning

function had been chosen with regard to learning intent behind neural network (4-2-1: 4 input, 2 hidden layers, 1 output).

d) *Training:* Within this component, 60% of input data including four forms of details, Age at first calving relating to cows in days, First lactation milk yield, Calving interval, and also Productive life have been implemented to train the particular network.

*e)* *Verifying:*Within this aspect, the time stop of computation had been utilized together with 20% data to find out the network architecture work that has been not applied in training. Verifying information have got checked out in different series of training and furthermore continued each time the amount of error reduced within the verifying.

*f)* *Testing:* From complete data 20% data have been implemented for the actual testing method following training and verifying.

## III. RESULTS AND DISCUSSION

Developing a good ANN depending on pre-recorded experimental outcomes Works well for conjecturing Herd life as well as milk yield with no need of any practical operation. The particular results of the developed network are usually compared with the pre-recorded data to determine the developed network efficiency.

Regarding herd life conjecture we've constructed a straightforward Two input individual output [2, 1] FFNN having a tansig function at first hidden layer neuron along with a purelin function at second hidden level neuron. To predict the actual herd life, we've adopted 10 inside the quantity of Neurons box. Layer one had been set to tansig that has been based on our requirement. After that click on the drop-down menus regarding attributes and set it to Layer 2. Now, alter the transfer function to purelin transfer function. Regarding Herd Life, overall eight networks with various architectures as shown within table1 had been developed to figure out best final results. further variables demonstrated inside of Table1 which includes training function, quantity of hidden layers, performance function, adaption learning function, transfer function inside input layer, along with transfer function inside of output layer, had been considered to obtain the the best possible network. The very best network had been selected with respect to the least error inside training along with the higher correlation coefficient of knowledge. The least error had been taken out with the MSERG learning function with regard to network8, as demonstrated within Figure1 that displays mean square error. The correlation coefficient furthermore demonstrated in several data sets in figure4 with regard to Network8, along with 10 neurons inside the hidden layer, is regarded as to own best efficiency together with minimum error as shown in Figure3 along with the best possible correlation coefficient, nearer to one in figure4. With regards to this particular network, figure5 shows the network output data bar graph. Network output bar graph is actually a vital parameter in analysing with all the networks output data along with input data. In figure5 network output data appear like input data along with minimum errors. However, the created network N8 is a lot more knowledgeable when compared with other networks. We've applied trainscg concerning training function, learngdm concerning learning function, along with MSERG concerning performance function in development of network8 as demonstrated inside TableI.

TableI. REGARDING TRAINING NETWORKS
Network Type = FFBP, Layer1 = TANSIG, Layer2 = PURELIN

| Network No. | Training function | Learning function | Performance function | No. of neurons |
|---|---|---|---|---|
| Network 1 | Trainbfg | Learngdm | Mserg | 10 |
| Network 2 | Trainbr | Learngdm | Mserg | 10 |
| Network 3 | Traingd | Learngdm | Mserg | 10 |
| Network 4 | Trainlgdx | Learngdm | Mserg | 10 |
| Network 5 | Trainlm | Learngdm | Mserg | 10 |
| Network 6 | Trainoss | Learngdm | Mserg | 10 |
| Network 7 | Trainr | Learngdm | Mserg | 10 |
| Network 8 | Trainscg | Learngdm | Mserg | 10 |

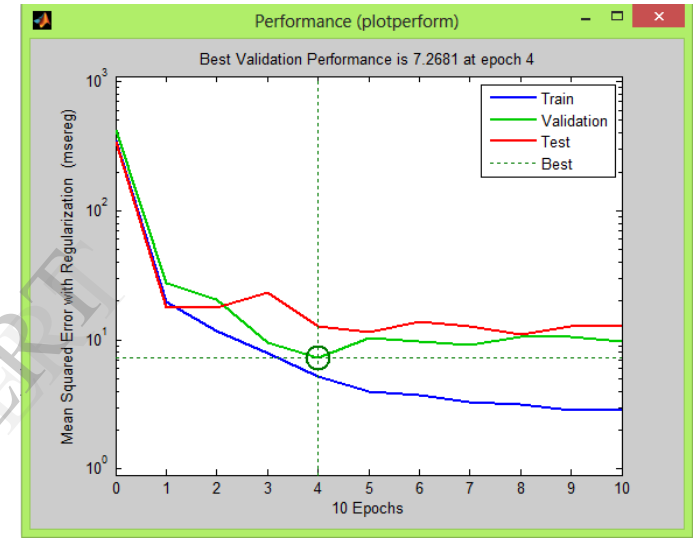


Figure3: Performance Graph showing best efficiency for Herd Life

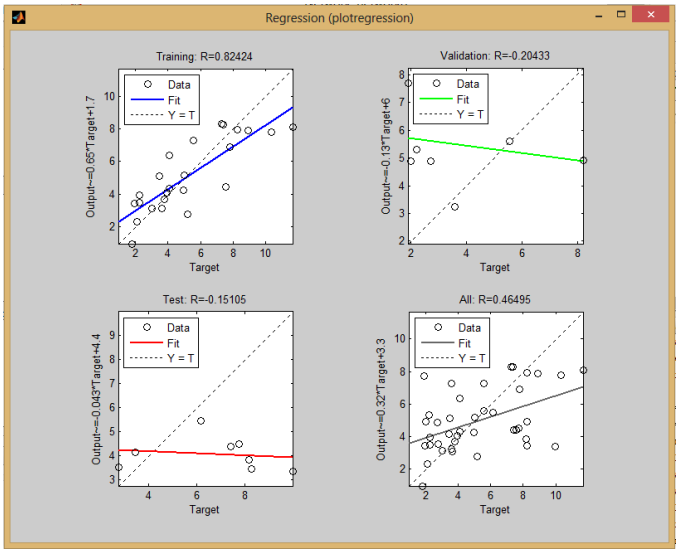


Figure4: Regression Graph showing correlation coefficient in Herd Life conjecture

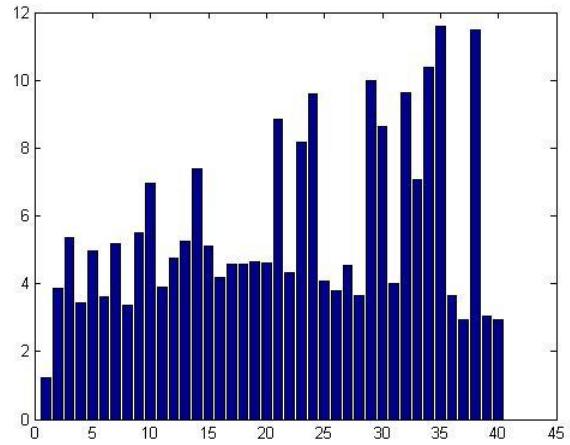

Figure5: Network output Bar Graph showing Herd Life

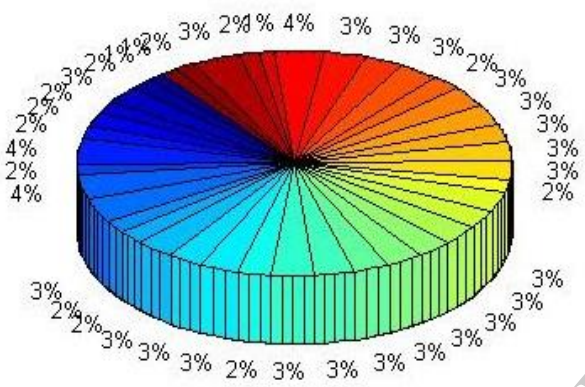

Figure6: Pie Chart showing error in target data and conjecture values of Herd Life

Whereas in the case of milk yield, nine networks with various architectures as demonstrated in table1 had been created to determine ideal results. Another parameters demonstrated inside Table2 including training function, number of hidden levels, performance function, adaption learning function, transfer function within input level, as well as transfer function within output level, had been considered to get the optimum network. The most effective network had been chosen depending on the minimal error within training and also the higher correlation coefficient of knowledge. The minimal error had been taken out utilizing the SSE learning function for network9, as demonstrated in Figure7 that shows sum squared error. The actual correlation coefficient also demonstrated in various data sets in figure5 for Network9, together with 10 neurons within the hidden layer, is recognized as to achieve the best efficiency along with minimal error as demonstrated in Figure4 as well as optimum correlation coefficient, closer to one in figure8. Concerning this network, figure11 displays the actual network output data bar graph. Network output bar graph is in fact an essential parameter in evaluating using the networks output data as well as input data. In figure11 network output data resemble input data together with minimal errors. Nonetheless, the developed network N9 is much more knowledgeable as compared to other networks.

TableII. Regarding Trained Networks
Network Type = FFBP, Layer1 = TANSIG, Layer2 = PURELIN

| Network No. | Training function | Learning function | Performance function | No. of neurons |
|---|---|---|---|---|
| Network 1 | Trainbr | Learngdm | Mserg | 14 |
| Network 2 | Traingd | Learngdm | Mse | 10 |
| Network 3 | Traingdx | Learngdm | Mse | 10 |
| Network 4 | Trainlm | Learngd | Mserg | 8 |
| Network 5 | Trainlm | Learngdm | Mserg | 12 |
| Network 6 | Traingd | Learngd | Mserg | 12 |
| Network 7 | Trainbr | Learngd | Mserg | 8 |
| Network 8 | Traingdx | Learngd | Mserg | 15 |
| Network 9 | Trainbr | Learngdm | Sse | 10 |

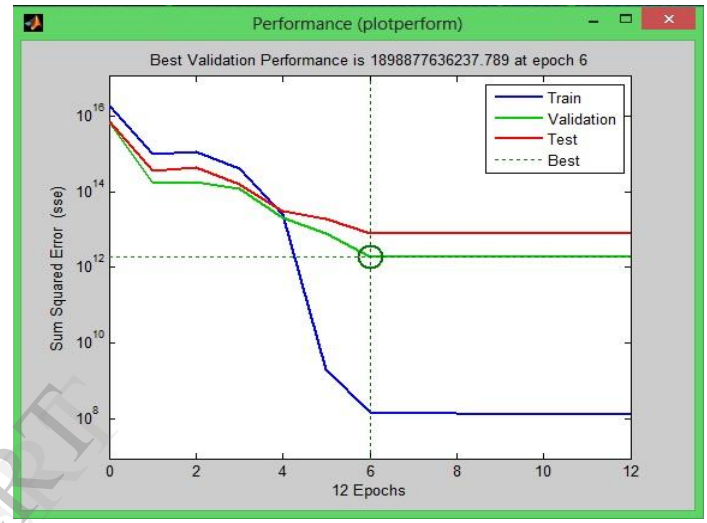


Figure7: Performance Graph showing best efficiency of Milk Yield

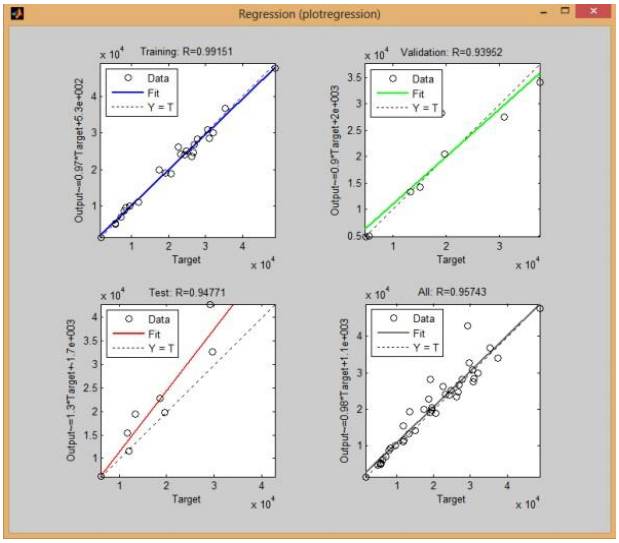


Figure8: Regression Graph showing correlation coefficient in Milk yield conjecture

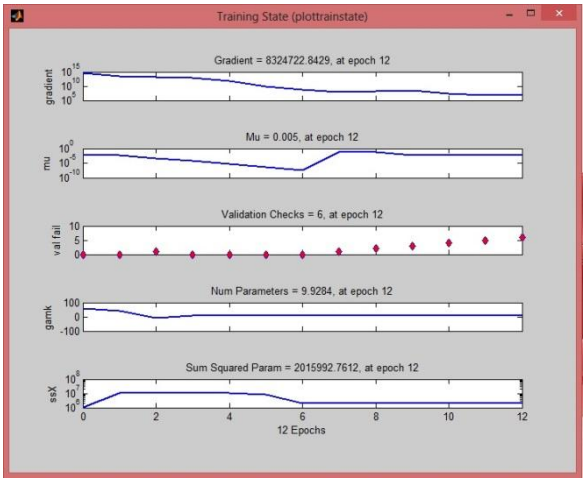


Figure9: Training State Graph of NetworkOutput_Network9

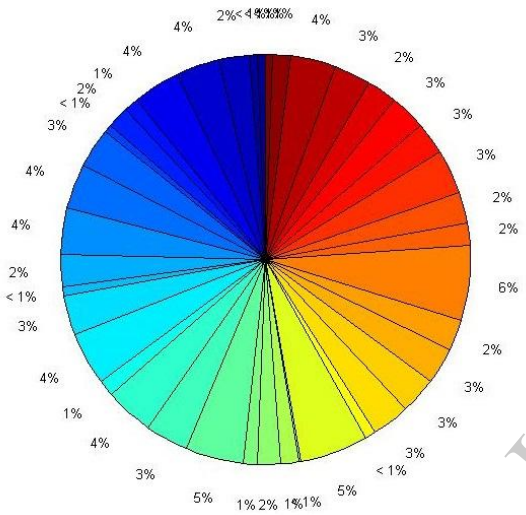

Figure10: Pie Chart showing error in target data and conjecture values of Milk Yield

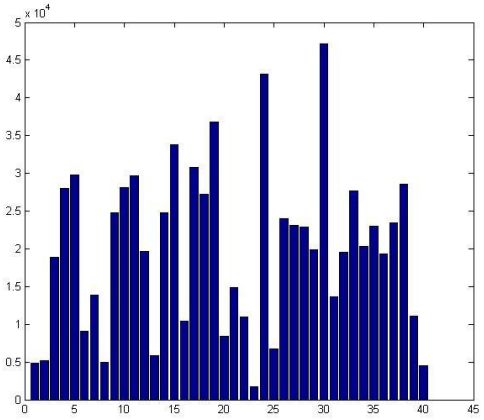

Figure11: Network output Bar Graph showing Milk Yield

## IV. CONCLUSION

As explained above we have predicted the actual values regarding Milk Yield and Herd life in accordance with documented data associated with cows utilizing the ANN. The conjecture of herd life and milk yield making use of ANN demonstrate the closest results to the target data. The particular neural network conjecture through trained neural networks has confirmed effectiveness and can easily be integrated to boost the features associated with intelligence decision support system within cow selection system. The final results claim that a non-linear relationship is out there among the characteristic factors within the data which are discovered through the hidden layer neurons of the NN. Artificial Neural Network (ANN) models tend to be effective resources to calculate the cattle herd life as well as milk yield depending on the features of their parents.

Within this study, the actual experimental outcomes of various data samples had been applied to produce an artificial neural network to calculate herd life as well as milk yield associated with dairy cows. The herd life and also the milk yield had been determined based on utilized inputs. The end result from the developed ANN had been compared with the final results of the experimental work.

With regard to Herd life conjecture the specific chosen network and its particular variables were; in which Age at First Calving (AFC) and Calving Interval were the input, and the Herd life of cattle was the output of the network.

- The specific framework of the chosen network possessing least error was a couple of input, ten neurons and individual output (2-10-1) FFNN.
- Through total employed data 60% data had been chosen concerning training, 20% data relating to verifying and leftover 20% data had been made use regarding testing.
- The best possible network utilized with regard to conjecturing the actual milk yield was feed-forward neural network (FFNN) in which the learning function was LEARNGDM. In which the training and transmission functions were TRAINSCG and TANSIG at first layer and PURELIN at second layer, correspondingly.
- The particular final results of the created network tend to be closer to the particular outcomes of the documented data related to experimental work.
- The specific selected ANN enables you to predict the actual herd life together with least error along with optimum correlation coefficient near to 1.

In the present research, the actual experimental outcomes of cow's data samples had been applied to produce an artificial neural network (ANN) to calculate the actual milk yield associated with dairy cattle. The end result of the developed ANN had been compared with the outcomes from the experimental work which usually displays the closest values towards the recorded data. With regard to milk yield conjecture the certain chosen network and its particular parameters were,

- The particular structure of the picked network having minimal error was four inputs, two hidden layer and one output (4-2-1).
- From overall utilized data 60% data were chosen regarding training, 20% data regarding verifying and remaining 20% data were utilized for testing.
- The finest network applied with regard to conjecturing the milk yield was feed-forward back propagation (FFBP) where the training and learning functions were TRAINBR and LEARNGDM, correspondingly. While TANSIG and PURELIN

were the transfer function on layer1 and layer2 respectively.

- The actual end results of the developed network tend to be nearer to the outcomes of the documented data associated with experimental work.
- The chosen ANN enables you to predict milk yield along with minimum error, along with a maximum correlation coefficient close to 1.

## REFERENCES

[1] Anderson, J. A. (2003), An introduction to neural networks. Prentice Hall.

[2] Chakrabarti, S. (2009). Data mining: know it all. Burlington, MA, Elsevier/Morgan Kaufmann Publishers.

[3] D M Njubi*, J Wakhungu and M S Badamana, "Milk yield prediction in Kenyan Holstein-Friesian cattle using computer neural networks system",Livestock Research for Rural Development 21 (4) 2009.

[4] Dr K.G. Karmakar and Dr G.D. Banerjee, "Opportunities And Challenges in The Indian Dairy Industry", Technical digest ISSUE 9, 2006.

[5] Heikki N. Koivo (Feb, 2008) NEURAL NETWORKS: Basics using MATLAB Neural Network Toolbox.

[6] Jianhua Yang, "Intelligent Data Mining using Artificial Neural Networks and Genetic Algorithms: Techniques and Applications" University of Warwick, 5, 2010.

[7] **MATLAB2002**MATrixLABoratory. Matlab 6.5 (Release 13), The Language of Technical Computing, The MathWorks , Natick, Mass , USA.

[8] Sanjay V S, "An overview of the Dairy Sector in India", FICCI-Food 360, 6 November 2012.

[9] Venugopal, K. r. (2009). Soft computing for data mining applications. New York, Springer.