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Original Article

Prediction of the Weight and Number of Eggs in Mazandaran Native Fowl Using Artificial Neural Network

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ABSTRACT

Traditional poultry production has changed to a considerable industry after few decades. Now, poultry industry is one of the main sectors to obtain the required protein for human consumption. Prediction of the weight and number of eggs according to economic traits can improve the efficiency of production and the profit of producers. In present study, the weight and number of eggs in Mazandaran native fowl were predicted using artificial neural network (ANN). The information of BW at birth, 8 and 12 weeks of age, weight and age at sexual maturity and the polymorphism of prolactin gene were used for the prediction. The results showed that ANN is reliable method for predicting the weight and number of eggs based on available information.

Introduction

In Iran for the first time in 1954 and with importing some chickens and eggs from modified race, the basis of apiary industry was found in a modern method. At the same time with development of apiaries of growing hens, production units of oviparous hen and pullet had been developed so that producing egg averagely had a significant growth of 4/4 percent during 1982-2003 which according to population growth of the country, its annual consumption had a 1/6 growth. High profit rate attracted asset and this caused the stage for fine growth in producing eggs (3/4 percent) during 1993-2003 and intensely increased motivation of those having capitals for investing and creating new production capacities (1). In segregating programs, profit can increase through improving genetic level of features related to egg production such as weight of sexual maturity, age of sexual maturity, number and weight of producing egg the best animals can be chosen with these features through modifying and choosing genetics. Artificial neural network can be used as one of ways of investigating relations of producing features with producing egg in oviparous egg. Artificial network is used in predicting the relation between producing features in animals such as cow, sheep and hen (6 and 7). Artificial neural networks (ANN) have been introduced as powerful tools for modeling system of planning (5). Artificial neural networks are smart dynamic systems of free model which can transfer data to the network structure by processing on empirical data of knowledge or hidden rule beyond data and they can encompass general rules based on calculations on numerical data or examples. These networks are designed based on structure of

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human brain. Artificial neural networks are usually organized by three layers as follows:

- Input layer: it the first layer in neural networks and receives resource out of the system.
- Hidden layer: it is located between input and output layers. In this layer the process of calculating is conducted on input data and the results gained are transferred to the output layer.
- Output layer: it is ht last layer in artificial neural networks and it is similar to independent layers in regression model (3).

In a research modeling data related to Sprague-dawley rate was compared to regression method and neural network. The results gained showed that both methods can predict weight in a suitable manner. Rash et al (2006) compared modeling of Gompertz non-linear regression equation and modeling of neural network using a set of data related to growth of chickens. They concluded that coordination of artificial network model for curve of growth of chickens is relatively better than Gompertz model. Tamhouras Pour (2011) used an artificial neural network for explaining increase in weight of sheep which had been done through multi-forms of genes, weight and type of birth. In this model, Multi-form of gens GH, PIT-1, GDF-8, GDF-9, Leptin, Calpain and Calpastatin, birth weight and type were all used as input data. Coordination of model was tested using MSR, R2 and Bias methods. Based on the results gained, Tamhouras Pour reported that neural networks model is a suitable tool for recognizing patterns related to data in order to predict growth in form of average increase in daily weight.

Bahreini Behzadi and Eslaminejad (2010) compared two methods of artificial neural network and non-linear regression in predicting sheep growth. After comparing results of various regression performance and neural network model, they concluded that the network model is more suitable and more accurate. Tayebi et al (2009) predicted process of eggs in time horizons by two models of neural network and ARCH model. They showed that the rate predicted by neural networks have more accuracy in minimizing predicting error in most cased, especially in long-term time horizons. Therefore, efficient and effective tools are able to provide every kind of prediction from the existence of fluctuation and variable rate of strategic materials such as egg in line with taking economic policies which are consistent with marketing condition. Since there has been no study on applying neural network in predicting weight and number of producing eggs using data related to other features like production, reproduction, multiform gens and Prolaktin gen, in this research using data of economic features related to oviparous eggs, predicting weight and number of eggs can be investigated using artificial neural network.

Material and Methods

In this research, blood of 138 native hens was taken out and then genotype was determined for Prolaktin gen. records used contained weight of sexual maturity, age of sexual maturity, number of eggs, egg weight, order of giving birth to chicken and birth weight and age period of 8weeks and 12 weeks. For predicting number of producing eggs by artificial neural network, input data included weight and sexual maturity age., weight of egg, order of giving birth to chicken, birth weight, 8 and 12weeks age and for predicting producing egg weight by artificial neural network, input data contained weight and sexual maturity age, number of eggs, order of giving birth to chicken, birth weight and 8 and 12weeks age.

Table 1: Featuers and values measures in native hen

Maximum	Minimum	Standard devition	Mean	Number	Trait
41/75	28/65	2/63	35/84	158	Birth weight(gr)
880	380	107/52	689/80	158	Body weight at 8 weeks(gr)
1420	700	150/74	1099/80	158	BW at 12 weeks
180	121	12/91	141/961	158	Age at sexual maturity(day)
2500	1370	188/72	1837/14	158	weight at sexual maturity(gr)
38	5/5	4/82	13/79	158	egg number
62/5	39/06	3/95	49/26	158	egg weight(gr)

In order to design neural network, first data were divided to 80 and 20 percents for training and testing data. Then, using relation available data values were standardized and then 10 input neurons were considered for independent variables and 1 output neuron was considered which is weight and the other one is number of eggs. Then types of neural network were tested containing multilayered Prosperon network, radial basis function and element. Also, different types of threshold functions were used. To investigate the accuracy of the neural network method, analyzing statistics were applied such as R2 and RMSE.

Results and Discussion

Figure 1 shows neural network structure designed. The results showed that among different neural networks, multilayer Prosperon with two hidden layers and four neurons in each layer provides the best solution (answer). Also, sigmoid threshold function provided accurate answers for hidden neurons.

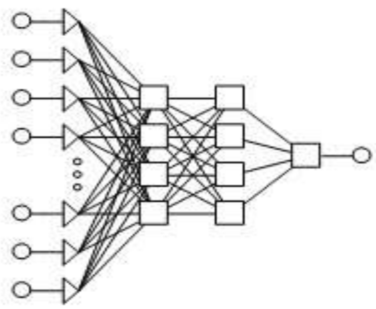
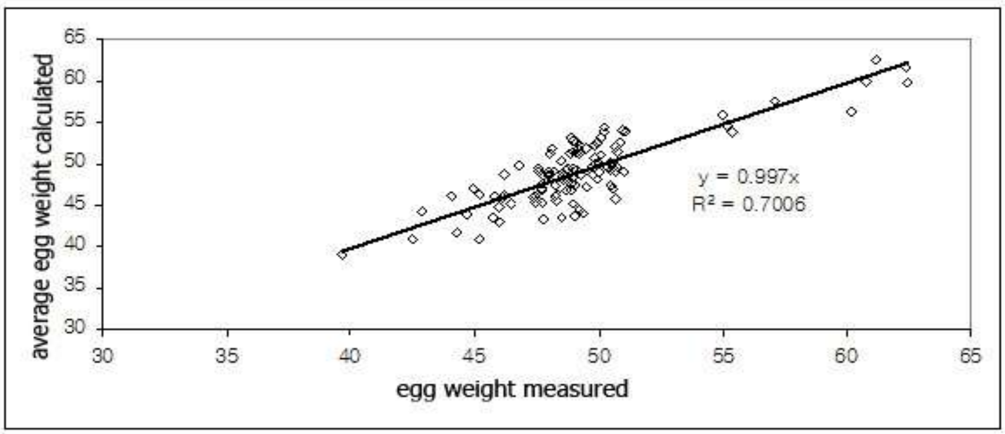


Figure1. Structure of neural network designed



Figures 2. changes in values of average egg weight calculated with neural network against observational values for training data

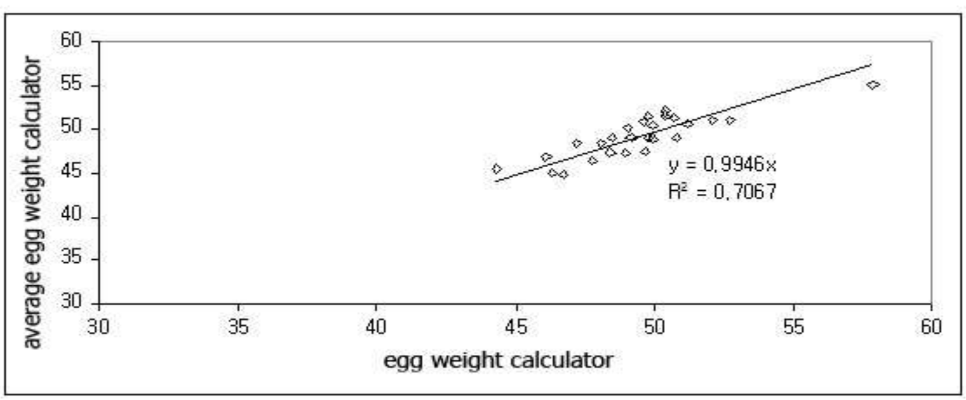


Figure 3. changes in values of average egg weight calculated with neural network against observational values for testing data

Figures 2 and 3: show values calculated compared to observational values of average weight of eggs for training and testing data, respectively. According to these images, it is clear that neural network conducted this measure with a suitable accuracy.

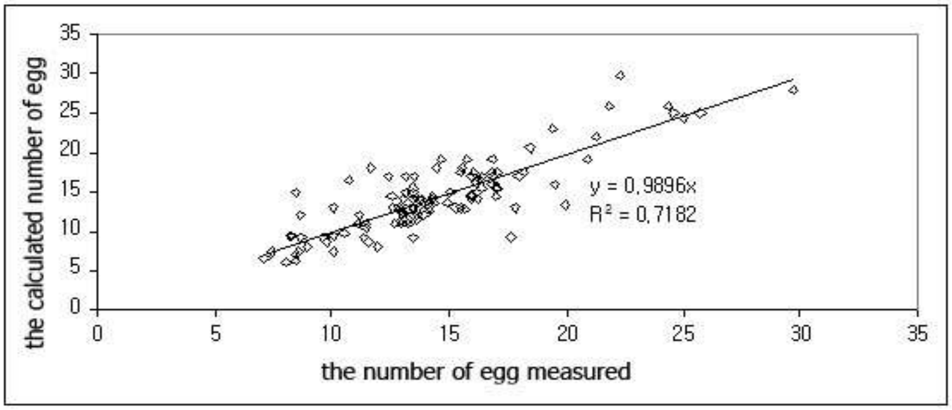


Figure 4. changes in values of eggs calculated with neural network against observation values for the training data

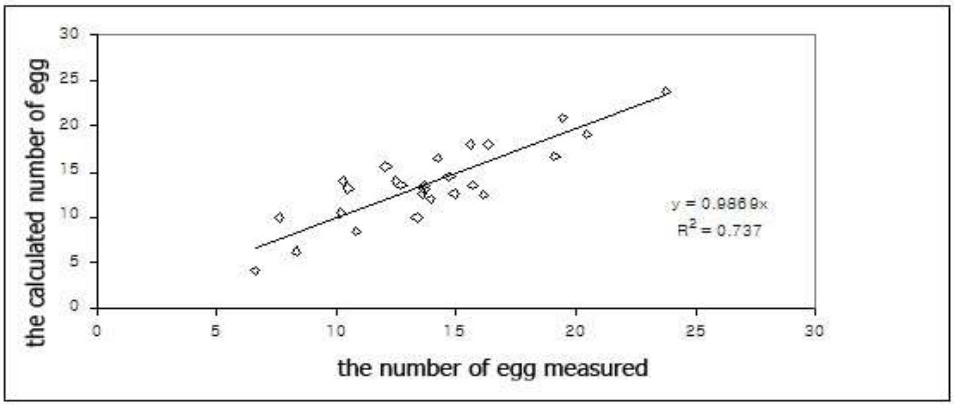


Figure 5. changes in values of eggs calculated with neural network against observation values for the test data

Figures 4 and 5: also show values calculated compared to observational values of number of eggs for training and testing data, respectively. According to these images, it is clear that neural network conducted this measure with a suitable accuracy.

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