BROILER GROWTH MODELING WITH NEURAL NETWORKS USING SIMULATED DATA

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Abstract: Broiler growth modeling is most often done using average body weight data over certain periods of time for a given strain of birds and farm management conditions. Such growth curve data are then analyzed to forecast the future growth rate, using mathematical models, like Gompertz or other nonlinear statistical models that fit the data best. Constant selection in genetic pool, nutritional factors and environmental concerns however, make such models limited in their utility due to difficulty in fitting the growth curve across time, bird-strain and other determining variables. Moreover, generating data for every strain of birds under continually changing variables is not an efficient approach either. The current model addresses two objectives: it simulate data using published literature for different growth periods; and develop artificial intelligence models with various architectures of Neural Networks. By breaking down the actual broiler growth data into five-day intervals, with known means and standard deviations, Normal distributions were generated for the broiler growth using @Risk software. These simulated data were then used to recognize data patterns and model growth curve with various Neural Networks. Three Neural Networks, namely BP3 (three layers back propagation, each layer connected to previous layer), BP5 (five layers back propagation, each layer connected previous layer) and Ward (five hidden slabs with various activation functions) were used in this research. These Networks were trained using the broiler growth simulated data generated through Normal distributions. Once the Networks were sufficiently trained, they were then exposed to the actual growth data that they were not exposed before to predict broiler growth over next 50 days. BP3 Neural Network gave the best fitting line with predictions tightly fitting to the actual data points. The $R^2$, the coefficient of multiple determinations, was 0.998, a near perfect. The $R^2$ for BP5 and Ward Neural Networks were 0.967 and 0.973, respectively.

Keywords: Broiler growth curve, simulation, modeling, neural networks.