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Field of work: Non-ruminant nutrition and production

Explainable artificial intelligence as a tool for assessing egg quality

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Eggs are important in the human diet, as they are accessible sources of essential nutrients such as amino acids, vitamins and minerals. Therefore, assessing egg quality is important for both producers and consumers. In this sense, the use of explainable artificial intelligence (XAI) techniques can help evaluate egg quality. With this in mind, the aim of this study is to demonstrate and relate the most decisive egg quality characteristics for discriminating between young and old eggs. In order to evaluate egg quality variables, 200 eggs were used from light laying hens of the Dekalb White strain reared at the DZ-UFRPE Poultry Research Laboratory. Evaluations were carried out on freshly laid eggs and eggs stored at room temperature for seven, 21 and 28 days, 50 eggs for each time period, where freshly laid eggs and eggs aged seven days were classified as new eggs, and eggs aged 21 and 28 days were classified as old eggs. The quality variables analyzed were Haugh unit, albumen height, yolk height and yolk diameter. Two XAI techniques were used to evaluate the egg quality data: logistic regression (LR), which is able to determine the importance of each variable in the classification, and decision tree (DT), which classifies the instances. The analyses were carried out using Weka 3.8.6 software (Waikato Environment for Knowledge Analysis), with the default settings for the models. Both techniques were trained with 160 samples and tested with 40 samples. LR and DT obtained 100% and 97.5% accuracy respectively in the test set. With regard to the most important explanatory variables in LR, yolk height had the greatest weight (1.7714) in the decision-making process for grading eggs, followed by yolk diameter, which had a negative correlation and a weight (- 0.1516). With regard to DT, yolk height and yolk diameter stood out as the most explanatory variables, following the same trend as the previous analysis, where eggs with yolk height greater than 13.6 mm were classified as new eggs, and when they had values less than 13.6 mm the variable of interest was yolk diameter, where because there was an inverse relationship, when they had values greater than 45.3 mm they were classified as old eggs. It can be concluded that the height and yolk diameter variables can be used accurately to classify eggs as young or old, demonstrating that the patterns identified discriminate the proposed classes excellently. In addition, the XAI techniques found relationships that corroborate knowledge in the field and can be further explored to discover new relationships in egg quality data.

Keywords: Decision tree, Explainable artificial intelligence, Logistic regression, Poultry farming.

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