ANDROLOGICAL CLASSIFICATION OF BULLS EVALUATED BY MACHINE LEARNING

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The study aimed to verify the behavior of classifying Andrological Exams (AE) of bulls used in natural breeding through Machine Learning (ML). A database of AE of 2308 bulls was used, with the following attributes for each examination: region, breed, genotype, age class, testicular consistency, scrotal circumference, semen volume, sperm swirl, sperm motility, sperm vigor, acrosome defect, proximal cytoplasmic drop, head defect, midpiece defect, total major defects, distal cytoplasmic drop, normal isolated head, tail defects, total minor defects, total defects and total normal sperm. The classification of these animals for each test was made as fit (n = 1088), unfit (n = 672) and questionable (n = 548). This database was submitted to the ML tool Orange Data Mining, twelve algorithms were tested, Gradient Boosting (GB), Random Forest (RF), Neural Network (NN), Tree, AdaBoost, kNN, Logistic Regression, CN2 Rule Induction, Stochastic Gradient Descent, Naive Bayes, SVM and Constant, these the first tree presented better results. Where the GB had 83,7% of Precision, against 83,3% of the RF and 82,7% of the NN, the values for Classification Accuracy were 83.8%, 83.2%, and 82.7%, respectively. GB was able to identify results similar to AE for most bulls, especially for animals classified as fit 93.8% (1020/1088) and unfit 77.1% (518/672). For animals classified as doubtful, the results of the ML matched those of the AE in only 72.1% (395/548) of the bulls. Thus, 83.6% (1930/2308) of the bulls generally have the same results using ML or AE. In comparison, RF classified as fit 92.6% (1008/1088) and unfit 77.7% (522/672). For animals classified as doubtful, the results of the ML matched those of the AE in only 72.3% (396/548). Thus, 83.4% (1926/2308) of the bulls generally have the same results using ML or AE. Finally, NN classified as fit 89.7% (976/1088) and unfit 80.1% (538/672). For animals classified as questionable, the results of the ML matched those of the AE is also 72.1% (395/548), this time, in general, 82.7% (1909/2308) of the bulls have the

same results using ML or AE. We concluded that ML can be used to assist andrologists in classifying the results of AE. Further studies could increase the accuracy and even determine which features best represent the classes in the final classification using ML.

Keywords: andrological exams, gradient boosting, natural breeding, neural network, orange data mining, random forest.