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A computer vision based automatic system for egg grading and defect detection in cage-free facilities

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Egg defects can decrease food quality and market value of laying hen production, especially in cage-free houses where have more or less floor eggs. Automatic grading and defect detection have been developed using machine vision and image processing technology. Egg weight is also an important aspect of egg quality and market value, with automated egg measurement systems being developed to improve efficiency and accuracy. Previous studies primarily focused on using computer vision techniques for egg classification, but few have combined deep learning and machine vision techniques for joint egg classification and weighting. To address this gap, a two-stage model was developed based on real-time multitask detection (RTMDet) and random forest networks for predicting egg category and weight. The model uses deep learning and machine learning techniques to perform joint egg classification and weighing. RTMDet was used to extract egg features for classification, and a Random Forest algorithm is used to regress egg weight data based on the extracted features. The results of the study showed that the best accuracy achieved was 94.8% and best R^2 is 96.0%. In addition, the model can be used to automatically exclude non-standard size eggs and eggs with exterior issues (e.g., cacium deposit, stains, and cracks) . This detector is among the first models that perform the joint function of egg sorting and weighing. By implementing the findings of this study, the poultry industry can reduce costs and increase productivity, ultimately leading to better quality products for consumers.

Key words: Cage-free system; egg classfication; egg weight; deep learning; machine learning