A computer vision based automatic system for egg grading and defect detection

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1. Introduction

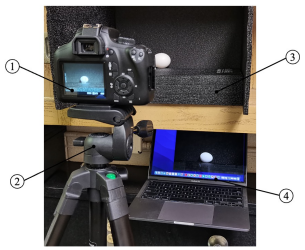
Egg production is a valuable industry, but defects during production can result in significant financial losses for producers. Traditional egg grading and defect detection methods are often inefficient and inaccurate for large-scale production. Advancements in deep learning and supervised machine learning techniques offer promising solutions for egg grading and weight measurement.

This study aims to develop an automatic system for joint egg classification and weight measurement that meets the evolving demands of the industry.

Figure 1. A defect egg.

2. Data Description

Egg Data = Classification + Weights



(a)

(b)

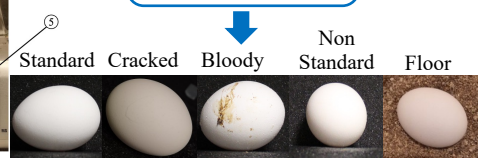
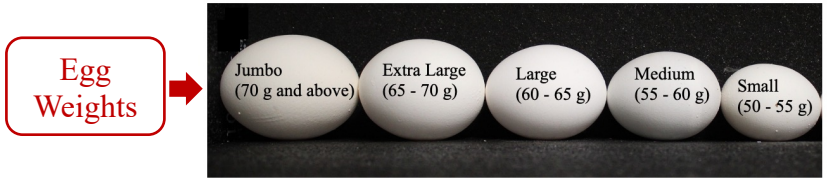


Figure 2. The egg samples acquisition system for classifying eggs (a) and weighting eggs (b): (1) camera; (2) tripod; (3) egg base; (4) computer; (5) digital scale.



3. Methodology

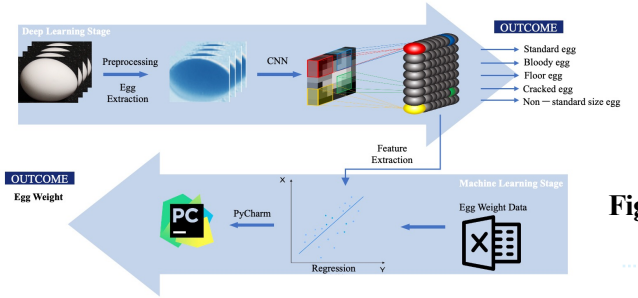
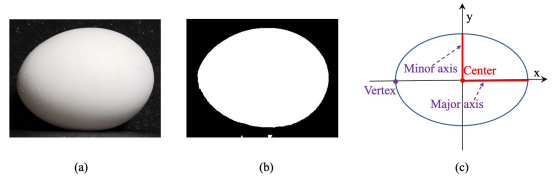


Figure 3. A streamlined approach to egg quality classification using computer vision.

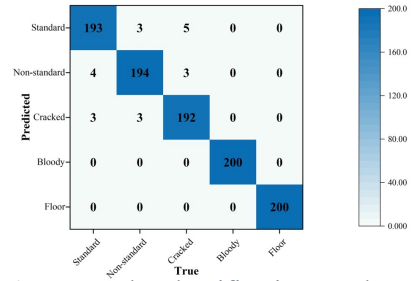


(a) (b) (c)

Figure 4. The process of calculating egg parameters: (a) original image; (b) binary image; (c) geometric image.

[Training set]: 1680 pics **[validation set]:** 420 pics

4. Results



- Classification accuracy is 94.80%.
- Floor and bloody eggs have
- Misunderstanding classification between other types.

Figure 5. The classification results using CNN.

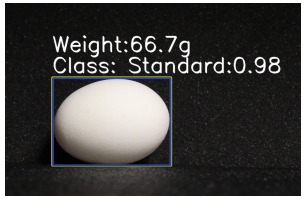
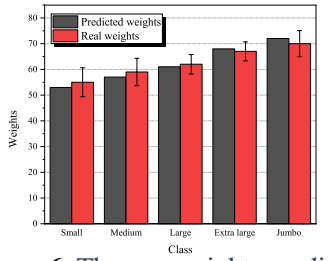


Figure 7. Two-stage detection results.



- Correlative coefficient is 96.00%.
- Better prediction performance in large and extra large eggs.

Figure 6. The egg weights prediction results using RF.

5. Conclusions

- ❑ A two-stage model was developed based on CNN and random forest networks for predicting egg category and weight.
- ❑ Results show that the best classification accuracy is 94.80% and a 96.0% R^2 regression model.
- ❑ The model can be installed on the egg collect robot to sort eggs in advance and collect our target eggs specifically.

[Acknowledgements]