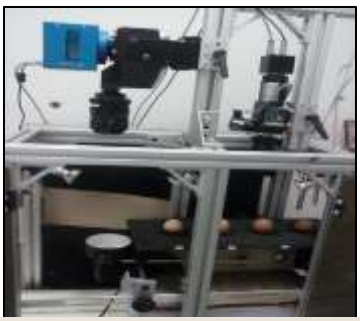

NON-DESTRUCTIVE ASSESSMENT OF CHICKEN EGG FERTILITY USING HYPERSPECTRAL IMAGING TECHNIQUE

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Abstract

The hatchery industries are faced with huge economic losses in millions of dollars, resulting from incubating non-fertile eggs that will never become chickens. There is therefore an urgent need for non-destructive techniques to predict the fertility and/or hatchability of chicken eggs prior to incubation. This study investigated the use of a near infrared (NIR) hyperspectral imaging technology in a non-destructive assessment of chicken egg fertility. Brown and white fertile eggs were obtained from a commercial hatchery. Hyperspectral data were collected over incubation periods of days 0 to 3 in the NIR wavelength regions of 900 – 1700 nm. Regions of interest were segmented out from each acquired hypercube image and mean spectra information were computed. Mean spectra information were then analysed using data mining, chemometric and machine learning tools. Models developed were validated and verified using cross-validation, permutation testing and hold-out data set verification. Our concluding results showed that the SMOTE data mining algorithm was adequate in lifting models' performance. With sensitivity = 92.10%, specificity = 80.50%, precision = 99.10%, F1-score = 95.40%, and AUC = 91.70%, our model structure was considered stable and ready for preliminary industrial testing, having been verified using independent and non-synthetic imbalanced data. Of all machine learning classification algorithms considered, KNN classifier was found preferrable in exposing chicken egg fertility data structure to learning, and was presented as appropriate towards building an industrial online classification system for chicken eggs.

About the Candidate

Adeyemi Olutoyin Adegbenjo is a native of Igangan, Nigeria and holds both B.Sc. and M.Sc. degrees in Agricultural Engineering. He joined the Hyperspectral Imaging Lab of McGill in 2013 under the supervision of Dr. Michael Ngadi. He was among the McGill team members that won the 2018 Food Security Social Innovation Challenge (SIC) Award by World Vision Canada.