Hunger classification of *Lates calcarifer* by means of an automated feeder and image processing

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ABSTRACT

In an automated demand feeder system, underlining the parameters that contribute to fish hunger is crucial in order to facilitate an optimised food allocation to the fish. The present investigation is carried out to classify the hunger state of *Lates calcarifer.* A video surveillance technique is employed for data collection. The video was taken throughout the daytime, and the fish were fed through an automated feeding system. It was demonstrated through this investigation that the use of such automated system does contribute towards a higher specific growth rate percentage of body weight as well as the total length by approximately 26.00% and 15.00%, respectively against the conventional time-based method. Sixteen features were feature engineered from the raw dataset into window sizes ranging from 0.5 min, 1.0 min, 1.5 min and 2.0 min, respectively coupled with the mean, maximum, minimum and variance for each of the distinctive temporal window sizes. In addition, the extracted features were analysed through Principal Component Analysis (PCA) for dimensionality reduction as well as PCA with varimax rotation. The data were then classified using a Support Vector Machine (SVM), *k*-Nearest Neighbor (*k*-NN) and Random Forest Tree models. It was demonstrated that the varimax based PCA yielded the highest classification accuracy with eight identified features. The prediction results based of the developed *k*-NN model on the selected features on the test data exhibited a classification rate of 96.5% was achieved suggesting that the features examined are non-trivial in classifying the fish hunger behaviour.

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