AARHUS UNIVERSITY
BIOINFORMATICS RESEARCH CENTRE (BIRC)

Master's Thesis in Bioinformatics in collaboration with Scio⁺

Implementing Deep Learning Models and Optimization Techniques for Image-Based Weighing of Poultry

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Abstract

A most critical metric in poultry livestock farming is the daily average flock weight, which can be indicative of various health issues while also informing feed scheduling and market readiness. It has traditionally been estimated through labor-intensive manual weighing. This process is what the data science company Scio⁺ seeks to automate for grand-parent broiler breeder chickens, throughout their rearing period in a live farm setting, by applying image-based technologies and machine learning with data from ceiling-mounted digital cameras. Using the semantic segmentation and weight prediction dataset generation pipelines already employed by that firm as a springboard, this project implements and presents a variety of optimization techniques for the segmentation model and a newfangled deep learning regression pipeline that makes weight predictions based on image inputs. This takes the form of exploring hyperparameters and performance for both the segmentation models and weight regressors, while also examining the segmentation training data and the weight recordings produced by the farm's automatic electronic scales that are used in conjunction with pictures to train the weight regressors. By joint use of the segmentation and regression models, predictions of the daily average flock weight can be made using only visual inputs, which leads to a performance of 11.3% mean absolute percentage error when compared to the estimates produced via the manual weighing conducted weekly at the farm, and this number is lowered to just 4.2% if only predicting for the weeks in the middle of the twenty weeks rearing period. The results showcase the promising potential of the approach but also cements that further improvements are necessary before this solution can replace manual procurement.

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