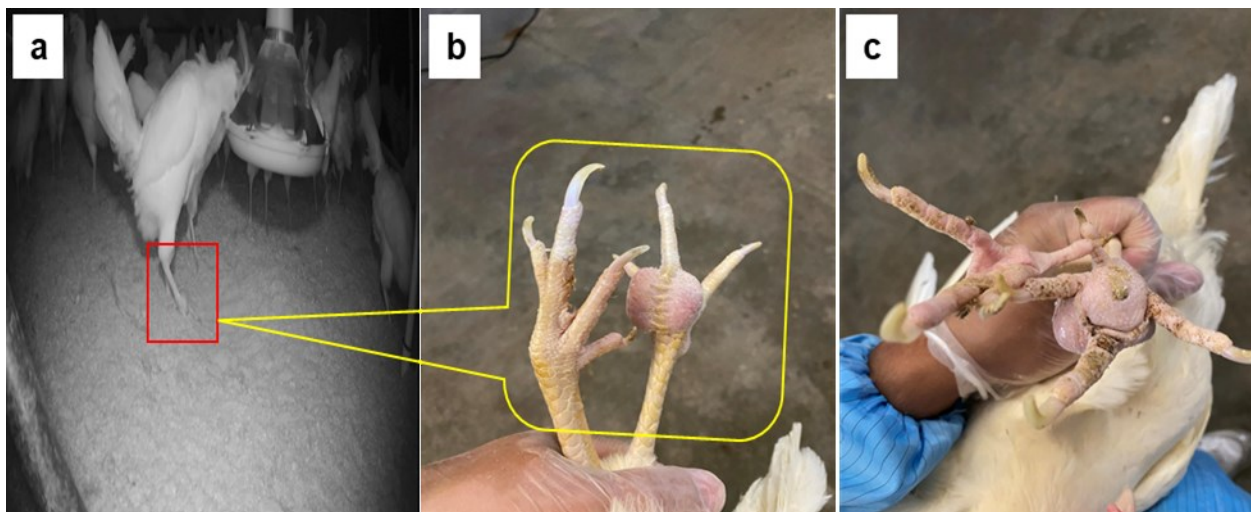


## Tracking Poultry Bumblefoot Issues with Deep Learning

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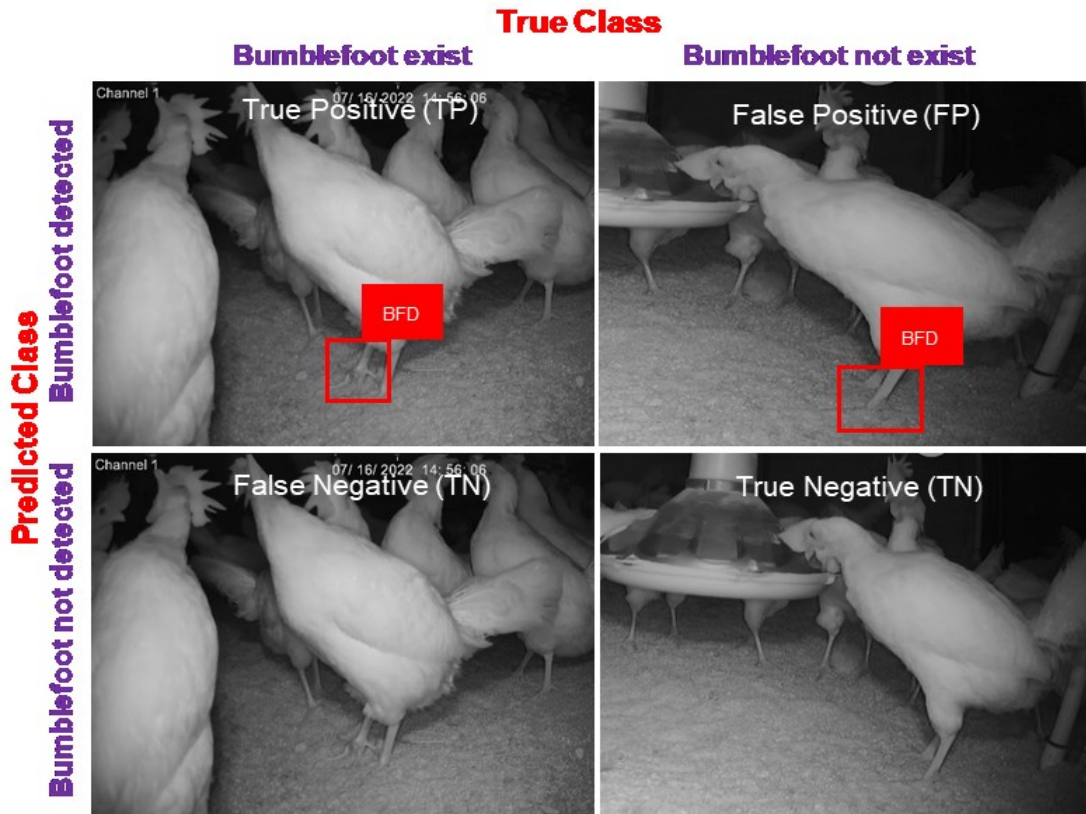
Bumblefoot (pododermatitis, footpad dermatitis, or foot rot) is the term used to describe a common bacterial infection and chronic inflammatory reaction in a chicken. It is clinically characterized by swelling, abrasion, hyperkeratosis, and ulceration of the digital pad, planta metatarsal region, or both. Bumblefoot compromises the foot's internal tissues, including the mesoderm, tendons, and bones, leading to laminitis (inflammation and damage that affects feet and can lead to lameness), synovitis (acute to chronic systematic disease caused by *Mycoplasma synoviae* infection), osteomyelitis (an inflammatory condition leading to infection of the bone), and ultimately death if left untreated. Cage-free hens and breeders spend a lifespan of 60-80 weeks or longer on litter floor, which may lead to bumblefoot under poor bedding quality (Figure 1).



**Figure 1.** Cage-free laying hen having bumblefoot from a) side view, b) top view, and c) bottom view of the hen's foot.

To address bumblefoot detection challenges, researchers at the University of Georgia

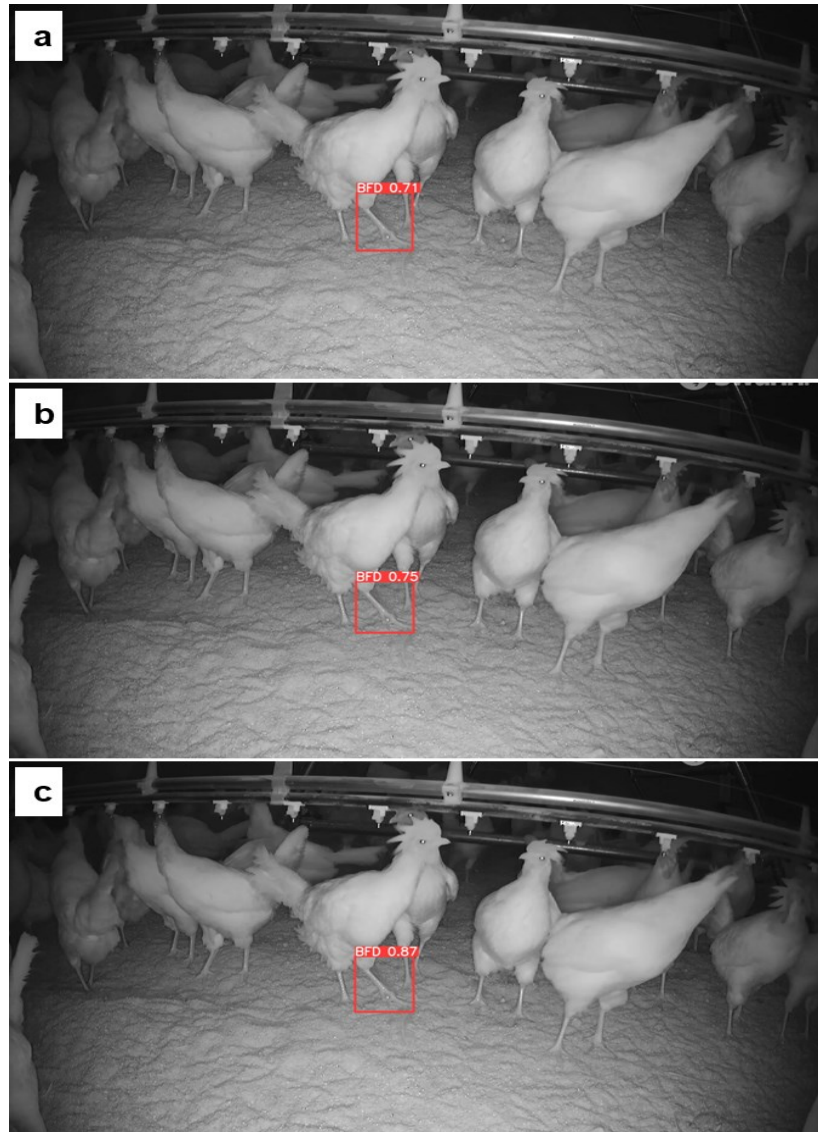
developed and tested artificial intelligence methods (i.e., deep learning models) to track chickens' bumblefoot condition automatically (Figure 2) in a cage-free environment under various settings such as epochs (number of times the entire dataset passes through the network during training), batch size (number of data samples processed per iteration during training), and camera height.



**Figure 2.** Confusion matrix for bumblefoot detection model. The figure with rectangular box represents the legs were detected with the bumblefoot. BFD-bumblefoot detection.

The performance of three newly developed deep learning models (i.e., YOLOv5s-BFD, YOLOv5m-BFD, & YOLOv5x-BFD) were compared (Figure 3) in detecting hens with bumblefoot of hens in CF environments. The result shows that the YOLOv5m-BFD model had the highest precision (93.7%), recall (84.6%), mAP@0.50 (90.9%), mAP@0.50:0.95 (51.8%), and F1-score (89.0%) compared with other models. The observed YOLOv5m-BFD model trained at 400 epochs and batch size 16 is recommended for bumblefoot detection in laying hens. This study

provides a basis for developing an automatic bumblefoot detection system in commercial CF houses. This model will be modified and trained to detect the occurrence of broilers with bumblefoot in the future.



**Figure 3.** The bumblefoot detection results of a) YOLOv5x-BFD, b) YOLOv5s-BFD, and c) YOLOv5m-BFD. The figure with rectangular box represents the legs were detected with the bumblefoot. BFD-bumblefoot detection.

Further reading:

Bist, R. B., Yang, X., Subedi, S., & Chai, L. (2024). Automatic detection of bumblefoot in cage-free hens using computer vision technologies. *Poultry Science*, 103(7), 103780.