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Automated Lameness Detection in Sheep Using Wearable Sensors and Machine Learning

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ABSTRACT

Lameness is a critical issue that impacts the welfare and productivity of livestock, resulting in diminished weight gain, fertility issues, and an increased susceptibility to secondary diseases. Conventional detection methods frequently fail to identify early signs due to their dependence on labour-intensive visual assessments. This study examines the use of tri-axial inertial measurements units affixed to neck collars in a sensor-based approach to objectively detect lameness in sheep. Time and frequency domain feature extraction techniques were employed to analyse data collected from livestock in Eastern and Central Macedonia, Greece, which were segmented into 2-second behaviour windows. Feature selection was performed using ReliefF to identify the most informative gyroscope and accelerometer features.

Two machine learning models, Least Squares Support Vector Machine (LS-SVM) and Multiclass Random Forest (MRF), were used to classify lameness severity into three levels: healthy, mildly limp, and severely lame. The MRF model achieved a superior accuracy of over 83%, while both models exhibited good classification performance. The efficacy of integrating ubiquitous sensor data with machine learning techniques for the automated detection of lameness in sheep is underscored by these findings. This method improves animal health and farm management practices by reducing reliance on subjective evaluation and enhancing early intervention strategies.

Keywords: Lameness detection; machine learning; accelerometer sensors, Multiclass Random Forest, Least Squares Support Vector Machine