Automatic Classification of Eating and Ruminating in Cattle Using Accelerometer Signatures

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Within the past ten years, methods for automating the process of monitoring the behaviour of cattle have become increasingly important. Within the UK, there has been a steady decline in the number of milk producers since 1970 and increasing commercial pressures have forced consolidation within dairy farming. As a result the average farm size has grown from around 90 to 160 cows. A direct consequence of these trends is that that farmers have less time to observe their herd and are increasingly reliant on technology to undertake this function. This is underlined with the growth in oestrus or 'heat' detection collars to assist in the optimisation of fertility services. Here we report on the analysis of signatures obtained from an accelerometer based collar (Silent Herdsman) to identify both eating and rumination signatures. A combination of frequency and statistical analysis has enabled these signatures to be identified. A range of post processing methods have been evaluated in order to identify the most appropriate one for integration within a low power processor in order to recover eating and rumination signatures reliably. We report here on the performance of a range of methods including Gaussian Mixture Models combined with Mahalnobis distance metric, and K-Means methodologies using Euclidian and Taxi-Cab distance estimation methods and a Hidden Markov Model. Trials have been carried out using a Rumiwatch rumination sensing halter to provide verification data. Analysis of this data over a period of several days, on a minute by minute basis has shown that it is possible to recover eating and rumination with sensitivities and positive predictive value greater than 85%.

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