Session 33 Theatre 5

Real-time collection and visualisation of methane emission on dairy farms: new challenges

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The Dutch government has set an objective to reduce emissions of greenhouse gases (GHG) to 116 Mton CO_2-equivalent in 2030. All sectors have to participate in this reduction, including the livestock sector. A significant contributor to the GHG emissions in the Netherlands is the dairy sector. By making the CH_4 (methane) emission measurements directly available to the dairy farmer, the farmer gets insight in the CH_4 emission of his farm, and can employ different strategies customised to his farm. This will contribute to the reduction of the GHG emissions. To achieve this continuously monitoring of GHG emissions, we have built an infrastructure and this is currently implemented on 17 commercial dairy farms. This infrastructure offers the opportunity to quickly identify issues around the data collection due to for example technical failure of the sensor. We also connected these private CH_4 data with outdoor temperature and wind speed, through API connections with Akkerweb. Data streams are visualised on a web or mobile phone platform, providing real-time information to the farmer. The next challenge is to add individual cow data. To do so, we have performed a feasibility study investigating the use of computer vision for the automatically identification of cows near the CH_4 sensor. This is done by using a camera to capture images of the cows in the milk robot where the CH_4 sensor is located. The video footage is first passed through a blob detection algorithm to select regions of interest, in this case the yellow ear tag of the cow. The regions of interest will then be passed through an optical character recognition algorithm trained to recognise numbers. Both these analyses will be done locally on a Raspberry Pi. The extracted cow identifier number from the optical character recognition model will then be passed on to the Arduino. The Arduino will push this data together with the collected CH_4 measurements to the cloud. This data will flowback to the application platform, where it can provide more detailed information for the farmers by tagging the animal identifier to the CH_4 measurements during milking.

Session 33 Theatre 6

A systematic approach to quantify the impact of feeding and farm management on bovine health

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Digitalisation in dairy cattle farming holds the promise of substantially improving early detection and prevention of animal disease, in particular through the collection, linkage, and analysis of routine data generated by milking, feeding, and performance recording systems. However, the identification of risk factors from such routine data is complicated by the fact that most frequent diseases are caused by multiple risk factors with strong mutual correlations. Here, we present a systematic framework to disentangle the impacts of feeding and farm management practices on frequent diseases to derive risk profiles for farms. Based on data from 167 Austrian farms and 6,519 cows, we quantify the predictive accuracy of approx. 200 different variables for feeding, housing, bedding and farm management practices in the prediction of diseases by means of multivariate regression models. Individual risk factors can explain up to 60% in the observed variation of disease occurrences, after adjusting for lactation, season, breed, region, and overall farm performance. Regarding feeding practices, we find for instance that intake of grass silage was predictive of strongly reduced risks for ovarian cysts ([OR] 0.39, 95% confidence interval [CI] 0.31-0.50), ketosis (OR 0.42, CI 0.27-0.67) and milk fever (OR 0.69, CI 0.55-0.88); Hay intake showed reduced risk of lameness while concentrated feed intake (OR 15, CI 9.3-24) and maize silages (OR 8.7, CI 6.7-11) showed increased risk. Further, ketosis was strongly reduced in farms with alpine pasturing of heifers (OR 0.28, CI 0.18-0.43) and with long straw litter pens (OR 0.46, CI 0.33-0.64). Lameness increased in farms without alpine pasturing (OR 4.6, CI 3.4-6.2) and with high bed cubicles (OR 3.2, CI 2.8-3.7) whereas low bed cubicles correlate with decreased lameness (OR 0.44, CI 0.40-0.50). A principal component analysis reveals that farms can be grouped into three clusters. We discuss the highly heterogeneous disease risk profiles in these farm clusters and their associated management practices. Farms of the 21st century are becoming digitally integrated sensing systems. We show how the information derived from such systems can be used to increase animal welfare by identifying those management practices whose adoption might lead to the greatest disease risk reductions.