ORAL

Technical Session 12

M Part 1: From Guidelines to the Barn: Implementing section 2 of ICAR's Milk Recording Guidelines – Updates and Lessons from the Field

Part 2: Buffalo DHI recording

A flexible non-parametric approach to assessing dairy cow performance

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A key data-driven insight supporting farm decision-making is the ability to compare milk-yield performance across individual cows within a herd. To derive meaningful performance measures, milk yield must be adjusted for systematic influences such as age at calving, calving season, lactation stage, and herd-level effects. However, even in large milk-recording datasets, stratifying by these variables often creates pockets of sparse data, making it difficult to derive robust and accurate adjustments across all stratifications. This research aims to develop a flexible, scalable framework that can model lactation curves reliably across both densely and sparsely observed stratifications.

To achieve this, we apply a stochastic variational Gaussian process (SVGP). A SVGP learns underlying lactation curve structure from data-rich regions and balances these with observed data to produce stable predictions in sparsely observed regions. This Bayesian trade-off between data fit and prior patterns generates smooth, biologically grounded lactation curves across all stratifications, supporting fair and interpretable cow-level comparisons. We trained the SVGP on approximately 16 million test-day milk yield records collected over three years from dairy herds across the Netherlands. All the records contained information about age at calving, calving season, lactation stage, and herd-level management metrics. These systematic variables were included as covariates. Model performance was assessed through predictive accuracy on held-out records and by inspecting the stability of this accuracy across regions with varying degrees of data density. We also inspected fitted curves across ages, seasons, and herd-level metrics to verify smoothness, biological plausibility, and stability in data-sparse regions.

The SVGP generated smooth, biologically consistent lactation curves and delivered stable estimates across stratifications with differing levels of data density. The SVGP scales efficiently to large-scale milk-recording datasets and provides a strong foundation for fairly adjusting milk yields.