Drinking Behavior Patterns in Dairy Cattle

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Abstract

This project investigates the consistent individual differences in drinking behavior of cows, as well as the relationship between frequency and duration of visits and water intake.

1 Introduction

Ad libitum access to water is critical for dairy cattle welfare and production. The environment of dairy farms must support this. However, it is not enough to decide about the efficiency of a system based on the herd level drinking behaviour. This is because cows are different in their drinking behaviour, and they respond differently to changes in feed, environment and social grouping [1]. For more efficient recommendations on housing, individuals' differences should be taken into account. But our knowledge about the drinking behaviour of the individuals and how their water intake and behaviour are affected by their housing systems is limited [2]. Whereas, this information is necessary for better housing and management decisions in dairy farms.

Luckily, increased use of technology on dairy farms can provide high-resolution data and help better explore individuals. InsenTec system, for example, is a system for monitoring the feeding and drinking behaviour of the group-housed cows [3]. Figure 1 shows how this system looks. In a longitudinal study conducted at the UBC Dairy Education and Research Centre, a pen of 48 lactating Holstein cows, with access to 24 feed bins and four water bins, were studied for ten months. By Exploring the dataset collected from the InsenTec system during that study, we aim to investigate the consistent individual differences in the drinking behaviour of cows, as well as the relationship between frequency and duration of visits and water intake. We will explore this dataset for the first time, and for further analysis, a better understanding of the dataset is required. For this purpose, we will use visualization tools.

This project is closely related to my research and master's project as I am a research assistant at UBC Dairy Education and Research Centre and my main focus is on automated monitoring of resource usage.

Figure 1: An InsenTec bin

2 Related Work

The analysis of dairy cow feeding and drinking behaviour has mainly been statistically [4, 5]. Specially about the drinking behaviour the existing analysis is very limited.

3 Data and Task Abstraction

The InsenTec system stores all the information regarding each visit to the bins that is described in Figure 2.

Cow ID	Bin Number	Time	Duration	Intake
Categorical	Categorical	Ordinal	Quantitative	Quantitative

Figure 2: Raw Data

Throughout the trial the group composition has not been the same and accordingly the dataset includes the information of more than 48 individuals (n=67) in different periods of time (less than 10 months). Average daily visit count is 700 which is equal to an overall of approximately 210,000 visits.

By visualisation of this data, we aim to answer some questions including:

1. Are there any relationships between duration of visits and intake amount among all visits?
2. How do individuals differ in their visits and daily drinking behaviour?
3. What stays the same for individuals throughout the time (if any)? What is the best scale to represent an individuals drinking behaviour?
4. Are there clusters that are close to each other in their drinking behaviour? or in some aspects of that?

5. How does the time of the day and the time of the year affect the visits/daily behaviours?

4 Solutions

An interactive dashboard where the users can select to look at different individuals up to group level. The user can select to look at the data on visit scale and daily scale in different time intervals, for the selected cows. The user would be able to add/remove attributes. Different time intervals can be chosen to observe. Preferably, we would have clustering options based on different combinations of attributes.
The visits can be represented as rectangles on a timeline based on the time and duration, and the area of the rectangle represents the amount of intake (the width). Also, the amount of intake can be coded by saturation and, the hue channel can be used for different cows. Figure 3 shows some of the ideas. I don't exactly know how to represent the daily drinking behaviour but the most straightforward is to use the number of visits per day, total intake, and total duration, but we'll lose some information by using this data abstraction.
The main tool for the project will be Python.

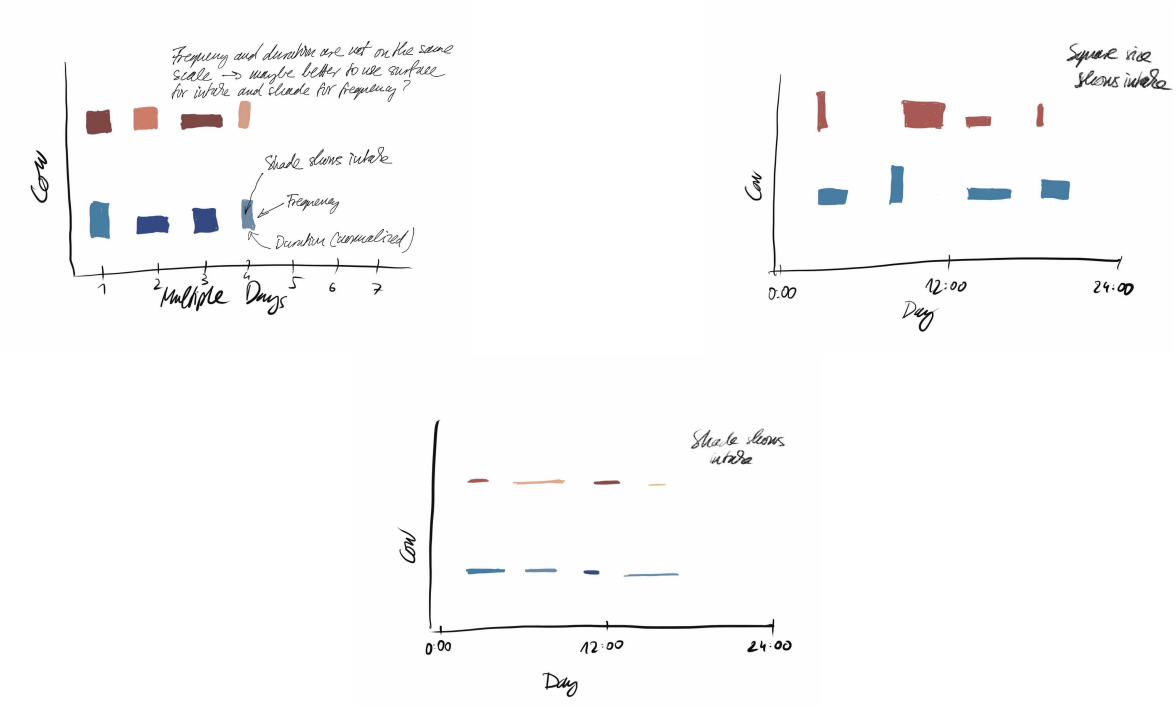

Figure 3: Ideas for Marks and Channels

5 Milestones

6 Discussion

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