

Problem Statement and Goals

ProgName

Team #, Team Name
Student 1 name
Student 2 name
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Table 1: Revision History

Date	Developer(s)	Change
Date1	Name(s)	Description of changes
Date2	Name(s)	Description of changes
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1 Problem Statement

1.1 Problem

Dairy farmers face significant challenges in managing the health, productivity, and breeding outcomes of their herds. Traditionally, these issues are managed reactively, with farmers responding to problems such as health declines, breeding failures, or unexpected herd turnover after they occur. This reactive approach leads to inefficiencies, financial losses, and reduced herd performance. Our project, in collaboration with CATTLEytics Inc., aims to address these challenges by implementing a machine learning (ML) model capable of predicting breeding success rates and the likelihood of animals leaving the herd based on historical data. This model will help farmers transition from reactive to proactive herd management, improving overall farm productivity and decision-making. The model will integrate with CATTLEytics Inc.'s existing systems, allowing seamless adoption by farmers.

1.2 Inputs and Outputs

Inputs

The software will use historical herd data related to health, productivity, and breeding outcomes. This data may include metrics such as individual animal health records, breeding attempts, and farm-specific environmental conditions. The input data will be fed into a machine learning model to generate predictions.

Outputs

The output will consist of predictive insights aimed at improving farm management. These will include:

1. Predictions about the success of breeding attempts for individual animals.
2. The likelihood of an animal leaving the herd.
3. Alerts about potential health issues or productivity declines.

The software will provide clear, actionable outputs to guide decision-making, presented in a format easily interpretable by farmers and other stakeholders.

1.3 Stakeholders

1. **Farmers:** The primary users of the software, who will benefit from improved herd management and decision-making.
2. **CATTLEytics Inc.:** The company that will deploy the software to its customers and provide ongoing support.
3. **Animal Health Experts:** Professionals who may use the software to provide advice to farmers based on the predictive insights generated.
4. **Regulatory Bodies:** Organizations that may use the software to monitor herd health and productivity.
5. **Dairy Production Companies:** Organizations that may use the software to optimize their supply chain and production processes.

1.4 Environment

Hardware

The software will be deployed in farm management systems typically used on standard personal computers or servers. These systems may also interact with IoT devices used for real-time data collection on farms.

Software

The model will be integrated into CATTLEytics Inc.'s farm management platform, leveraging their existing infrastructure. It will seamlessly integrate into the farmers' existing workflow, ensuring compatibility with the tools and systems they are already using.

2 Product Goals

Goal	Importance
The model accurately predicts breeding success rates for individual cows.	The accuracy of predictions can be measured by comparing the predicted success rates with actual outcomes over a defined period (e.g., a breeding cycle). A target accuracy rate, such as 80-90%, can be established to define success.
The model provides predictions on the likelihood of an animal leaving the herd.	This can be measured by tracking the model's predictions against actual herd turnover rates. A success threshold (e.g., 75% accuracy or better) for predicting cows that will leave the herd within a specified time frame can be set.
The system integrates seamlessly into CAT-TLEytics Inc.'s existing platform.	Success can be measured by the time taken to complete the integration and the absence of major system disruptions post-integration (e.g., within a 1-month test period, there should be less than 1% downtime or user-reported issues).
The system offers user-friendly, actionable insights for farmers.	User-friendliness can be measured through user feedback surveys post-implementation, focusing on ease of use and clarity of insights. A target of 80% or more of users rating the insights as "clear" or "actionable" can be set as a measurable goal.

3 Stretch Goals

Goal	Importance
The model processes real-time data to provide up-to-date predictions.	Real-time predictions allow farmers to respond quickly to changes in herd dynamics, preventing potential issues.
The system includes a feature for predicting long-term health trends of individual cows.	This would enable farmers to anticipate health problems and intervene early, leading to better animal welfare and reduced veterinary costs.
The model can be customized for different farm sizes and breeds.	Customization increases the model's marketability, allowing it to be adapted to various farm environments and specific herd characteristics.
The system offers encrypted data storage and transmission to ensure data security.	Data security is crucial for farmers and companies that handle sensitive herd information. This feature increases trust and protects data integrity.

4 Challenge Level and Extras

[State your expected challenge level (advanced, general or basic). The challenge can come through the required domain knowledge, the implementation or something else. Usually the greater the novelty of a project the greater its challenge level. You should include your rationale for the selected level. Approval of the level will be part of the discussion with the instructor for approving the project. The challenge level, with the approval (or request) of the instructor, can be modified over the course of the term. —SS]

[Teams may wish to include extras as either potential bonus grades, or to make up for a less advanced challenge level. Potential extras include usability testing, code walkthroughs, user documentation, formal proof, GenderMag personas, Design Thinking, etc. Normally the maximum number of extras will be two. Approval of the extras will be part of the discussion with the instructor for approving the project. The extras, with the approval (or request) of the instructor, can be modified over the course of the term. —SS]

Appendix — Reflection

[Not required for CAS 741 —SS]

The purpose of reflection questions is to give you a chance to assess your own learning and that of your group as a whole, and to find ways to improve in the future. Reflection is an important part of the learning process. Reflection is also an essential component of a successful software development process.

Reflections are most interesting and useful when they're honest, even if the stories they tell are imperfect. You will be marked based on your depth of thought and analysis, and not based on the content of the reflections themselves. Thus, for full marks we encourage you to answer openly and honestly and to avoid simply writing "what you think the evaluator wants to hear."

Please answer the following questions. Some questions can be answered on the team level, but where appropriate, each team member should write their own response:

1. What went well while writing this deliverable?
2. What pain points did you experience during this deliverable, and how did you resolve them?
3. How did you and your team adjust the scope of your goals to ensure they are suitable for a Capstone project (not overly ambitious but also of appropriate complexity for a senior design project)?