WHEN TO SELL CATTLE?

Each day cattle farmers throughout South Africa must make vital operational decisions that have consequences on the national food supply. The most important of these questions is "when do we sell an animal ?".

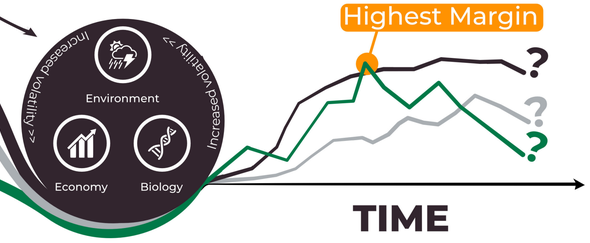
Animal value is the mass of an animal (kg) multiplied by its market value (ZAR/kg) at a certain time. The feed cost is the total mass of feed consumed multiplied by the value of the feed at the time is was consumed.

+ ANIMAL VALUE

- FEED COST

MARGIN

Both the value of an animal and the cost to feed it increases each day. The rates of profit gain and cost accrual are governed by biological, environmental and economic factors. The margin for each animal is at the mercy of these elements. To ensure long term profitability the optimal margin must be achieved amidst the uncertainty.



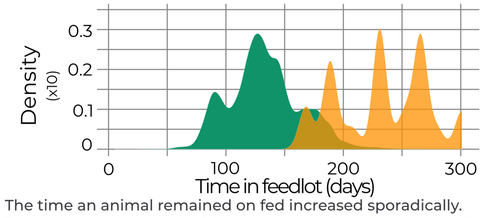
To **maximise profitability**, commercial feedloters must sell animals at their highest margin. However, feedlotters do not know **when** the highest margin will occur. How?

FIND THE OPTIMAL MARGIN

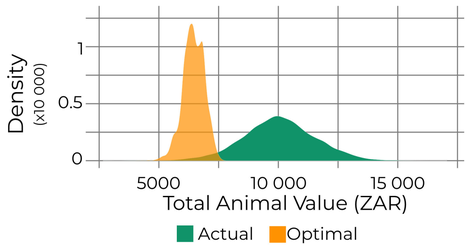
Two approaches were developed and compared to determine which could best predict when an animal would reach its optimal margin.

Results

The forecast perspective was largely unsuccessful due to the errors generated during the forecasting of each driver. Large scale volatility increased the noise within the time series and external forces created many confounding variables.

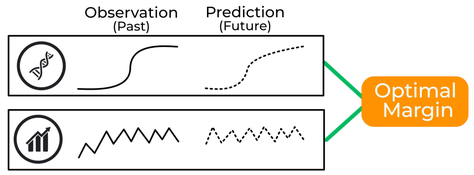


The time an animal remained on fed increased sporadically. The multi-modal nature of how long an animal stays on feed provides an impractical solution as the farmer would have to micro-manage cattle.



Forecast Perspective

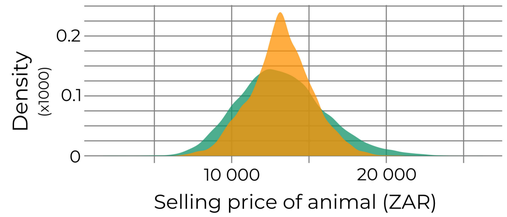
The forecast perspective predicts the core drivers of an animal's margin; the feed requirement and animal value. The future value of each driver is then combined to determine the margin.



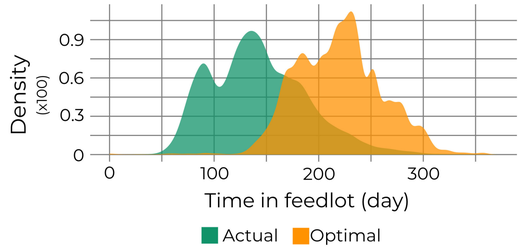
A Random Forest Machine learning algorithm was grown from historical operations data to model the future growth of cattle, creating growth and feed requirement forecasts. These mass based forecasts were multiplied by future market prices of cattle and feed to return a ZAR equivalent. Multiple Linear Regression was used to forecast market prices. The cost and sales price difference returned an animal's margin throughout the year. The highest margin is selected and the corresponding date is the optimal time to sell an animal.

Results

The state perceptive achieved a similar level of profitability to that of the current state of practice. The variance in profit is decreased.

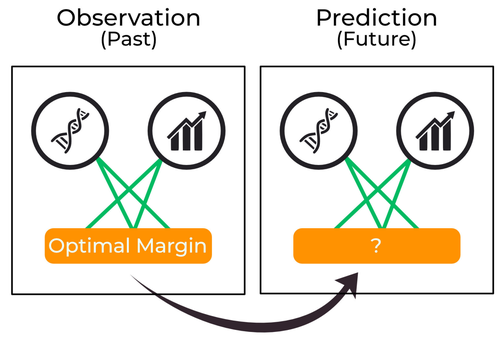


The time an animal remains in the feedlot has drastically increased. Increasing the days an animal remains on feed would impact on profitability and further analysis is required to ensure that the level of profitability previous mentioned can be attained.



State Perspective

The second evaluates past market conditions and learns when an optimal margin occurs based on the market's configuration.



A Random Forest Machine learning algorithm was grown from historical operations data to model the past growth of cattle, creating historical growth and feed requirement. The cattle mass and feed requirements were multiplied by their past market values to return a ZAR equivalent. The date at which the highest past margin occurred is used as a reference point to define the market's configuration during that time.

A second Random Forest is grown, predicting when the optimal market configuration will occur in the future thus returning the optimal date at which an animal should be sold.

Conclusion

The state based approached proved to be superior however, the model neglects the impact of fat accumulation over time in cattle which would lower their market price the longer they are fed. Other considerations such as increased labour costs, increased risk of illness and market volatility are also time dependent and can greatly impact on profitability.
Thus, at its current stage of development the decision support tool is not yet ready for implementation and requires further development using the state based approach.

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