**ANSC 689**

**Observations on Data Visualization Analysis in Decision Science**

**Abstract** This study presents a detailed visualization analysis of a dataset related to decision science, focusing on the relationships among wild temperament, temperature, humidity, stocking density, diet management, and Sub-Acute Ruminal Acidosis (SAARA) status in beef cattle. Using multiple visualization techniques, we explore patterns, correlations, and distributions that provide insights into SAARA's impact on cattle behavior and management. Key findings suggest distinct behavioral trends associated with environmental factors, which can aid in predictive modeling, early diagnosis, and decision-making strategies for managing SAARA in cattle.

**1. Introduction** Data visualization plays a crucial role in understanding complex datasets by highlighting patterns and relationships that may not be immediately apparent. This study employs various graphical techniques to analyze a dataset containing information on wild temperament, temperature, humidity, stocking density, diet transmission, and SAARA status. The objective is to extract meaningful insights that can inform clinical decisions, disease management, and preventive strategies for cattle affected by SAARA.

**2. Methods** A structured approach was employed to generate and analyze visualizations. The dataset was preprocessed to handle missing values and ensure consistency. The following visualization techniques were used:

* **Bar plots** to compare categorical distributions related to SAARA status.
* **Scatter plots** to assess bivariate relationships in cattle feeding and environmental conditions.
* **Pie charts** to visualize categorical proportions of grain type and SAARA occurrence.
* **Box and violin plots** to examine distribution variations.
* **Histograms** to assess humidity patterns.
* **Regression plots** to model linear relationships in stocking density and temperature.

**3. Results**

**3.1. Bar Plot: Average Wild Temperament by SAARA Status** This plot shows the variation in wild temperament based on SAARA status. Higher wild temperament scores were observed in SAARA-affected cattle, indicating increased restlessness and possible discomfort due to metabolic imbalances (Plaizier et al., 2008).

A graph with blue squares

Description automatically generated

**3.2. Scatter Plot: Wild Temperament vs. Temperature** A moderate correlation was noted, where higher temperatures were associated with increased wild temperament. This suggests that heat stress may exacerbate behavioral instability in cattle suffering from SAARA (Spigarelli et al., 2020).

A graph of different colored dots

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**3.3. Pie Chart: Proportion of SAARA Status** The distribution of SAARA statuses was imbalanced, with a higher proportion of cattle classified as SAARA-positive. This highlights a pressing need for early interventions and improved management strategies (Nagaraja & Lechtenberg, 2007)

A blue and orange pie chart

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**3.4. Bar Plot: Distribution of Diet Transmission Management (Slow vs. Fast)** The diet transmission management approach significantly affects SAARA occurrence. Cattle fed at a faster rate exhibited higher SAARA prevalence, aligning with findings that rapid grain introduction increases ruminal acid load (Plaizier et al., 2008).

A diagram of a diet transition management

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**3.5. Bar Plot: Climatic Events Categorized by SAARA Presence** This visualization categorizes climatic conditions in relation to SAARA prevalence. Hot and humid conditions were linked to increased SAARA cases, reinforcing the role of environmental stressors (Nagaraja & Lechtenberg, 2007).

A graph of different colored bars

Description automatically generated

**3.6. Scatter Plot: Rumen Modifiers Usage vs. Feeding Frequency** The plot illustrates how feeding frequency interacts with the use of rumen modifiers like monensin and virginiamycin. Frequent feeding with these modifiers helps in SAARA mitigation by stabilizing ruminal pH.

A chart with colored dots

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**3.7. Regression Plot: Stocking Density vs. Temperature** The regression analysis suggests a link between higher stocking density and increased environmental temperature. Overcrowded conditions can heighten stress responses, indirectly worsening SAARA outcomes (Compiani, 2014).

A graph of a graph showing the difference between a temperature and a stocking density

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**3.8. Violin Plot: Stocking Density vs. Days on Concentrate Diet** Stocking density variations influenced the number of days on a concentrate diet. A longer concentrate feeding period correlated with increased SAARA risks, emphasizing the importance of controlled grain adaptation (Owens et al., 1998).

A graph of stocking density

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**3.9. Pie Chart: Proportion of Different Grain Types Fed to Cattle** This visualization highlights variations in grain types. Diets rich in highly fermentable grains like wheat and barley were more prevalent in SAARA-positive cattle, reinforcing the need for balanced ration formulation (Nagaraja & Lechtenberg, 2007).

A pie chart with different colored circles

Description automatically generated

**3.10. Histogram: Humidity Distribution in Percentages** Humidity patterns showed clustering at higher levels, suggesting that environmental moisture may be a contributing factor to SAARA incidence, likely through effects on heat stress and microbial activity (Spigarelli et al., 2020).

A graph of a distribution of humidity

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**3.11. Grouped Bar Plot: Rumen Modifiers (Virginomycin, Monensin) vs. SAARA Occurrence** This grouped bar plot demonstrates that cattle receiving rumen modifiers had a lower incidence of SAARA, highlighting their role in mitigating acidotic conditions (Nagaraja & Lechtenberg, 2007).

A graph with blue and orange squares

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**3.12. Plot: Grain Processing and Grain Types vs. SAARA Occurrence** The impact of grain processing methods on SAARA was evident. Finely ground grains led to higher SAARA incidence, whereas coarsely processed grains reduced the risk, supporting recommendations for optimizing grain particle size (Owens et al., 1998).

A close-up of a graph

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**4. Discussion** The visualization results highlight significant trends and interactions within the dataset. The observed correlations suggest environmental influences on temperament, which have direct implications for SAARA diagnosis and management. Specifically:

* Cattle with SAARA exhibit increased wild temperament scores, potentially due to discomfort or metabolic imbalances.
* Temperature and humidity interact with temperament, suggesting that environmental stressors may aggravate SAARA symptoms.
* The presence of distinct behavioral clusters suggests that cattle may respond differently to SAARA based on intrinsic and extrinsic factors.

**Clinical Implications:**

* **Diagnosis:** Increased temperament scores could serve as an early indicator of SAARA, enabling timely intervention.
* **Management:** Monitoring temperature and humidity levels can help predict high-risk periods, allowing for proactive feeding adjustments.
* **Recommendations:** Farmers should implement strategies such as modifying feeding regimens, providing adequate ventilation, and ensuring proper hydration to mitigate SAARA risks.

The imbalanced distribution of SAARA statuses in the dataset suggests that certain populations may be more susceptible, highlighting the need for targeted preventative measures.

**5. Conclusion** This analysis underscores the power of data visualization in uncovering hidden patterns related to SAARA in cattle. Future work should incorporate advanced statistical modeling and machine learning techniques to enhance predictive capabilities based on these findings. Further research is recommended to validate these insights through controlled experimental studies and real-time monitoring of cattle behavior.

**References**

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