Accurate prediction of broiler bird weight distributions using machine learning
MTech Protein: Scope

FARMS

HATCHERY

FINISHED FEED MILL

PROCESSING PLANT
M-Tech Systems
Data Science
M-Tech Data Science

Artificial Intelligence

Machine Learning

Artificial Neural Networks
Reinforcement Learning
K-Means
SVM
Deep Learning
Boosted Decision Trees
Ensembling

Breeder:
% Hatchability, % Saleability, % HE Production

Optimized Scheduling and Planning
- LHS – Live Haul Scheduling
- PPO – Production Planning
- BRPA – Broiler Planning
- BPA – Breeder Planning
- HPA – Hatchery Planning

Broiler:
Head Sold, Average Weight, Total Weight Sold, Feed Consumed, FCR, high condemnations
Predicting Weight Distributions
Two different methodologies

Two different approaches depending on the data we have:

1. Symmetric
2. Asymmetric (Skewed)
Symmetric

- Can be done at as early as age zero
- Gets more accurate if you have weights throughout the life of the flock (manual)
- Does not require our Sonar/Echo IoT solution – real-time weights from the house
- If no IoT solution in place, then historical weight distributions are required from the plant
Symmetric cont...

- We separately project head sold, mean weight, and standard deviation
  - Mean weight and standard deviation projections are used to build a symmetric **probability distribution**
  - We use the **probability distribution** to formulate the projected head sold samples making up the bell curve.
This is where it gets interesting...
IoT: Echo Data Acquisition Devices

Converting House Data into Actionable Intelligence

1. Connect and Collect
   - Deploy multiple wireless sensors to capture real-time data

2. Securely Transmit
   - Send information from the farm to the MTech Cloud

3. Analyze and Act
   - Access performance analytics and Machine Learning to improve your production
Unsupervised Learning – Bird Scales
Age 16

![Histogram and Scatter Plot](image.png)
Asymmetrical Bird Weight Bell Curve
Asymmetric

• Requires our (Sonar/Echo) IoT solution
• Predictions as early as age 14
• We use historical processing plant weight distributions to dramatically reduce implementation time (training time).
Asymmetric cont...

We separately predict head sold, mean weight, standard deviation, and skewness:

- We then combine these predictions.
- Mean weight, standard deviation, and skewness are used to generate a probability distribution function.
- Projected head sold samples are drawn from the probability distribution.
Results…
Results – Bird Weight Distribution

Bird Weight Distribution

Total Head Error: 1,527
Total Weight Error: 2,690 kg
Production Planning
Live to Processing

- Live Animal ML Predictions
  - Quantity
  - Weight
  - Uniformity

- Plant Capacity
  - Resources
  - Time

- Demand
  - Customer Orders/Revenue
  - Stock

- Optimization

- Production Schedule
  - Cases by SKU
  - By Products
  - Materials Required
  - Profitability
Reinforcement Learning
Production Planning
Live to Processing

- **Live Animal ML Predictions**
  - Quantity
  - Weight
  - Uniformity

- **Plant Capacity**
  - Resources
  - Time

- **Demand**
  - Customer Orders/Revenue
  - Stock

- **Optimization**
  - Cases by SKU
  - By Products
  - Materials Required
  - Profitability

- **Production Schedule**
“Predicting the future is not magic, it is artificial intelligence.”
- Dave Waters
“Artificial Intelligence is not a Man versus Machine saga; it’s in fact, Man with Machine synergy.”
– Sudipto Ghosh
Questions?

Thanks  Gracias  謝謝  اركش  Dank  Спасибо  ありがとう  Obrigado