

A circular inset image on the left side of the slide shows a brown cow with a yellow ear tag labeled "145" standing in a field of tall, dry grass. Other cows are visible in the background.

Animal Agriculture:

From Data to Better Decisions

Practical applications for productivity, animal health,
feed efficiency and business growth



Bhaskar Karampudi

Co-founder & Director

B-CUBE Consulting Private Limited

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AI in Animal Agriculture:

Is associated with cameras, sensors, robots and automated farm equipment. They are not the only way businesses can benefit from AI.

Every organisation already produces enormous amounts of information through spreadsheets, ERP systems, laboratory reports, emails, customer complaints, sales records, technical-service reports and SOPs.

Today, we will explore how that information can be converted into better decisions, automated workflows and measurable business outcomes—without necessarily replacing existing equipment or systems, or people.

**Animal agriculture
has plenty of data—**



Animal agriculture has plenty of data—

Animal-agriculture businesses already generate:

- Procurement and raw-material data
- Feed, production and quality records
- Laboratory reports and certificates
- Sales and distributor information
- Farm-performance and technical-service reports
- Customer complaints and communications
- Inventory, dispatch and collection data
- SOPs, manuals and regulatory documents



Animal agriculture has plenty of data—

The challenge is converting fragmented information into timely action.

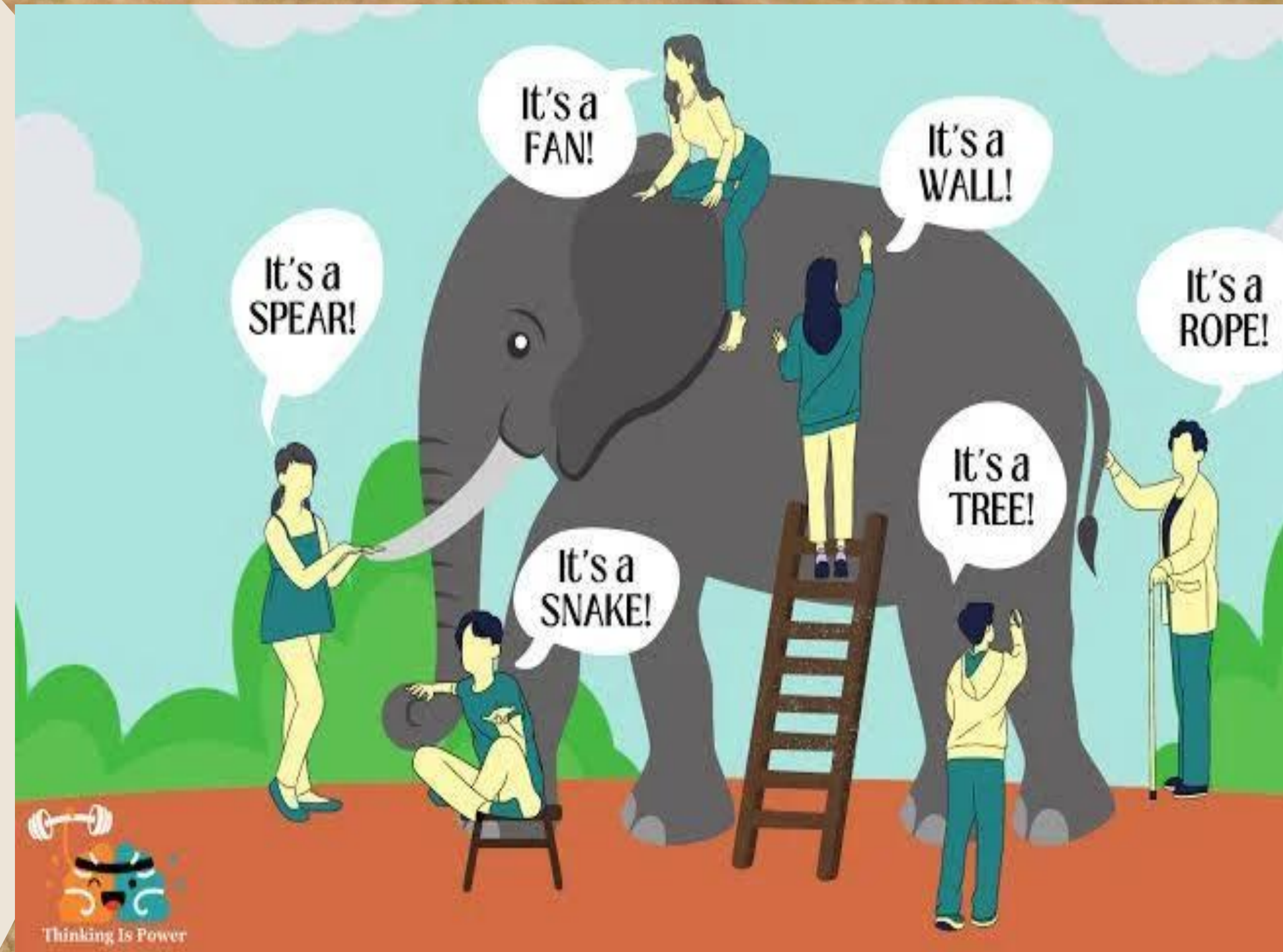
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The problem is that information is often distributed across departments and formats.

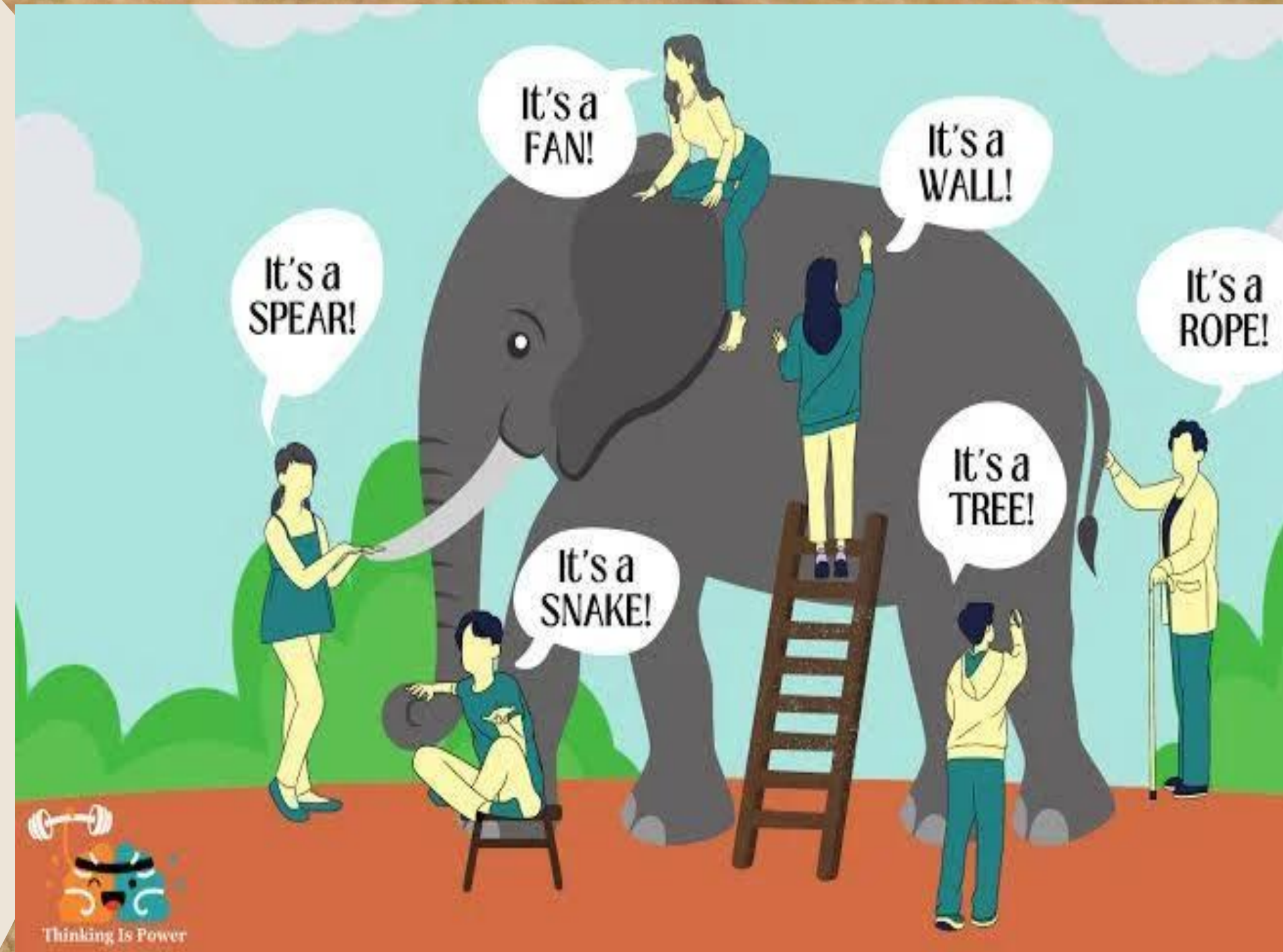
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Each department sees only one part of the picture.

Managers frequently spend more time collecting and reconciling information than analysing it. By the time a report reaches decision-makers, the opportunity to act may already have passed.

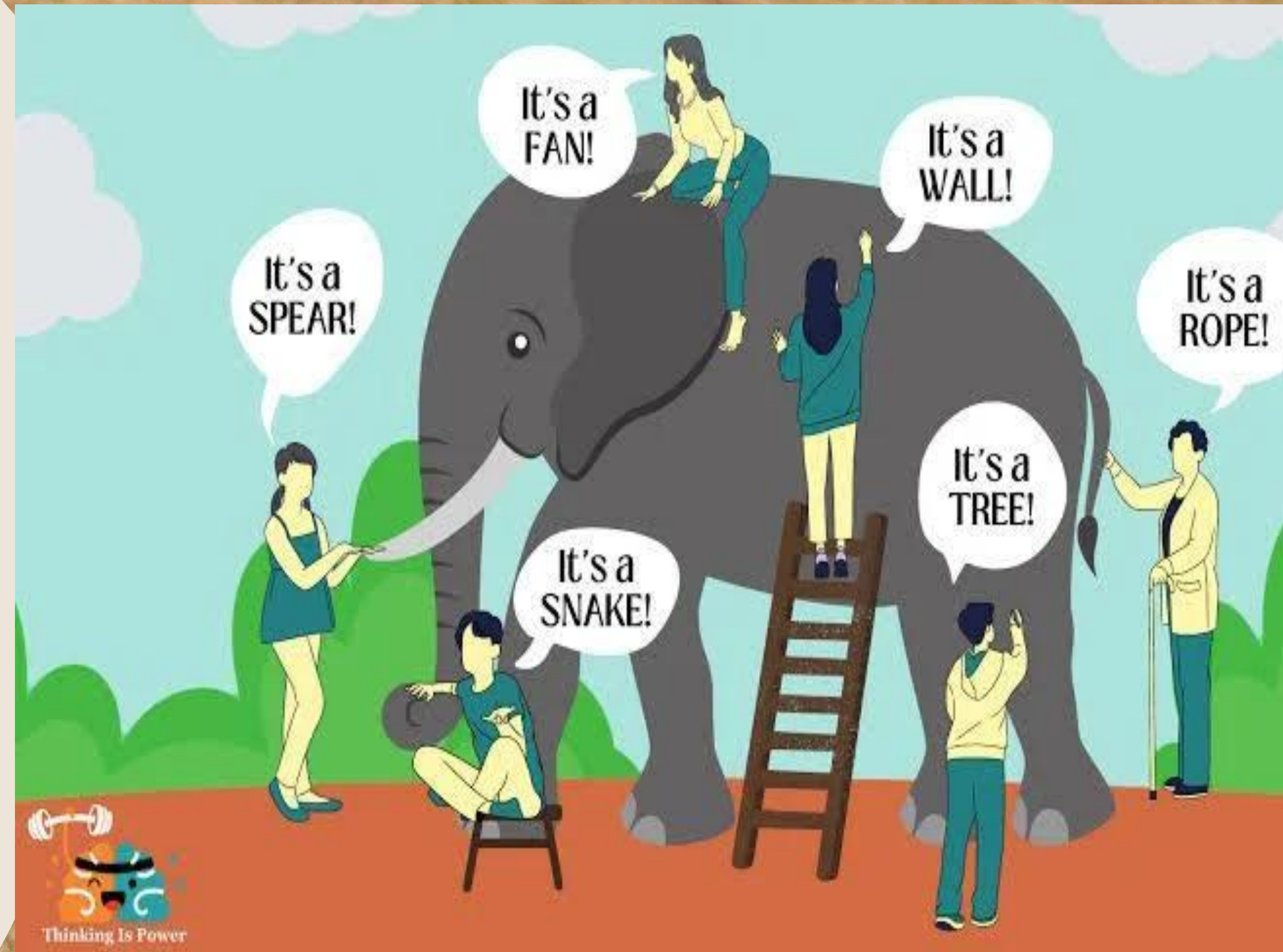


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AI can help connect these sources, identify patterns, flag exceptions and create decision-ready summaries.



What is **ARTIFICIAL INTELLIGENCE**



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Artificial intelligence enables machines to learn from information, recognise patterns and assist people in making decisions or completing tasks.

AI does not replace human intelligence.
It extends our ability to process information, identify patterns and act more quickly.



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A traditional system can be programmed to send an alert when feed consumption falls below a fixed limit.
An AI system can analyse feed consumption together with production, environmental conditions, historical patterns and quality records to detect an unusual change—even when no single fixed limit has been crossed.

Key Applications of **AI** in Animal Agriculture

AI is not just ChatGPT!

GENERATIVE AI

AGENTIC AI

WORKFLOW
AUTOMATIONS



Key Applications of **AI** in Animal Agriculture

AI is not just ChatGPT!



#1

GENERATIVE AI

AGENTIC AI

WORKFLOW
AUTOMATIONS



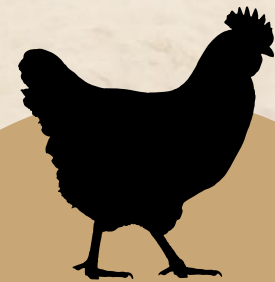
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#1

GENERATIVE AI



#2

AGENTIC AI



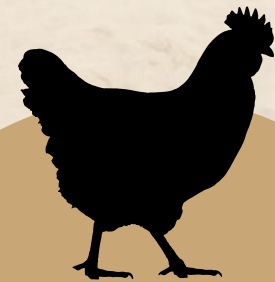
Key Applications of **AI** in Animal Agriculture

AI is not just ChatGPT!



#1

GENERATIVE AI



#2

AGENTIC AI



#3

WORKFLOW
AUTOMATIONS



TYPES OF **GENERATIVE** **AI**



01

TEXT

Content, Reports,
Analysis,
Formulations,
Code.

TYPES OF GENERATIVE AI



01

TEXT

Content, Reports,
Analysis,
Formulations,
Code.

02

VISUALS

Images, Graphics,
Vectors, Social
Media Content

TYPES OF GENERATIVE AI



TYPES OF **GENERATIVE** **AI**

01

TEXT

Content, Reports,
Analysis,
Formulations,
Code.

02

VISUALS

Images, Graphics,
Vectors, Social
Media Content

03

AUDIO / VIDEO

TTS, STT, Music,
Promo Videos,
Video Tutorials,
Avatar Videos,
Etc.



TYPES OF **GENERATIVE** **AI**

01

TEXT

Content, Reports,
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DEMO: AI MUSIC



TYPES OF **GENERATIVE** **AI**

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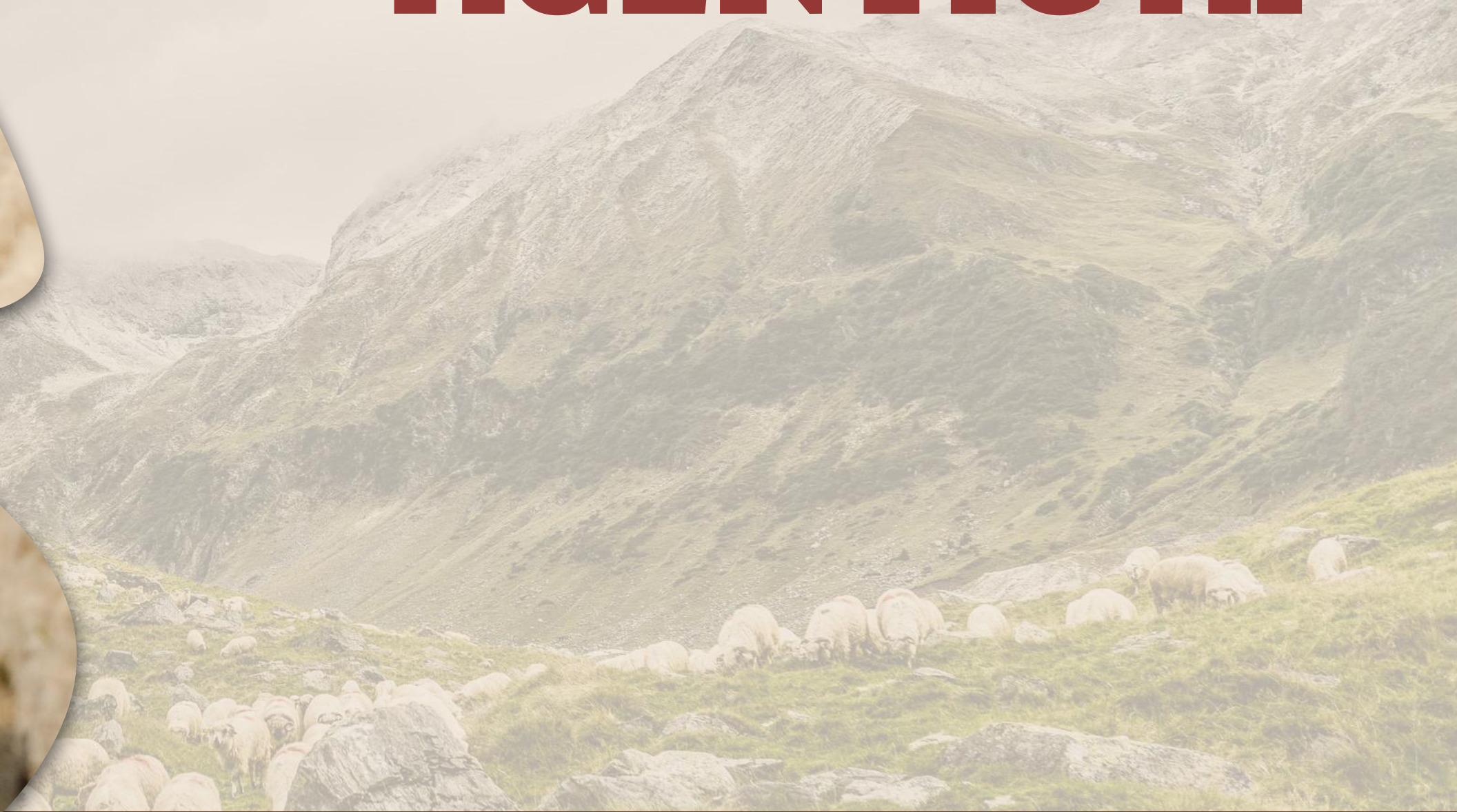
TTS, STT, Music,
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DEMO: AI MUSIC

DEMO: AI Video



TYPES OF **AGENTIC AI**



TYPES OF **AGENTIC AI**

CHATBOTS

Pre-sales, After-sales Support,
Tech Support, Client Engagement



TYPES OF **AGENTIC AI**



CHATBOTS

Pre-sales, After-sales Support,
Tech Support, Client Engagement

CHATBOT DEMO

AI ASSISTANTS

Predictive AI, Analytical AI,

AI ASSISTANT DEMO

TYPES OF **AGENTIC AI**



CHATBOTS

Pre-sales, After-sales Support,
Tech Support, Client Engagement

CHATBOT DEMO

AI ASSISTANTS

Predictive AI, Analytical AI,

AI ASSISTANT DEMO

AI AGENTS

Action Alerts, Payment Follow-
ups, BRS,

AI capability	What it can do
Generative AI	Create, summarise and explain
Predictive AI	Forecast likely outcomes
Analytical AI	Find patterns and anomalies
Optimisation AI	Compare possible choices
Intelligent automation	Connect information, decisions and action

TYPES OF AGENTIC AI

Generative AI can prepare summaries, reports, training material and communications.

Predictive AI can forecast sales, demand, prices, customer inactivity or production risk.

Analytical AI can identify anomalies in costs, quality, feed usage or customer complaints.





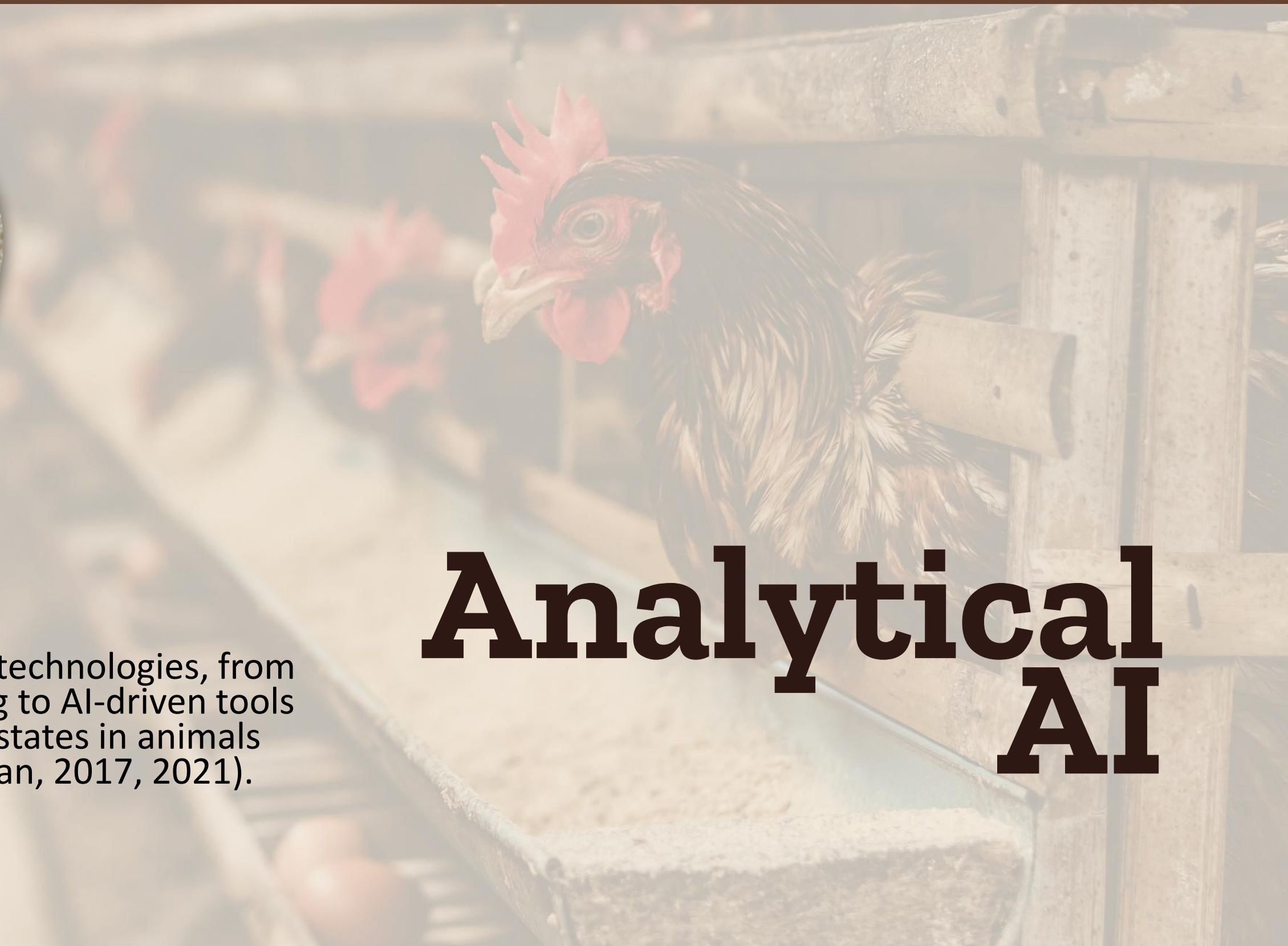
Analytical AI





Modern farms now utilize a variety of advanced technologies, from wearable sensors for real-time health monitoring to AI-driven tools for detecting behavioral indicators of emotional states in animals such as dairy cows, chickens, and pigs (Neethirajan, 2017, 2021).

Analytical AI



A circular inset in the top left corner showing a close-up of several white sheep looking towards the camera.

Procurement Intelligence

Modern farms now utilize a variety of advanced technologies, from wearable sensors for real-time health monitoring to AI-driven tools for detecting behavioral indicators of emotional states in animals such as dairy cows, chickens, and pigs (Neethirajan, 2017, 2021).

The background of the slide is a faded image of several chickens in a wooden enclosure.

Analytical AI

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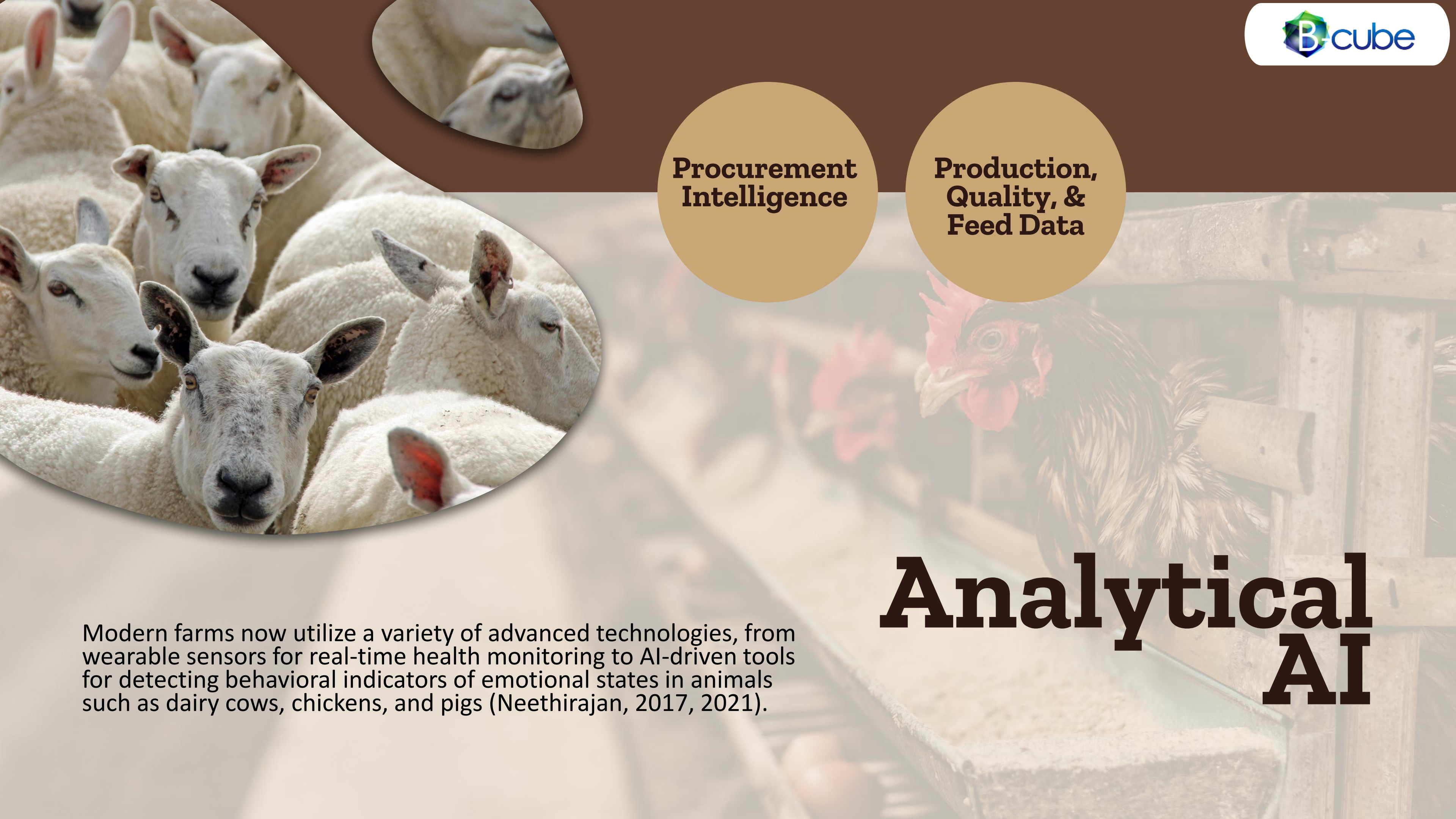
**Procurement
Intelligence**

A circular inset in the top center showing a close-up of a sheep's head.

**Production,
Quality, &
Feed Data**

A circular inset on the left side showing a group of white sheep.

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Analytical AI

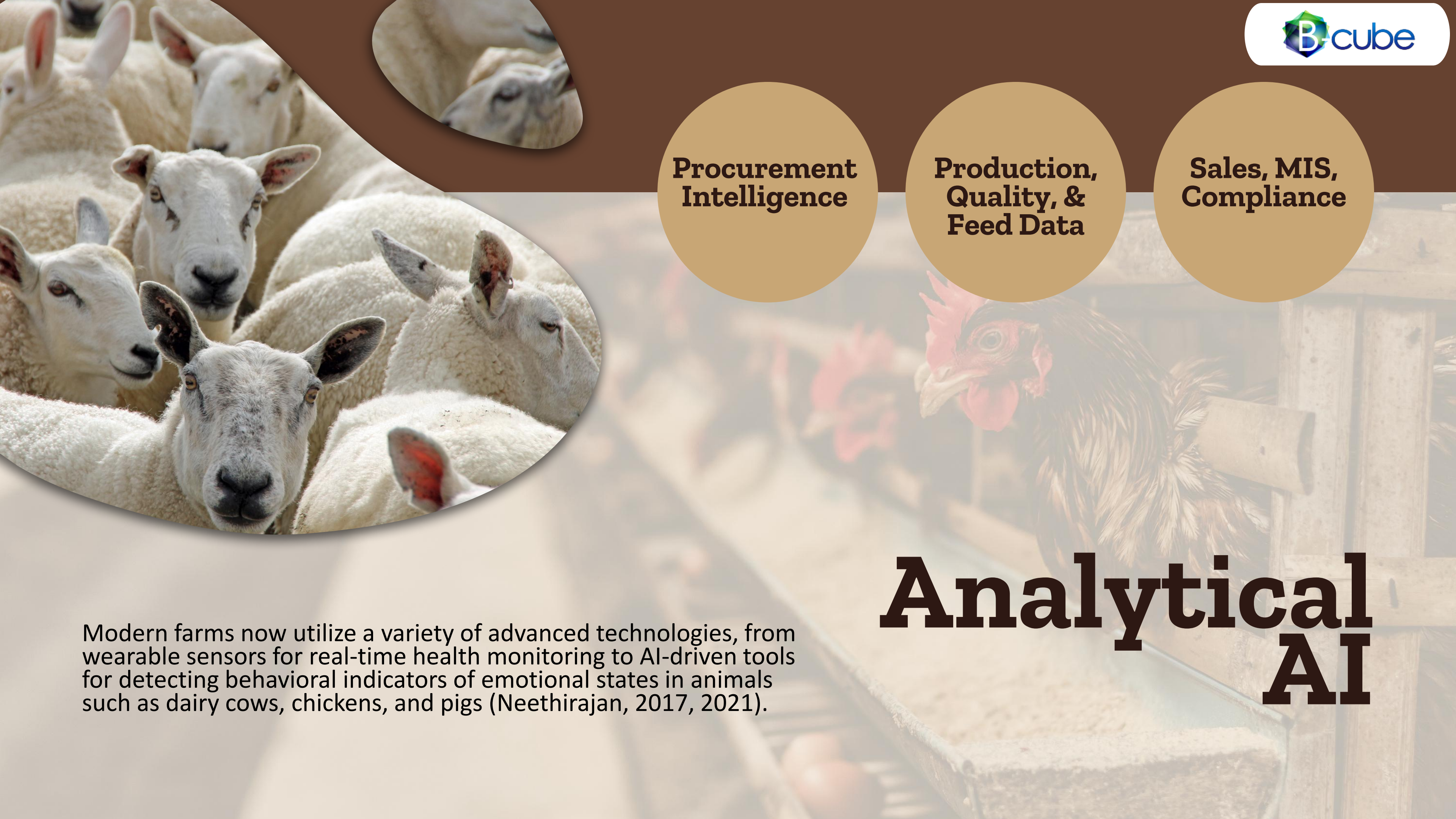
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**Procurement
Intelligence**

**Production,
Quality, &
Feed Data**

**Sales, MIS,
Compliance**

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Analytical AI



Emotions & Cognition

Digital Imaging & Video Analysis

Acoustic Analysis

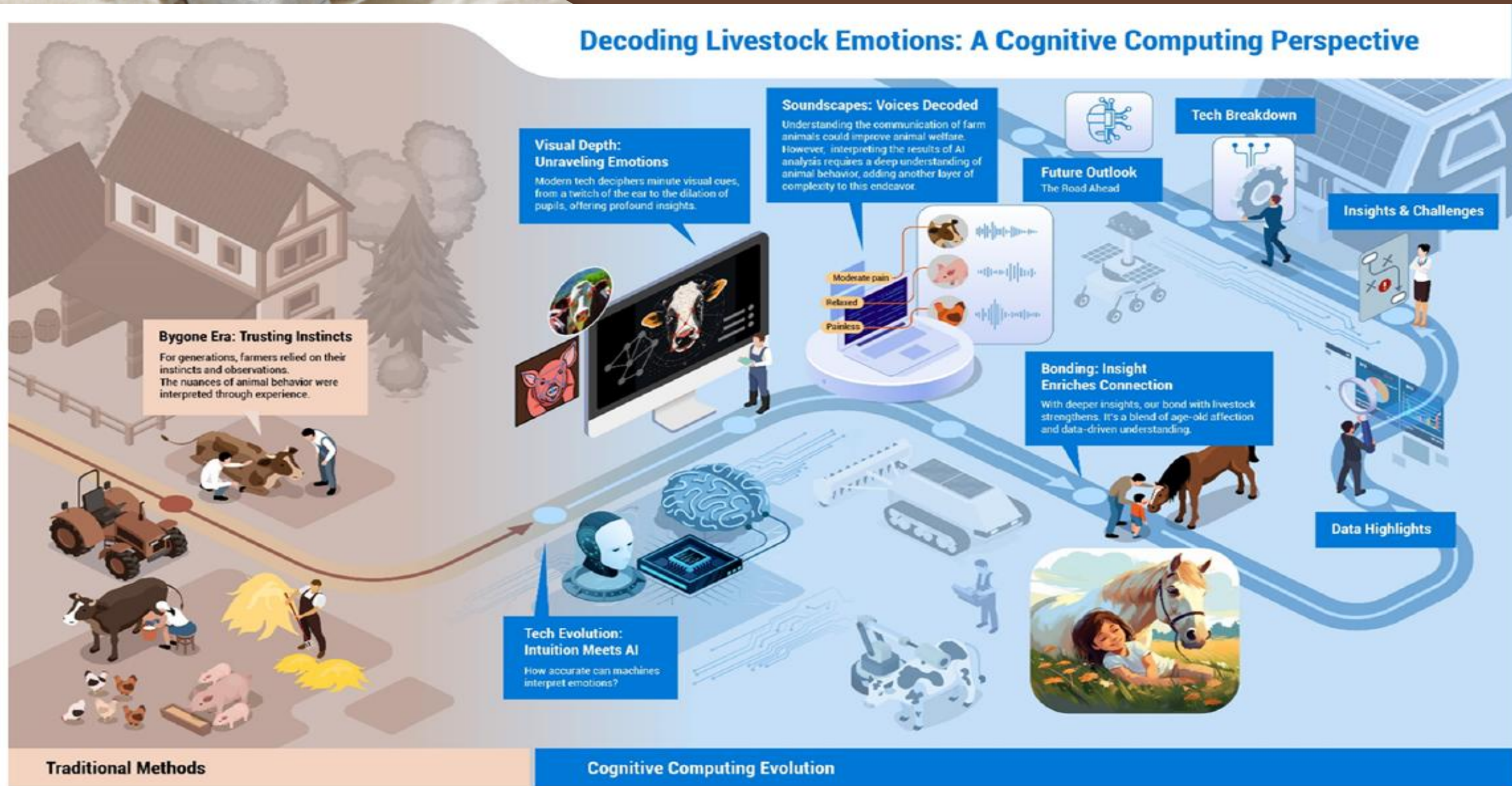
- Facial Recognition for Emotions
- Ear Base Temperature of Pigs
- Sleep, Cognition, Welfare, Stress in Dairy Cattle
- Poultry & Swine Management

*Ethical Dilemmas
Data Privacy and Security*

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Analytical AI

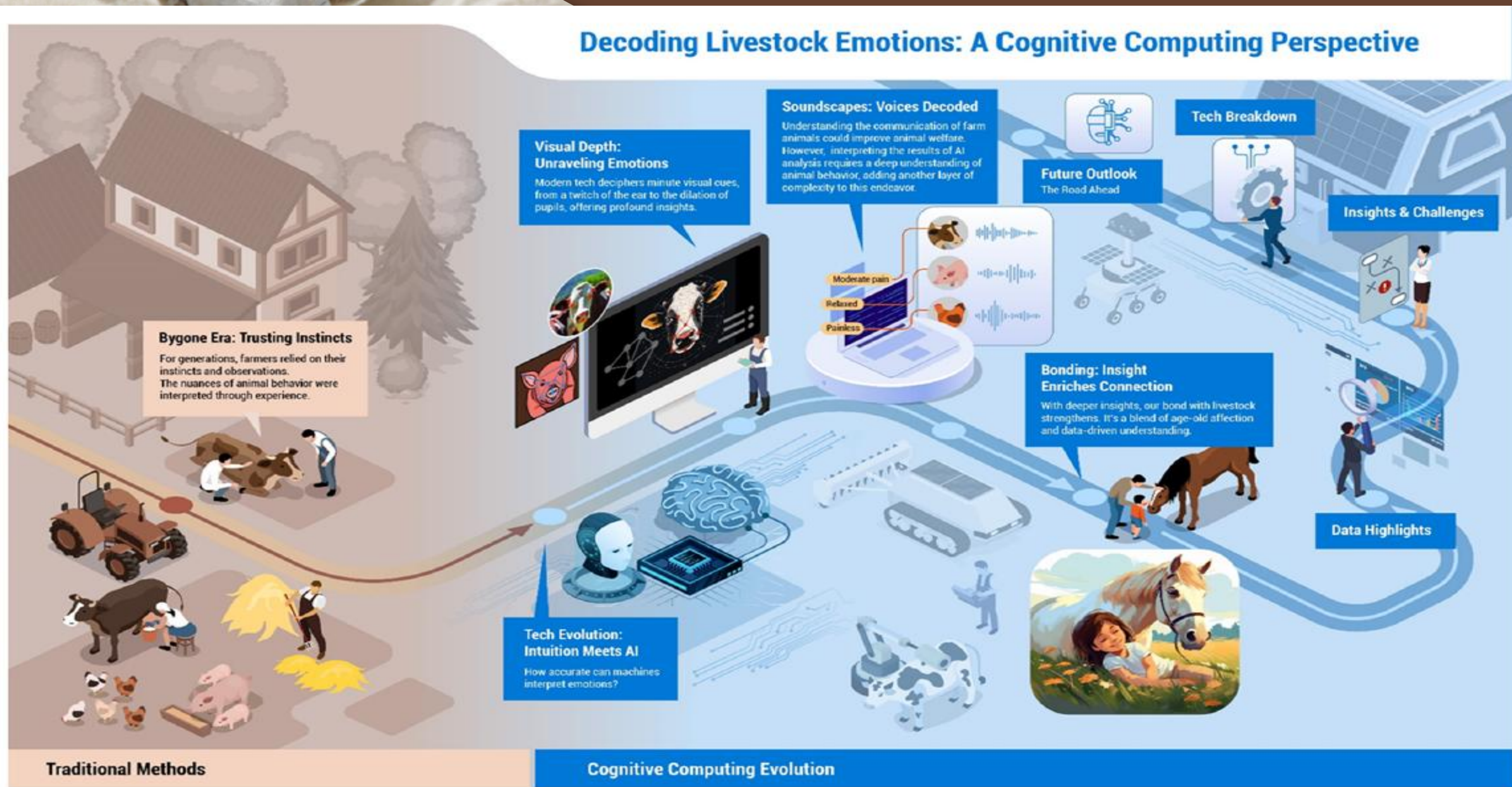
PREDICTIVE & ANALYTICAL AI



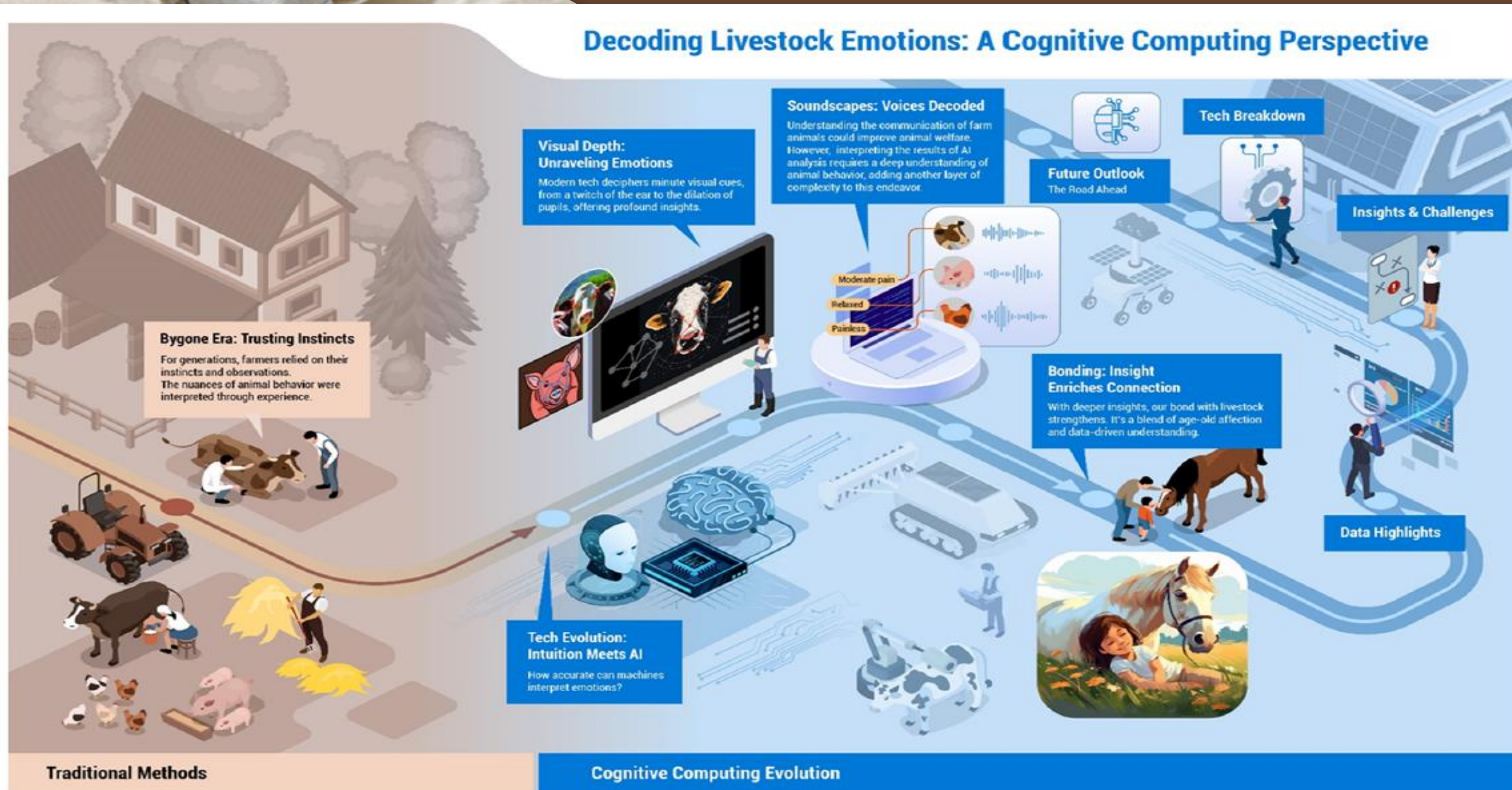
**SMART
POULTRY**

PREDICTIVE & ANALYTICAL AI

Emotions & Cognition



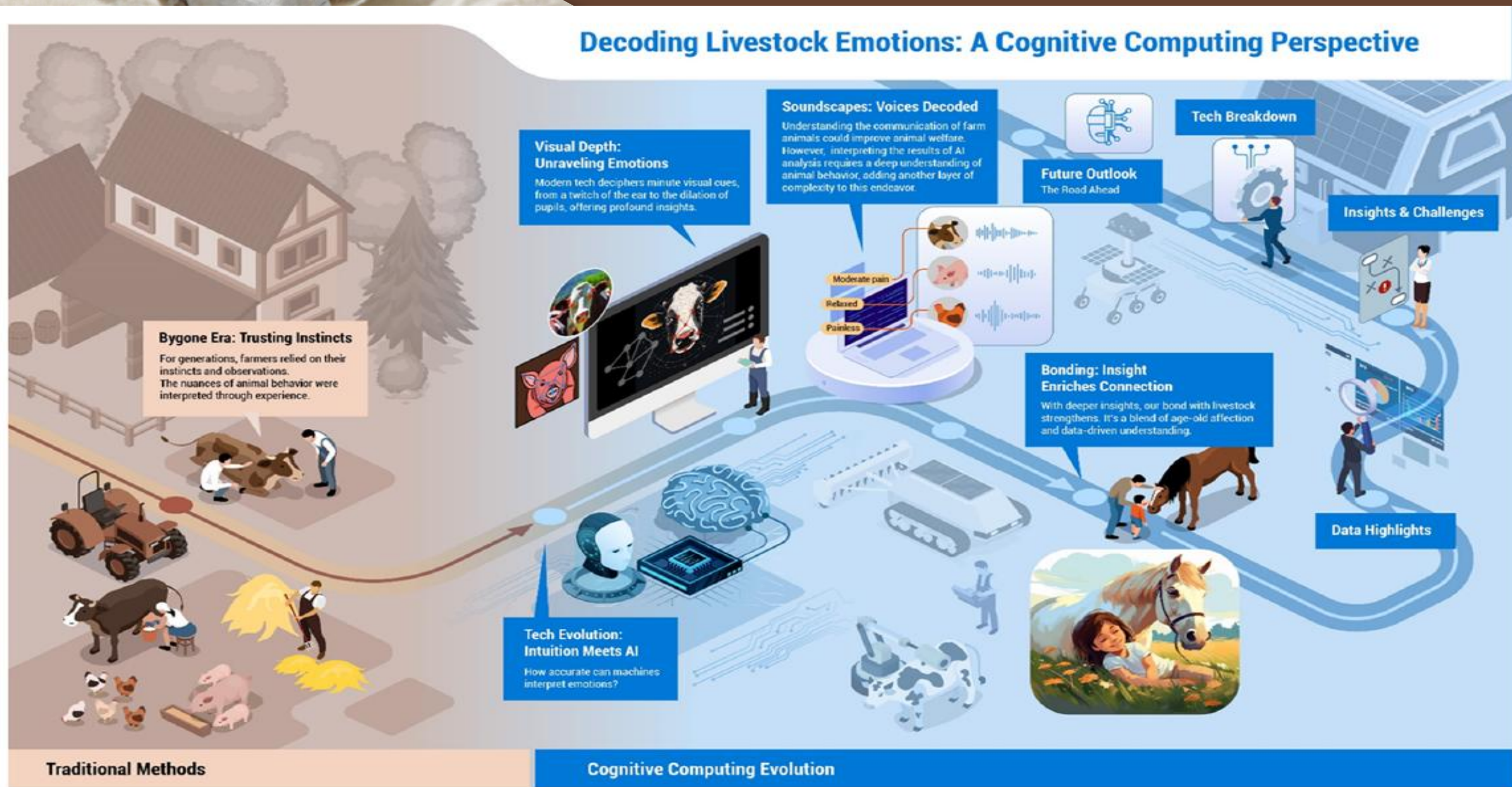
PREDICTIVE & ANALYTICAL AI



Emotions & Cognition

Digital Imaging & Video Analysis

PREDICTIVE & ANALYTICAL AI



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PREDICTIVE & ANALYTICAL AI

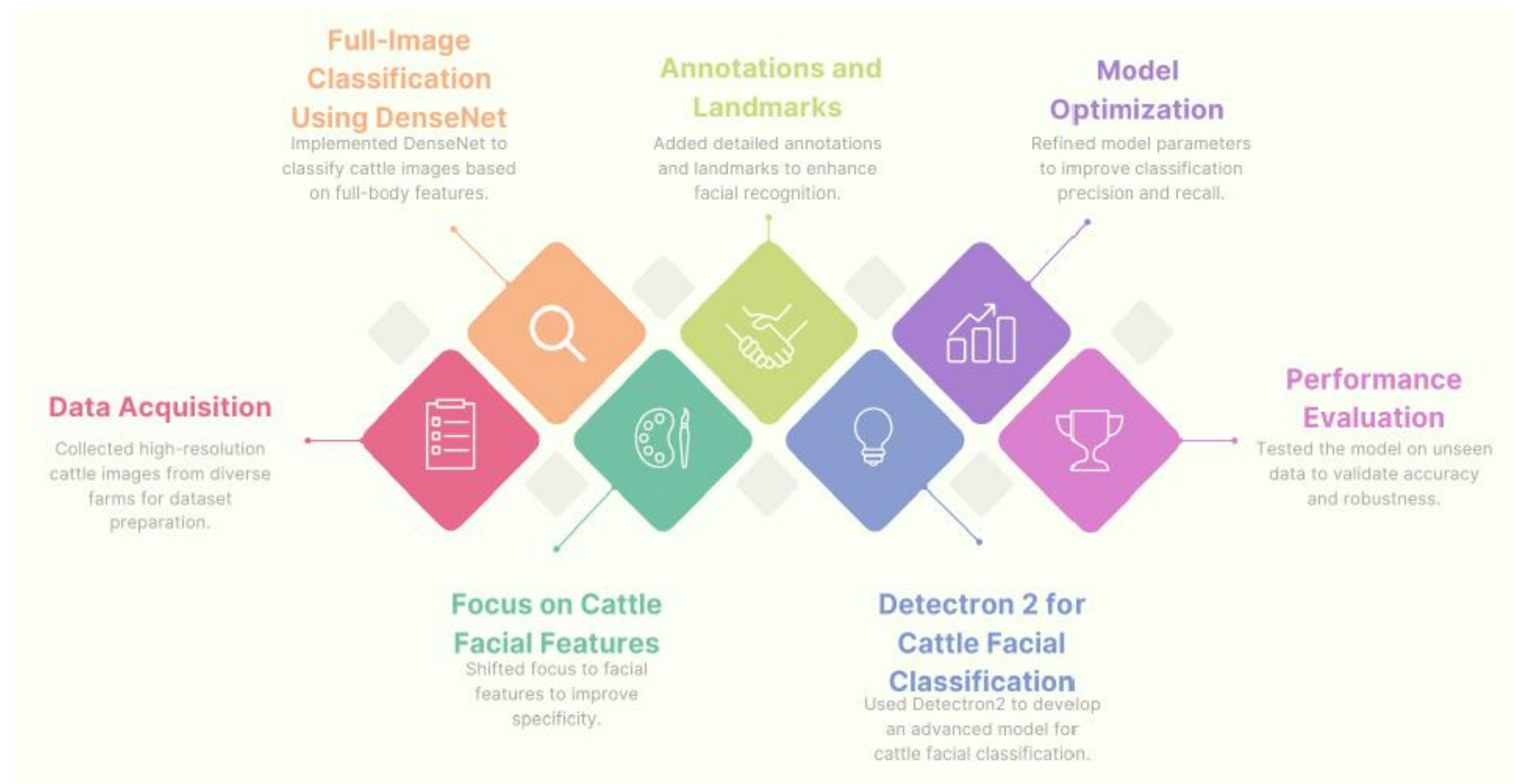


Figure 1. Workflow diagram illustrating the key steps in developing the Dairy DigiD cattle image classification model, from data collection to model evaluation.

PREDICTIVE & ANALYTICAL AI

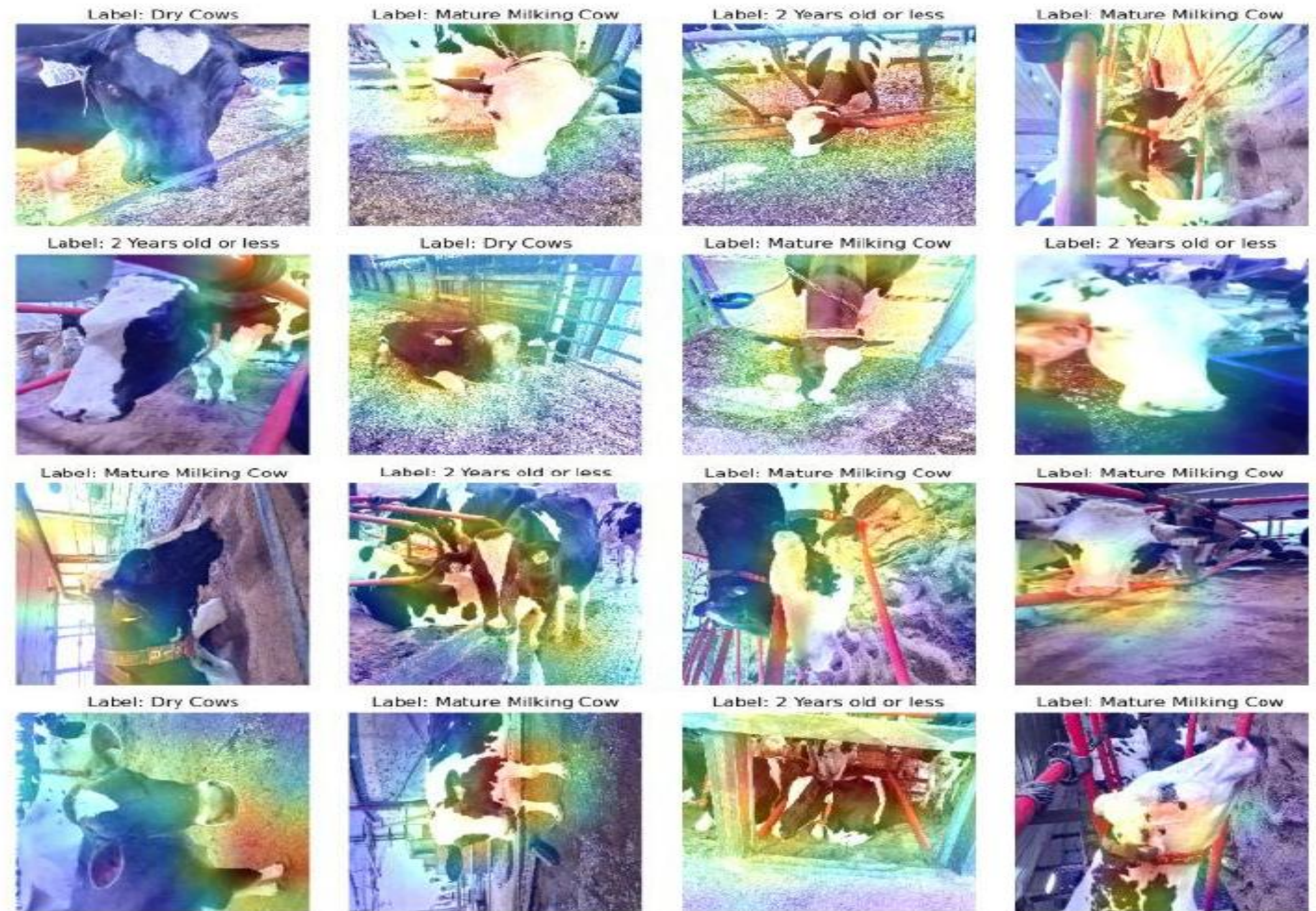


Figure 2. Grad-CAM visualizations of DenseNet-121 model attention regions for cattle classification, highlighting variability in feature selection across different samples.

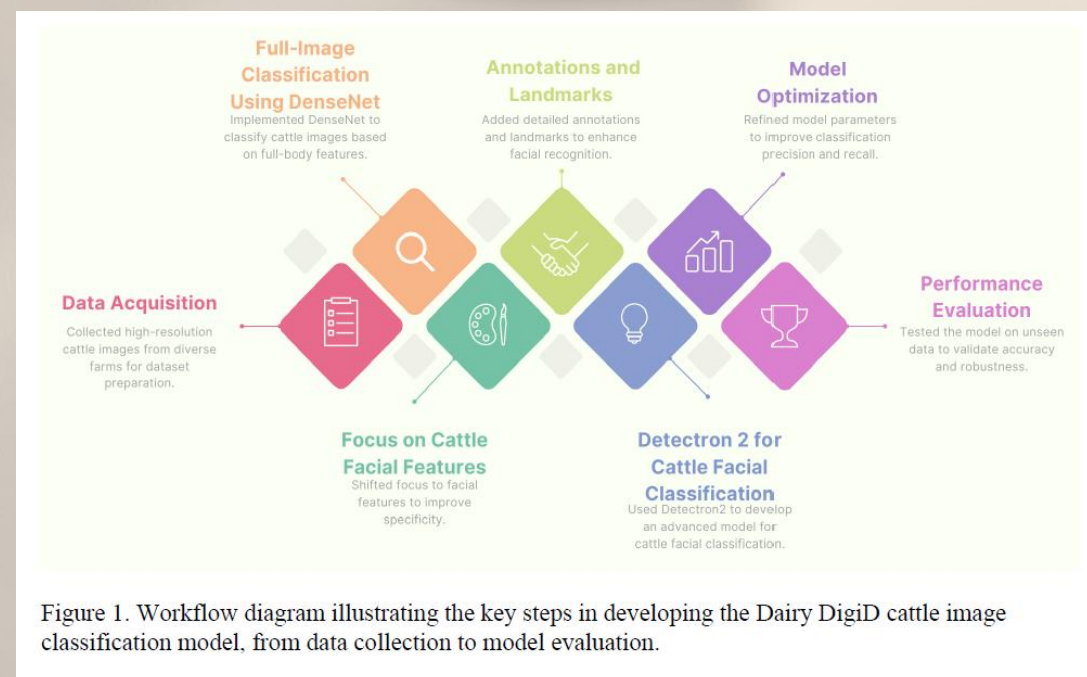


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PREDICTIVE & ANALYTICAL AI



Figure 3. Schematic representation of the 30 facial landmarks assigned to cattle faces, with color-coded dots indicating distinct keypoints for essential features.

Dairy DigiD ~ A Deep Learning-Based, Non-Invasive Biometric Identification System for Dairy Cattle Using Detectron2
 Shubhangi Mahatoa, Hanqing Bib, Suresh Neethirajana,c,*

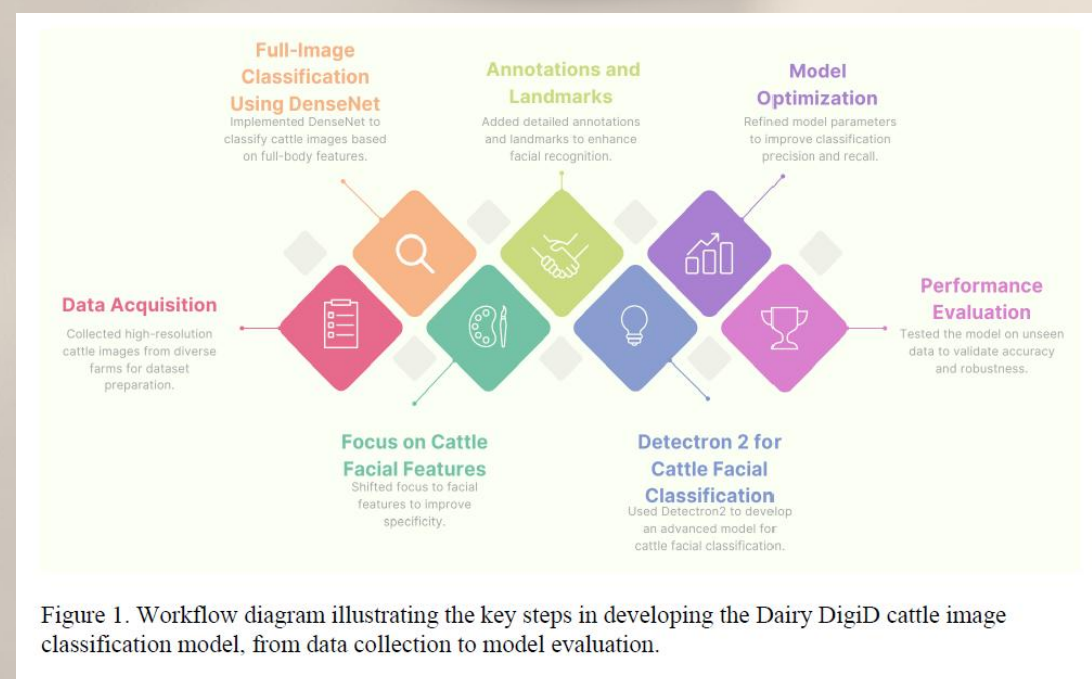


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PREDICTIVE & ANALYTICAL AI

Algorithm/ model	Description	Applications in animal cognition	Example use cases
Convolutional Neural Networks (CNNs)	Image and video analysis for behavior identification	Recognizing patterns and anomalies in animal behavior	Identifying stress behaviors in poultry from video feeds
Recurrent Neural Networks (RNNs)	Time-series data analysis for behavioral trends	Tracking changes in behavior over time	Monitoring feeding patterns in livestock to detect health issues
Generative Adversarial Networks (GANs)	Generating synthetic data for model training	Enhancing the robustness of behavioral models	Creating synthetic images for training models to detect lameness in cattle
Reinforcement Learning (RL)	Learning through interaction with the environment	Modeling animal decision-making processes	Simulating predator-prey interactions in a controlled environment

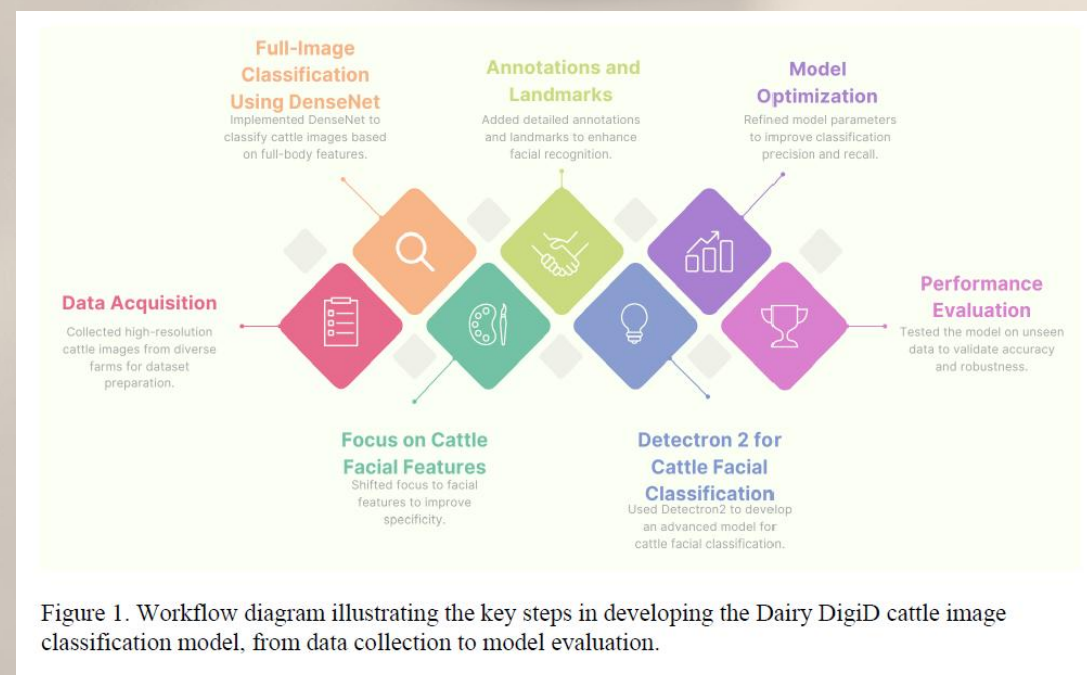


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Bimodal Data Analysis for Early Detection of Lameness in Dairy Cows Using Artificial Intelligence

*Yashan Dhaliwala, Hangqing Bib,c, Suresh Neethirajana,b,**

PREDICTIVE & ANALYTICAL AI



Autoencoders	Unsupervised data encoding and dimensionality reduction	Condensing complex behavioral data for analysis	Reducing dimensionality in acoustic data for stress vocalization analysis in pigs
Bayesian Networks	Probabilistic graphical models for decision-making	Understanding causal relationships in animal behavior	Analyzing the impact of environmental changes on flock behavior
Hidden Markov Models (HMMs)	Time-series analysis with hidden states	Deciphering underlying states from observable behaviors	Detecting estrus in dairy cows based on activity patterns
Support Vector Machines (SVMs)	Supervised learning for classification and regression	Classifying behaviors and predicting health states	Differentiating between normal and abnormal behaviors in sheep

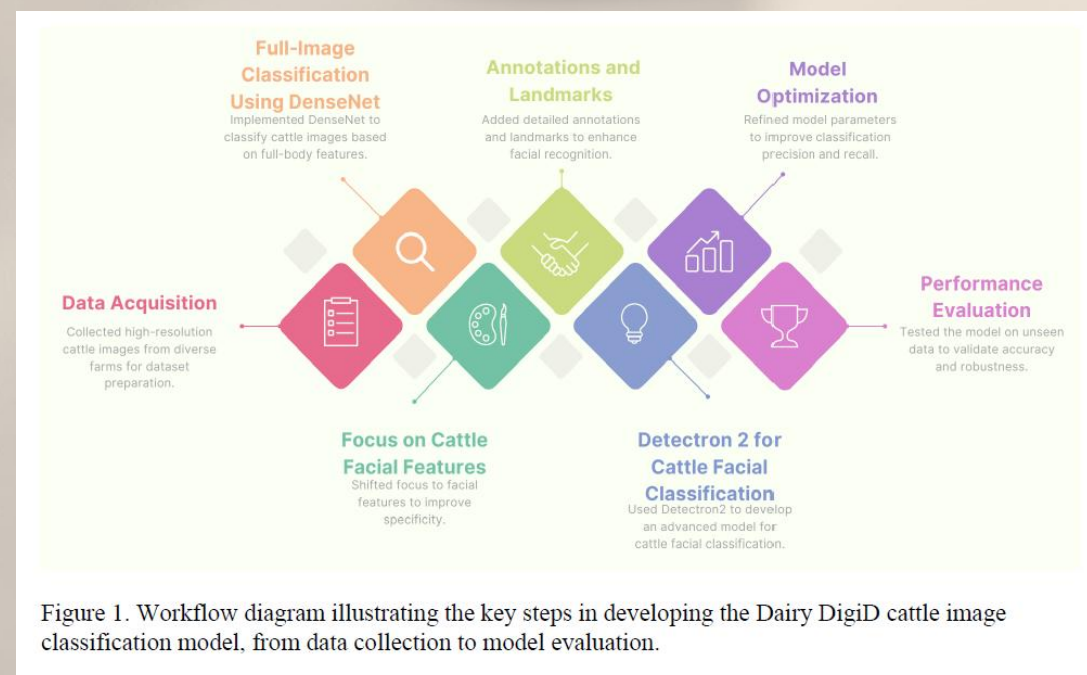


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PREDICTIVE & ANALYTICAL AI



Decision Trees

Hierarchical model for decision-making

Segmenting behavioral data for targeted analysis

Classifying different types of foraging behaviors in free-range poultry

Neural Evolution Algorithms

Evolving neural networks for optimal performance

Optimizing decision-making models in complex scenarios

Tailoring feeding schedules based on individual animal growth patterns

Graph Neural Networks (GNNs)

Exploiting the graph structure for relational data

Analyzing social structures and interactions among animals

Mapping social hierarchies in herds to prevent stress and injuries

Long Short-Term Memory Networks (LSTMs)

RNN variant designed to remember long-term dependencies

Understanding long-term behavioral patterns

Predicting future health conditions based on historical behavior data

Deep Belief Networks (DBNs)

Probabilistic, generative deep learning model

Extracting features from raw sensory data

Analyzing thermal images for early detection of diseases in livestock

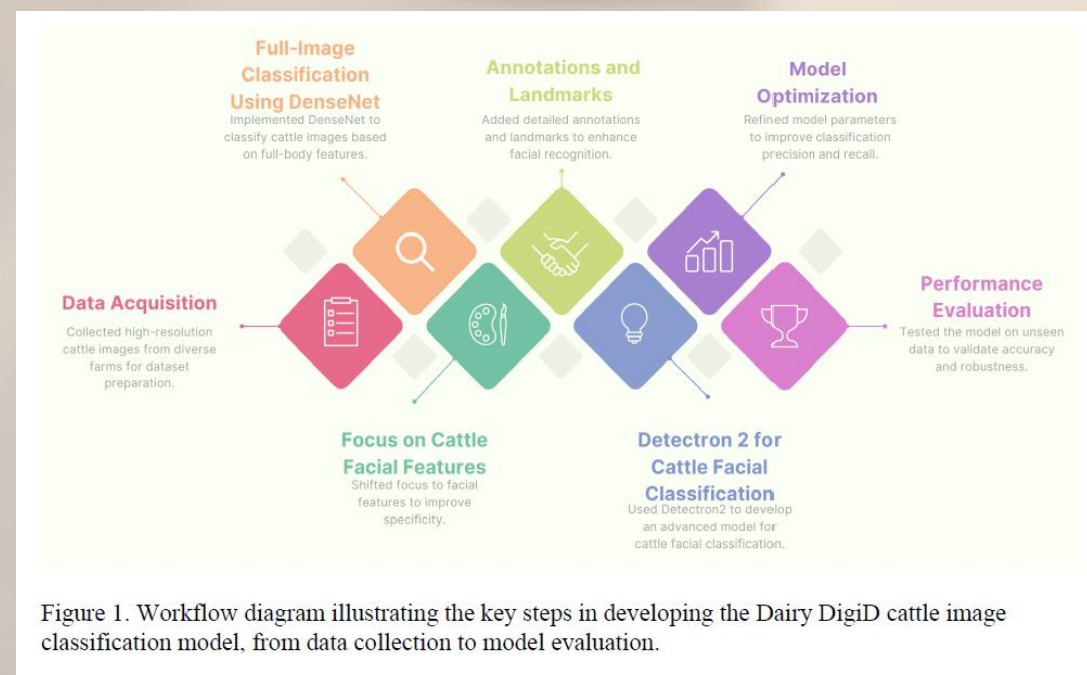


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PREDICTIVE & ANALYTICAL AI



Technique/ Method	Description	Advantages	Limitations
Predictive Analytics	Use of advanced algorithms and machine learning to predict and analyze animal behavior based on collected data.	Can predict potential health or behavioral issues. Provides data-driven insights. - Continuous evolution and learning from new data.	Requires vast amounts of data for accuracy. Potential for over-reliance on technology. May miss nuances that human caregivers can notice.
Real-time Monitoring	Use of sensors and devices to monitor animal behavior and health in real-time, feeding data to cognitive computing systems.	- Immediate detection of anomalies. - Enables proactive care. - Reduces human observation errors.	Requires constant power and connectivity. - Potential for data privacy issues.
Behavioral Pattern Recognition	Algorithms that recognize specific patterns in animal behavior, indicating mood, health, or needs.	- Enhances understanding of animal emotions. - Allows for tailored care based on individual	May require calibration for different species. - Potential for false positives.

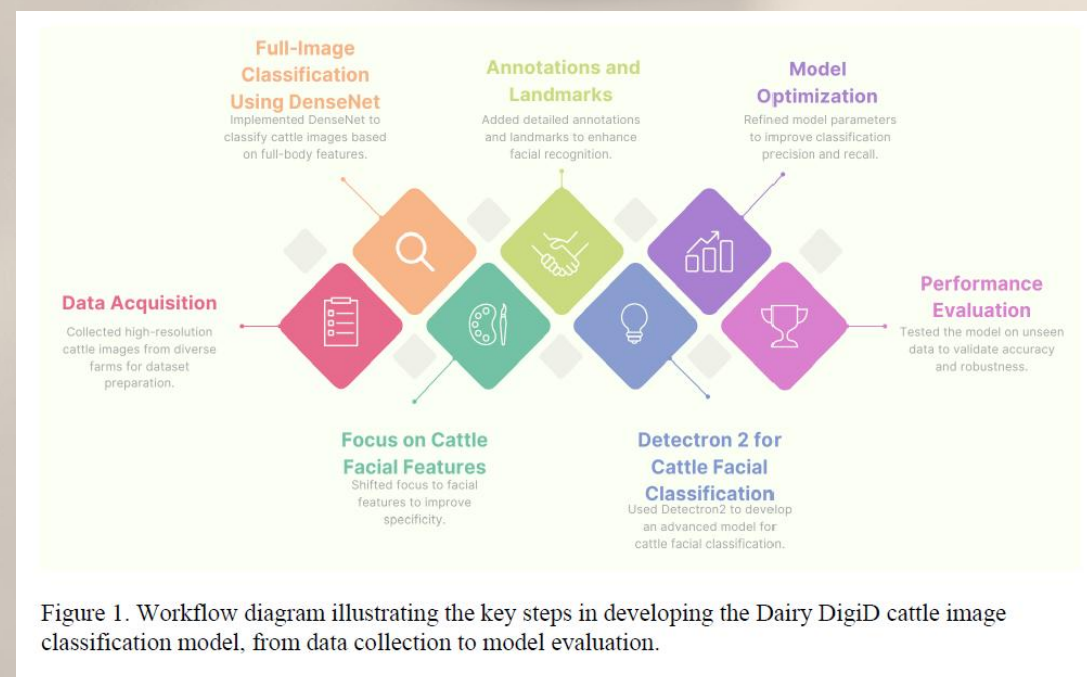


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PREDICTIVE & ANALYTICAL AI



Voice and Sound Analysis

Analyzing animal sounds and vocalizations using machine learning to detect distress, happiness, or other emotions. Using cognitive computing to analyze how environmental factors impact animal behavior and well-being.

behavior.

- Non-invasive method of understanding animal emotions.
- Can detect issues not visible through behavior.

Requires clear audio data. - May need extensive training data for accuracy.

Environmental Impact Analysis

Helps in creating optimal living conditions. - Can predict how changes in environment affect animals.

Requires multi-factor data collection. - Complex interactions may be hard to decipher.

Genetic and Health Analytics

Integrating genetic data with behavioral data to understand animal predispositions and health risks.

- Comprehensive understanding of animal health.
- Can lead to personalized care plans.

- Requires genetic data which may be hard to obtain.
- Ethical considerations around genetic data usage.

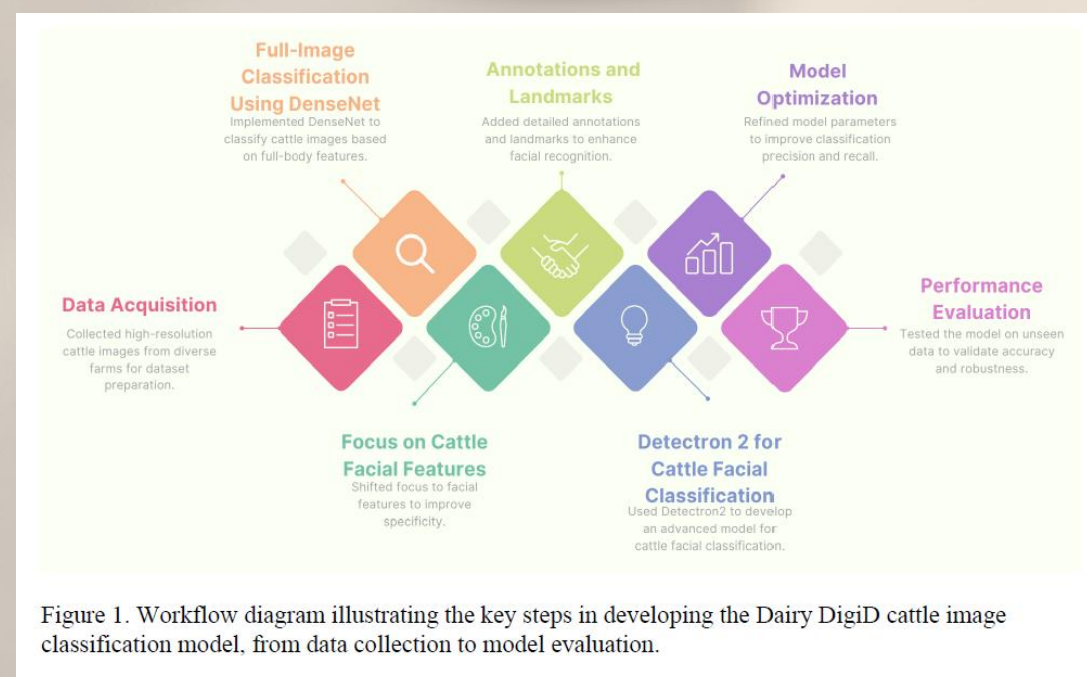


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PREDICTIVE & ANALYTICAL AI



Interactive Learning Systems

and health risks. Systems that learn from animal interactions and adapt to provide better care or stimulation.

- Enhances animal enrichment.
- Provides dynamic response based on animal needs.

Emotion Recognition Systems

Use of cameras and sensors to detect and interpret animal emotions based on facial expressions or body language.

- Direct insight into animal emotional state.
- Non-invasive and continuous monitoring.

Automated Health Diagnostics

Systems that automatically diagnose potential health issues based on behavior, sound, or other data.

- Early detection of health issues.
- Reduces reliance on periodic health checks.

Decision Support Systems

Cognitive computing systems that assist caregivers in making decisions about animal care based on collected data.

- Enhances decision-making with data-driven insights.
- Reduces human error in care decisions.

data usage.

- Requires sophisticated technology.
- Potential for system malfunctions.
- Requires extensive training data.
- May not be applicable to all species.

- Potential for false positives or negatives.
- Requires integration with other health systems.
- Over-reliance can reduce human intuition in care.
- Requires continuous data input and updates.

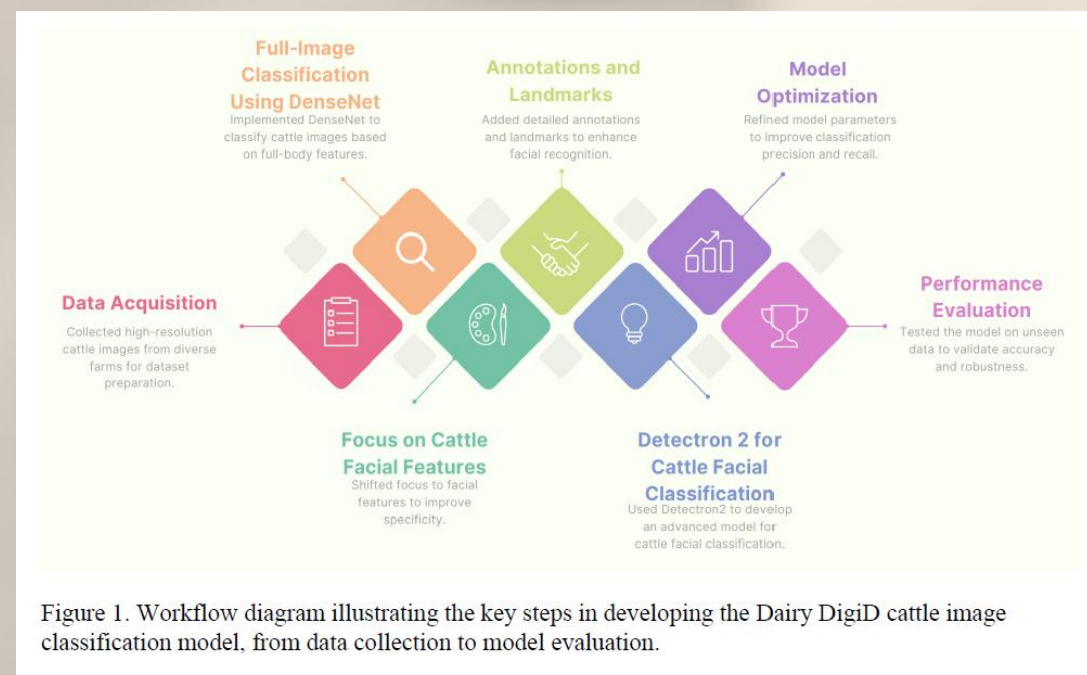


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Predictive AI

01

**Climate
change**

02

**Disease
outbreaks**

03

**Antibiotic
resistance**



Algorithmic Life Cycle in Human-Centric Animal Welfare Management



Fig. 1 Algorithmic life cycle in human-centric animal welfare management

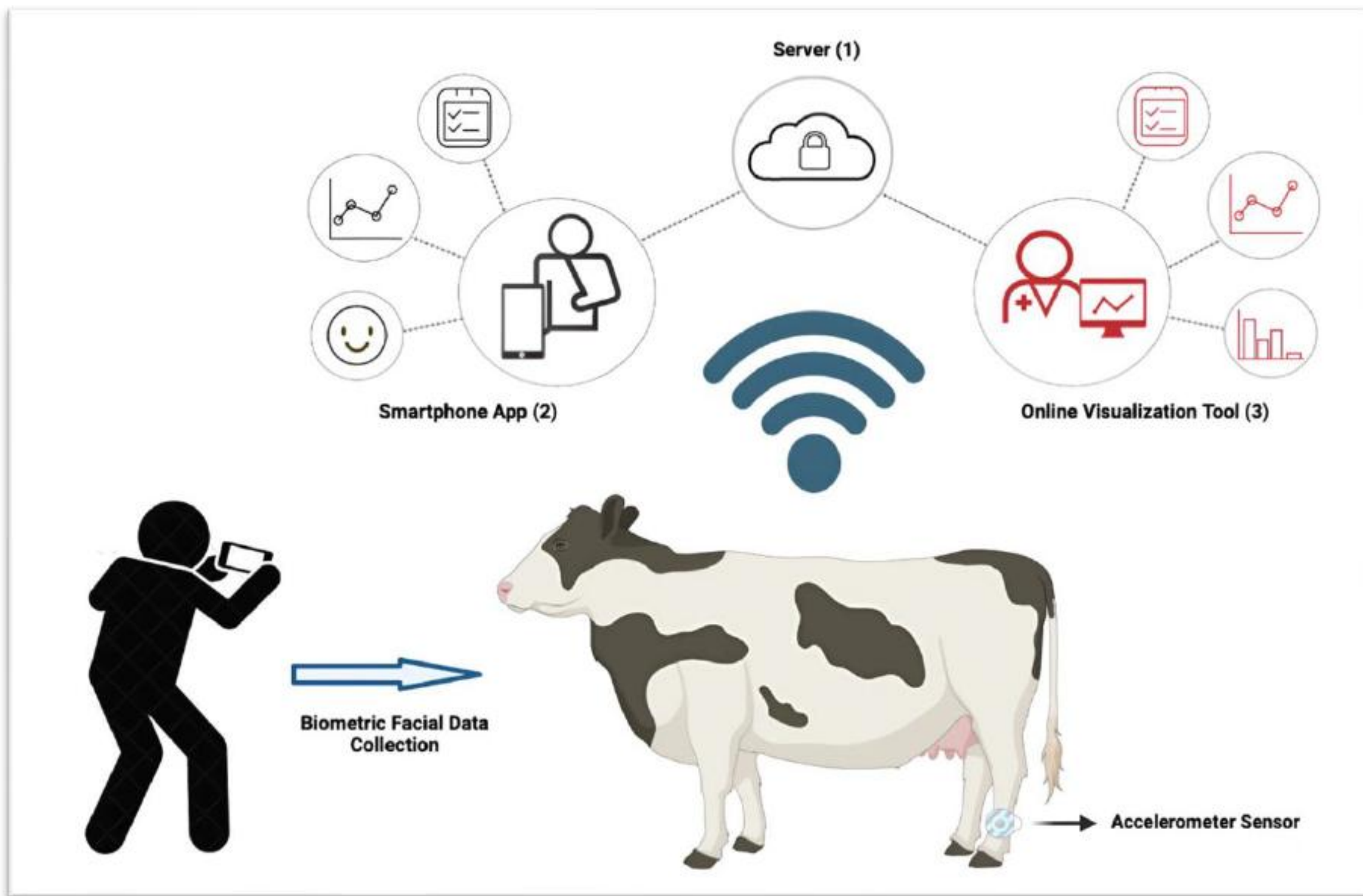
Predictive & Analytical AI

Table 2 Deep dive: pillars of AI and sensor technologies in human and farmer-centric digital livestock farming

Element	Description	Livestock farming implications	Human-centric benefits
Behavioral monitoring	AI analyzes sensor data to detect animal behaviors	Early detection of stress or illness in animals	Enables farmers to take timely action, ensuring animal well-being
Health diagnostics	Sensors monitor vital signs; AI predicts health issues	Proactive health management	Reduces suffering, aligning with human ethical values
Environmental control	Sensors monitor environmental factors; AI adjusts conditions	Optimal living conditions for livestock	Ensures ethical treatment by providing comfort to animals
Nutrition optimization	AI analyzes sensor data to optimize feed	Balanced nutrition for livestock	Promotes humane treatment by ensuring animals' dietary needs are met
Movement and activity	Sensors track animal movement; AI assesses activity levels	Monitors physical well-being and exercise	Aligns with human values of providing adequate space and freedom
Social interaction analysis	AI evaluates sensor data on animal interactions	Understands social dynamics in herds	Ensures animals maintain natural social behaviors, respecting their nature
Bioacoustic sensing	Sensors capture animal sounds; AI interprets vocalizations	Deciphers distress or comfort calls	Allows humans to understand and address animal needs more intuitively
Predictive analytics	AI predicts potential outbreaks or health issues	Early intervention in health crises	Minimizes animal suffering, reflecting human compassion
Ethical decision support	AI provides ethical guidelines based on sensor data	Guides farmers on humane practices	Reinforces human values in daily livestock management
Feedback mechanisms	AI and sensors provide continuous feedback	Refinement of care strategies	Ensures evolving care standards, mirroring human adaptability
Emotions measurement	AI interprets sensor data to gauge animal emotions	Enhanced understanding of animal moods and feelings	Deepens human empathy and connection to animals
Improvement of animal-human interactions	Sensors and AI guide human interactions with animals	More harmonious and positive interactions	Strengthens the bond and trust between humans and animals
Bonding enhancement	AI provides insights into animal preferences and behaviors	Facilitates better bonding between farmers and animals	Fosters a deeper emotional connection, enriching the farming experience

Predictive & Analytical AI





Predictive & Analytical AI



(a) Accelerometer sensor



(b) Cow equipped with sensor

Fig. 2. Left image (a) demonstrates FIBION Sens motion sensor utilized to monitor locomotor activity of cows; Right image (b) displays a cow with FIBION Sens motion sensor affixed to the right hind limb using a Velcro strap and tuck tape

Predictive & Analytical AI



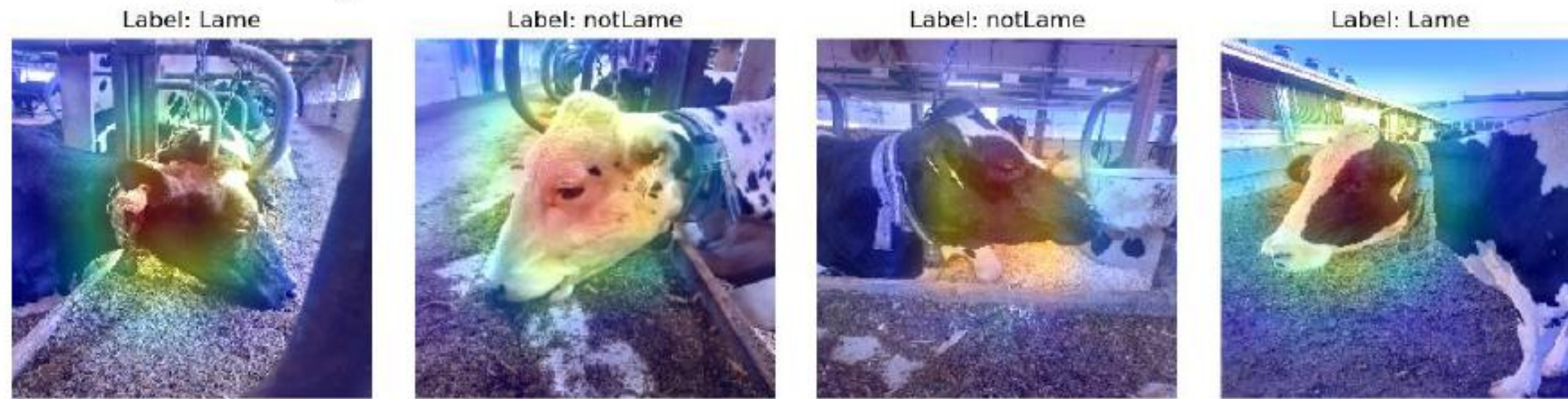


Fig. 9. Grad-CAM analysis for DenseNet model

01

**Climate
change**

02

**Disease
outbreaks**

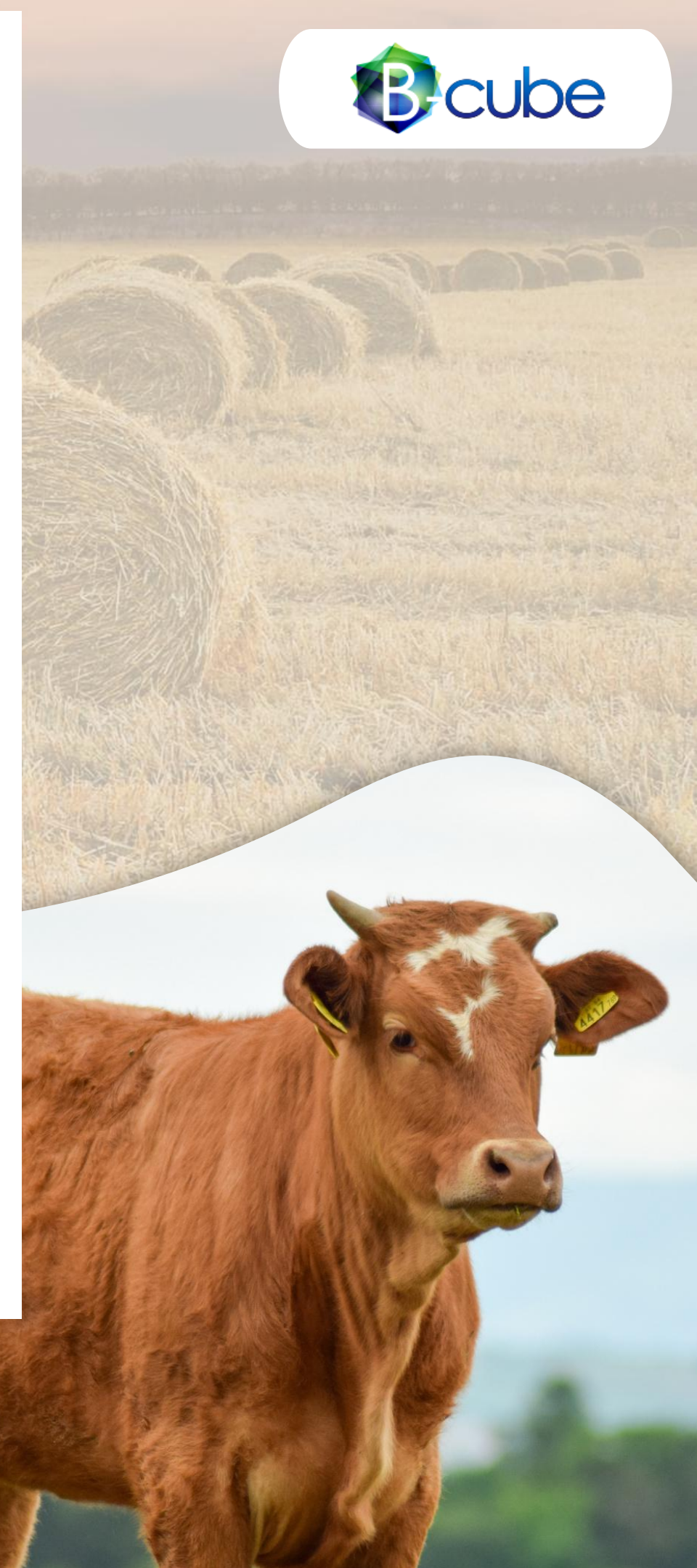
03

**Antibiotic
resistance**

Predictive & Analytical AI

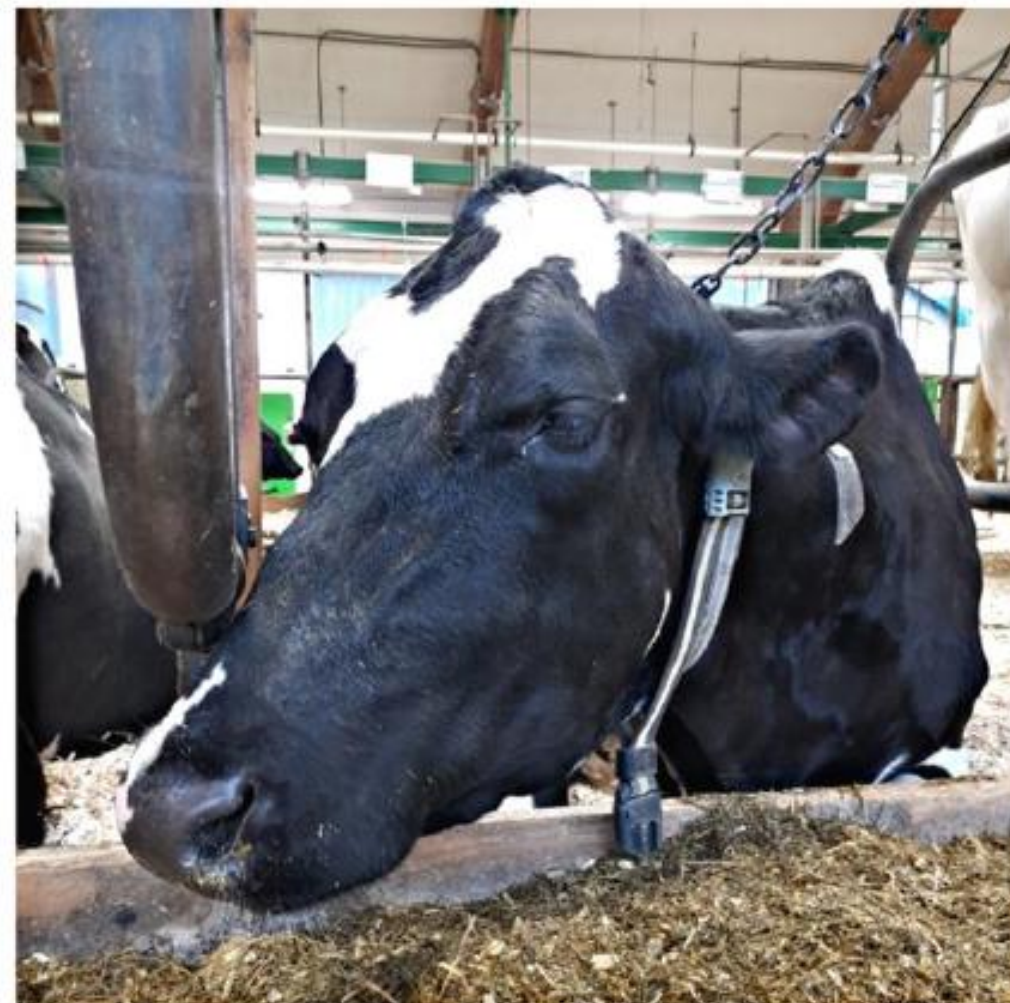


Facial Expression Unit	Expression(s) Indicative of Lameness
Ear positioning	Ears held back, drooping, upright or forward may signal discomfort or pain in cows. For lameness specifically, frequent changes in ear posture may be an indicator.
Muzzle tension	Tightening of the muzzle or changes in nostril shape may indicate facial tension associated with pain or discomfort
Overall facial tension	General stiffening or tension in facial muscles can be observed in cows experiencing pain or lameness
Nose bunching	This refers to wrinkling or bunching of the nose area, which may be seen in cows experiencing discomfort
Brow tension	Increased tension or furrowing in the brow area may be observed as indicative of pain
Eye position	More visible eye whites (larger percentage of white showing) are associated with stress, frustration, fear or arousal in cows. For lameness, increased visibility of eye whites could potentially indicate pain or discomfort associated with the condition.





(a) Lame cow



(b) Healthy cow

Fig. 10. Left image (a) displays a lame cow (Cow 1) with overall facial tension; Right image (b) displays a healthy cow (Cow 3) with relaxed facial features

Predictive & Analytical AI



Non-AI

Data Processing,
Data Exchange, etc.

AI-Driven

Data Transformation,
Data Conversion, Data
Analysis, etc.

TYPES OF WORKFLOW AUTOMATIONS

Ai

Intelligent automation connects these capabilities to existing workflows.

For example, it can receive a laboratory report, extract results, compare them with specifications, alert the quality manager and update a supplier-performance report.



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Data Processing,
Data Exchange, etc.

AI-Driven

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TYPES OF **WORKFLOW AUTOMATIONS**

Ai

**Operations Reporting
DEMO**



Non-AI

Data Processing,
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AI-Driven

Data Transformation,
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DEMO

POND HEALTH ADVISORY

Ai

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Non-AI

Data Processing,
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AI-Driven

Data Transformation,
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DEMO **POND HEALTH ADVISORY**

Ai

OPERATIONS COMMAND CENTER
AI GENERATED DASHBOARD



Non-AI

Data Processing,
Data Exchange, etc.

AI-Driven

Data Transformation,
Data Conversion, Data
Analysis, etc.

DEMO

POND HEALTH ADVISORY

Ai

CLFMA
AI INTELLIGENCE HUB

Non-AI

Data Processing,
Data Exchange, etc.

AI-Driven

Data Transformation,
Data Conversion, Data
Analysis, etc.

DEMO POND HEALTH ADVISORY

Ai

COMMODITY FORECASTING
AkshayaPatra on TradingView

THANK YOU!!



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THANK YOU!!

As a token of thanks to CLFMA and their members, we are happy to
offer a

FREE

1-hour Consulting Call

to explore the implementation of AI initiatives in your organization

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THANK YOU!!



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Fill Form for Research Papers & Consultation Call

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