

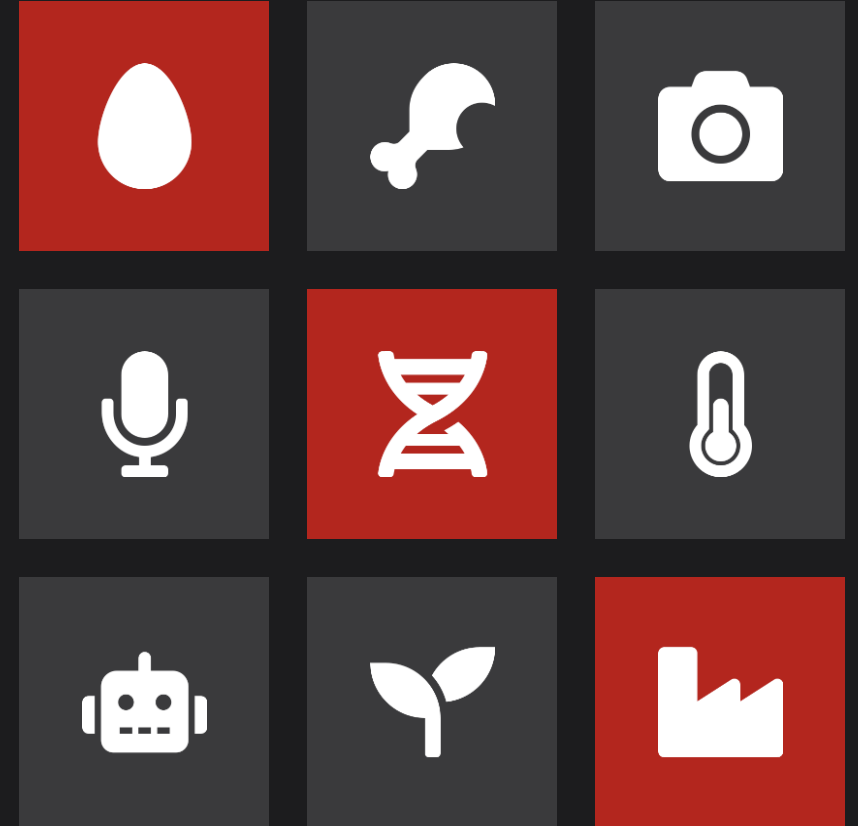


Artificial Intelligence in Poultry Production

From data to decisions in meat and egg production

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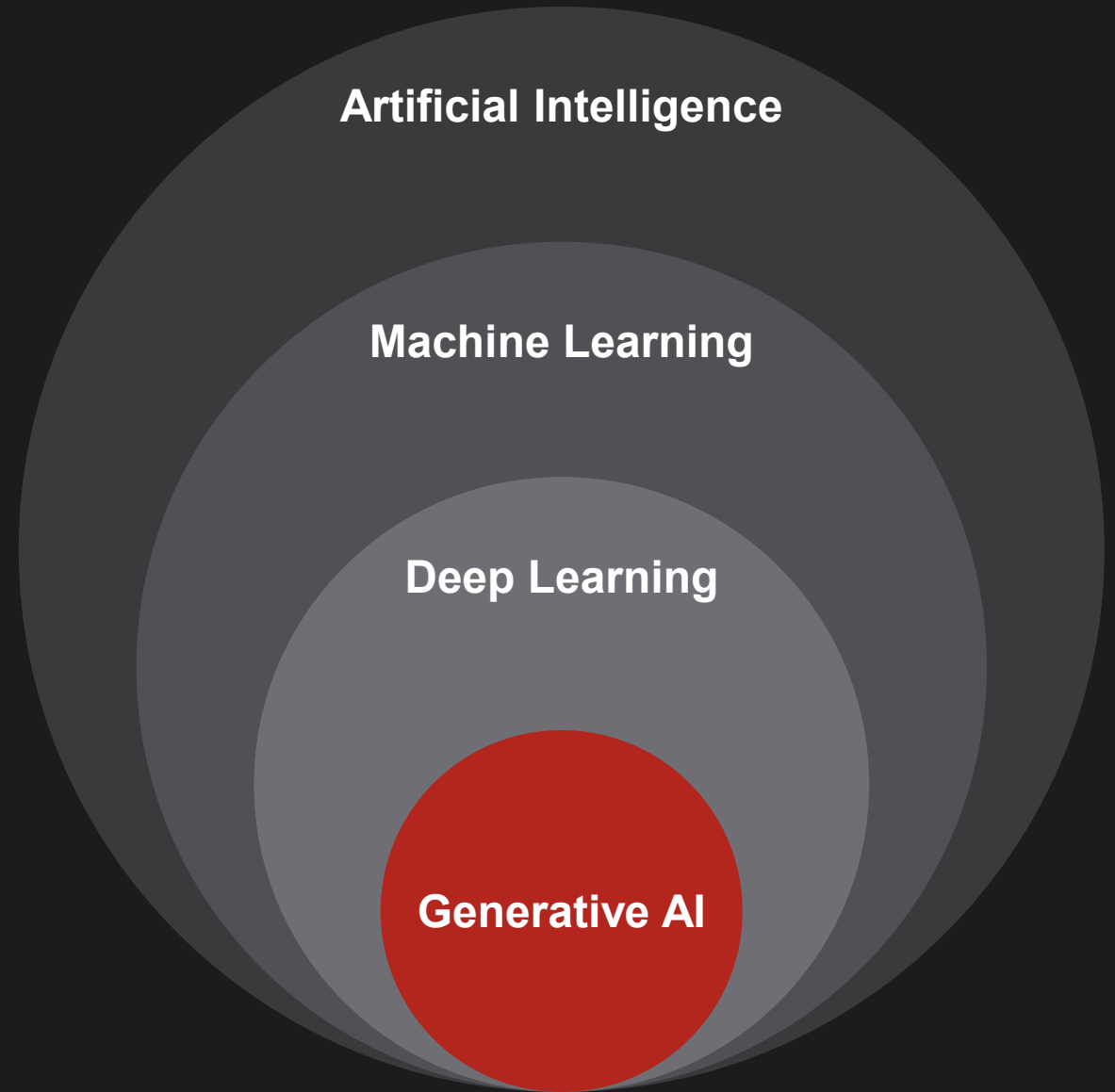
What is Artificial Intelligence?

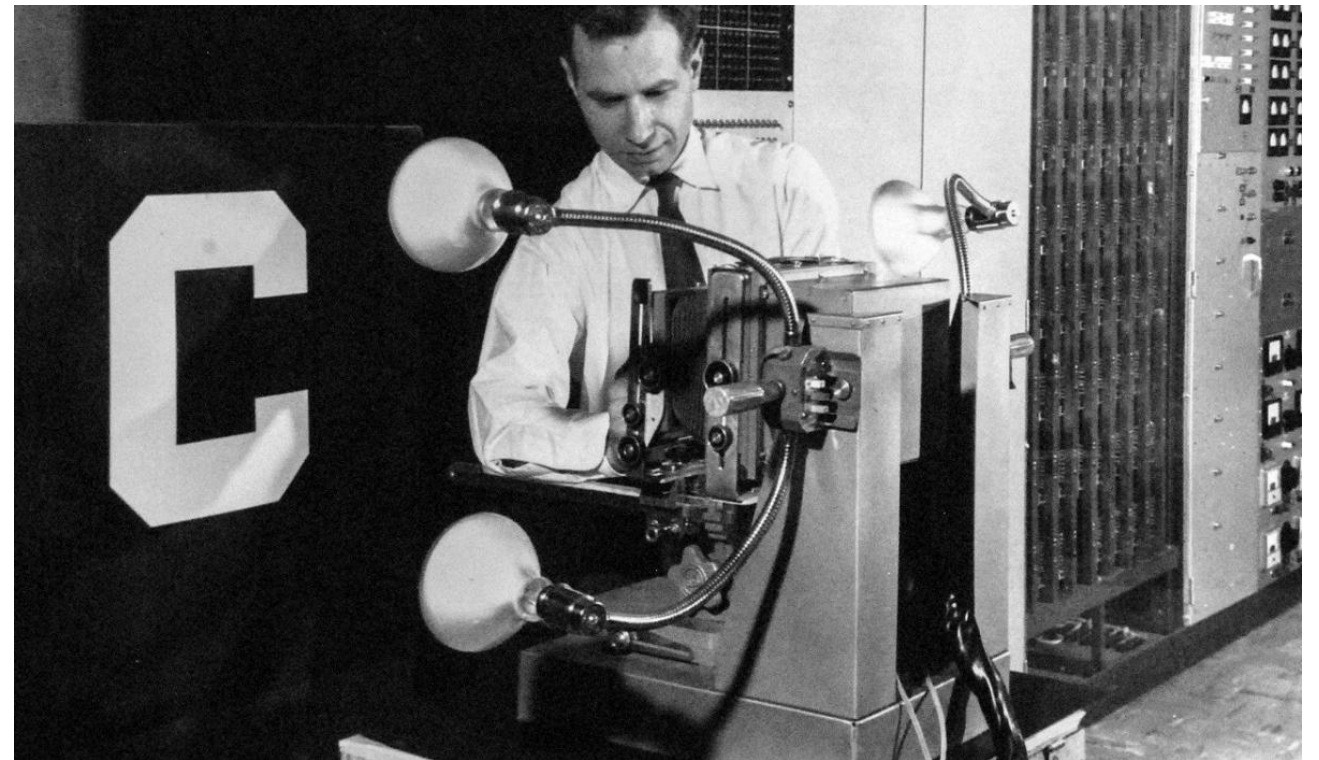
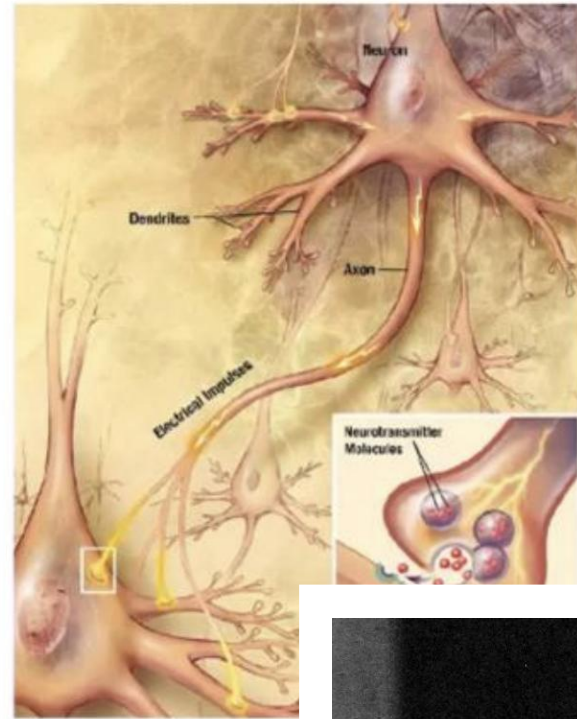
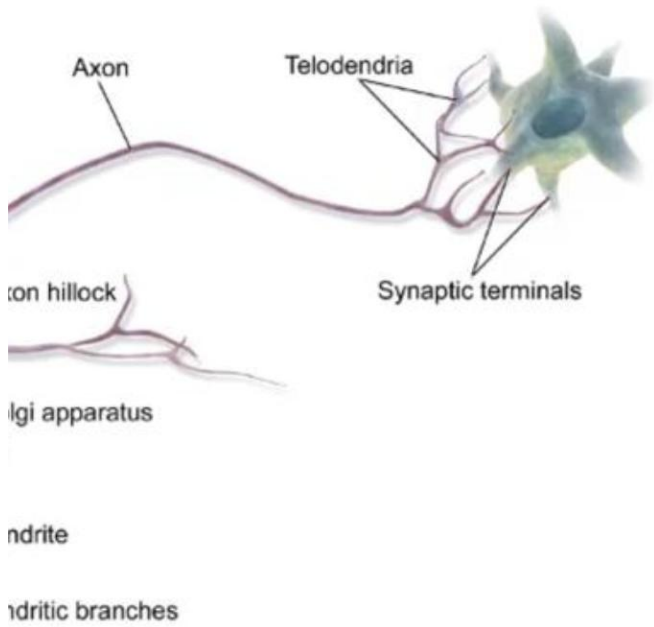
Computer systems that perform tasks which normally require human intelligence: perceiving, learning, reasoning and deciding.

EU AI Act (Reg. 2024/1689)

A machine-based system that infers, from the input it receives, how to generate outputs such as predictions, content, recommendations or decisions.

Key idea: modern AI is not programmed case by case — it learns patterns from data.





Seventy years of AI in brief

1950

■ Turing asks: "Can machines think?"

1956

■ The term "Artificial Intelligence" is coined at Dartmouth

1980s

■ Expert systems built on hand-written rules

1997

■ IBM Deep Blue beats Kasparov at chess

2012

■ Deep learning breakthrough in image recognition

2017

■ Transformer architecture, basis of today's language models

2022

■ ChatGPT brings generative AI to the public

2024

■ EU AI Act enters into force

What unlocked the current wave



Data

Sensors, images and digital records in huge volumes



Computing power

Graphics processors (GPUs) and the cloud

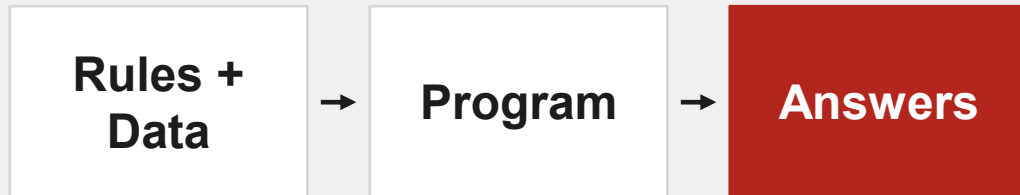


Algorithms

Neural networks that scale with data

From writing rules to learning from data

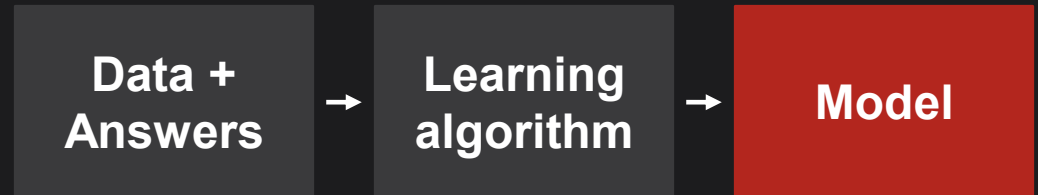
Traditional programming



Poultry example

A programmer writes the rule:
IF house temperature > 30 °C THEN sound the alarm

Machine learning

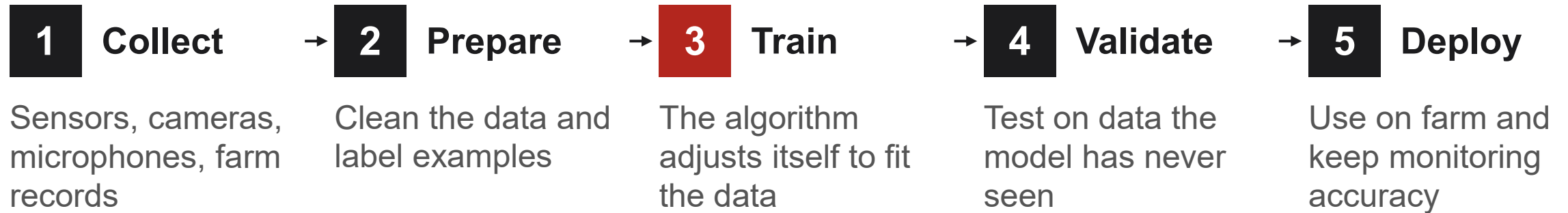


Poultry example

The model learns from temperature, humidity, water intake and bird behaviour records to predict heat stress hours in advance

The model is the "rule book" — discovered from examples rather than written by a programmer.

How a machine learns



Three ways of learning



Supervised

Learns from labelled examples.

e.g. Images of feet tagged with footpad dermatitis scores



Unsupervised

Finds hidden groups and anomalies without labels.

e.g. Unusual patterns in flock activity or feeding

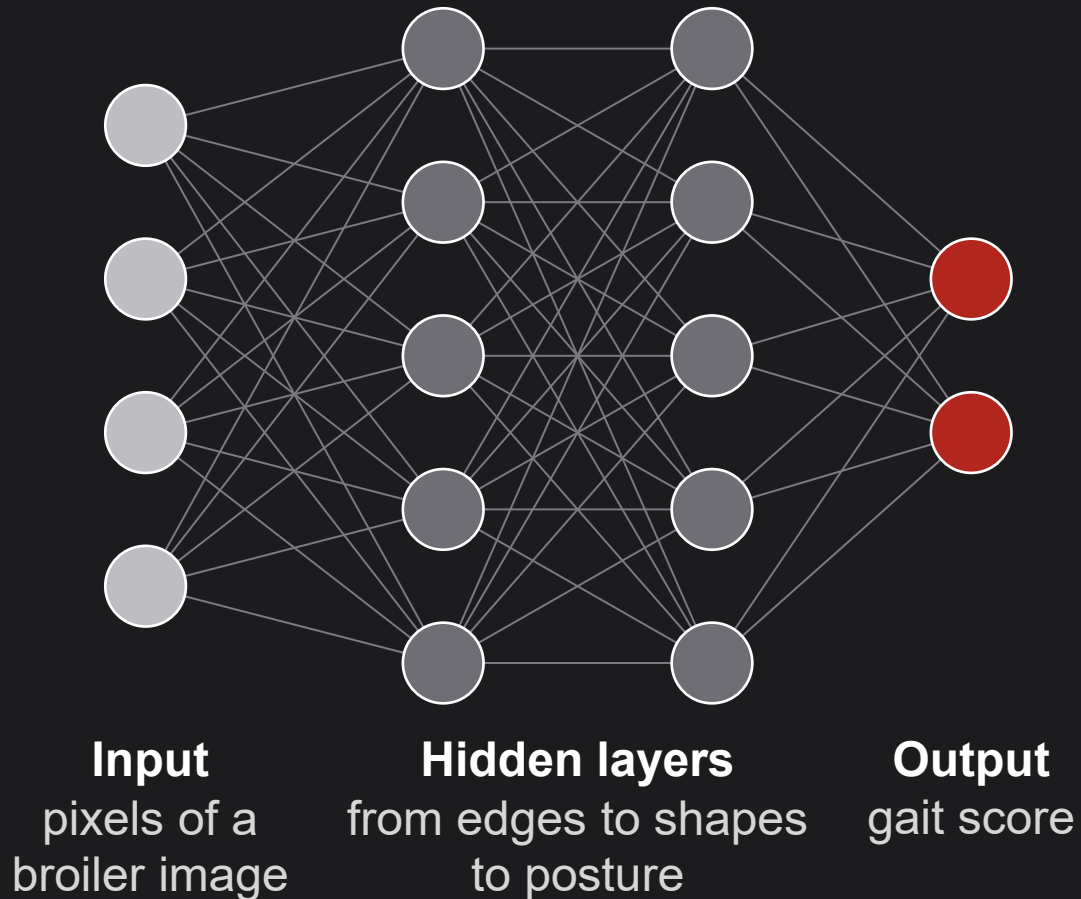


Reinforcement

Learns by trial, error and reward.

e.g. Ventilation control balancing bird comfort and energy use

Neural networks and generative AI



■ Deep learning

Artificial neurons stacked in many layers. Each layer extracts more abstract features, so the network can "see" images or "hear" sounds.

■ Generative AI

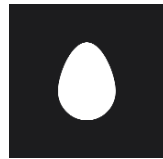
Large language models are trained on vast amounts of text to predict the next word. They draft, summarise, translate and answer questions.

■ Limits to keep in mind

Needs large, representative data; can be confidently wrong ("hallucinations"); reasoning is often hard to explain.

AI is only as good as the data it learns from.

AI along the poultry value chain



Breeding

Genomic selection and automated phenotyping

Hatchery

In-ovo sexing, egg and chick quality

Farm

Health, welfare, climate and growth

Feed

Raw material analysis and precision feeding

Processing

Carcass and meat inspection

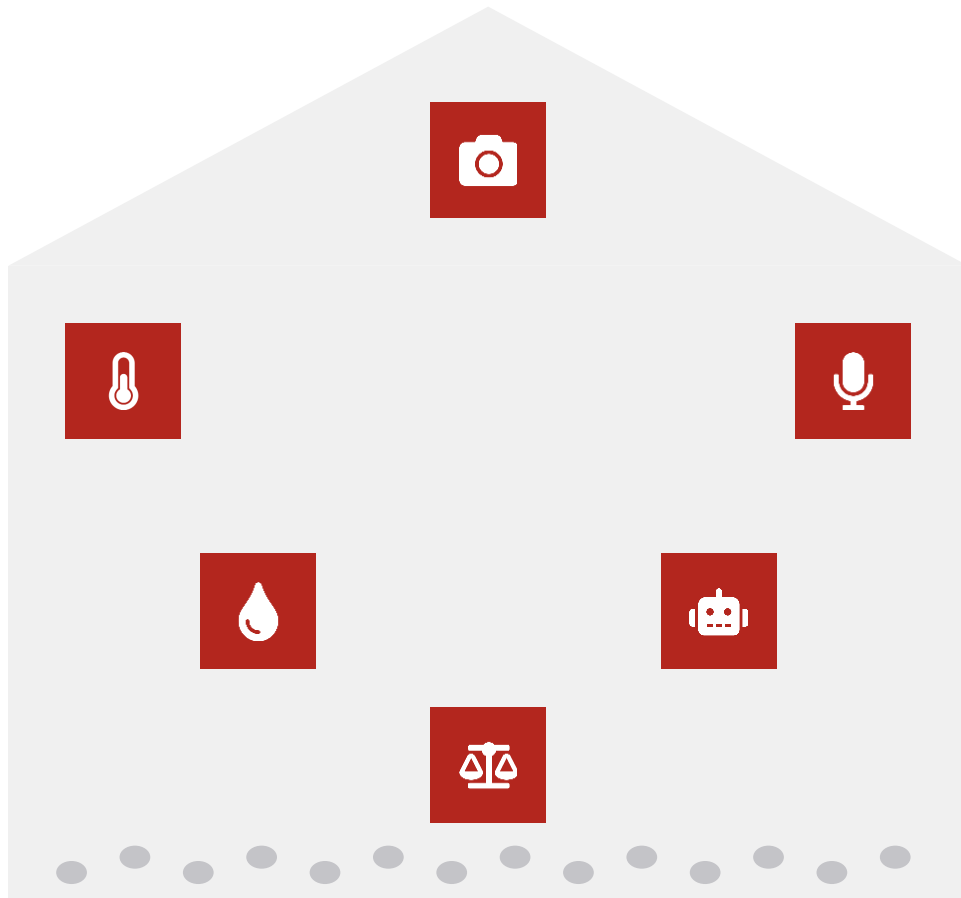
Egg grading

Cracks, dirt and blood spots



Every step produces data. AI turns them into earlier, more consistent decisions — from the breeding nucleus to the supermarket shelf.

Data sources in a modern poultry house



-  **Climate sensors:** temperature, humidity, CO₂, ammonia
-  **Cameras:** bird distribution, activity, gait, body weight
-  **Microphones:** coughs, rales, distress calls
-  **Water and feed meters:** daily intake patterns
-  **Bird scales:** growth curves
-  **Robots and farm records:** mortality, litter condition, treatments

The value comes from combining data streams, not from a single sensor.

Computer vision in broiler houses



Distribution and activity

How birds use the space: huddling, crowding or avoided areas



Body weight

Estimated from bird size in images, without handling



Gait and lameness

Walking patterns linked to gait scores and leg problems



Mortality and litter

Dead birds and wet or caked litter spotted early

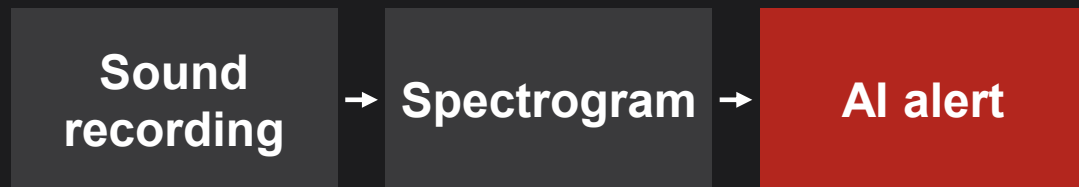
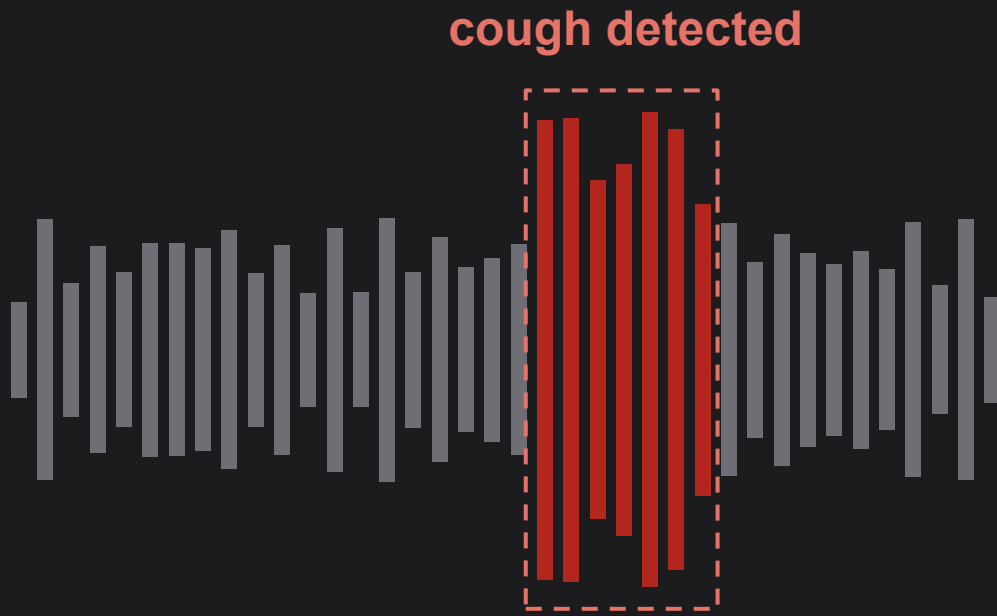
In practice

Ceiling cameras have tracked broiler distribution and activity on commercial farms for over a decade, alerting farmers when behaviour deviates from normal (e.g. Fancom eYeNamic).

■ Watch-outs

Dense flocks, dust and changing light make individual birds hard to follow; models must be validated in each type of house.

Listening to the flock



■ What it detects

Coughs, sneezes and rales linked to respiratory disease, distress calls and changes in overall vocal activity.

■ How it works

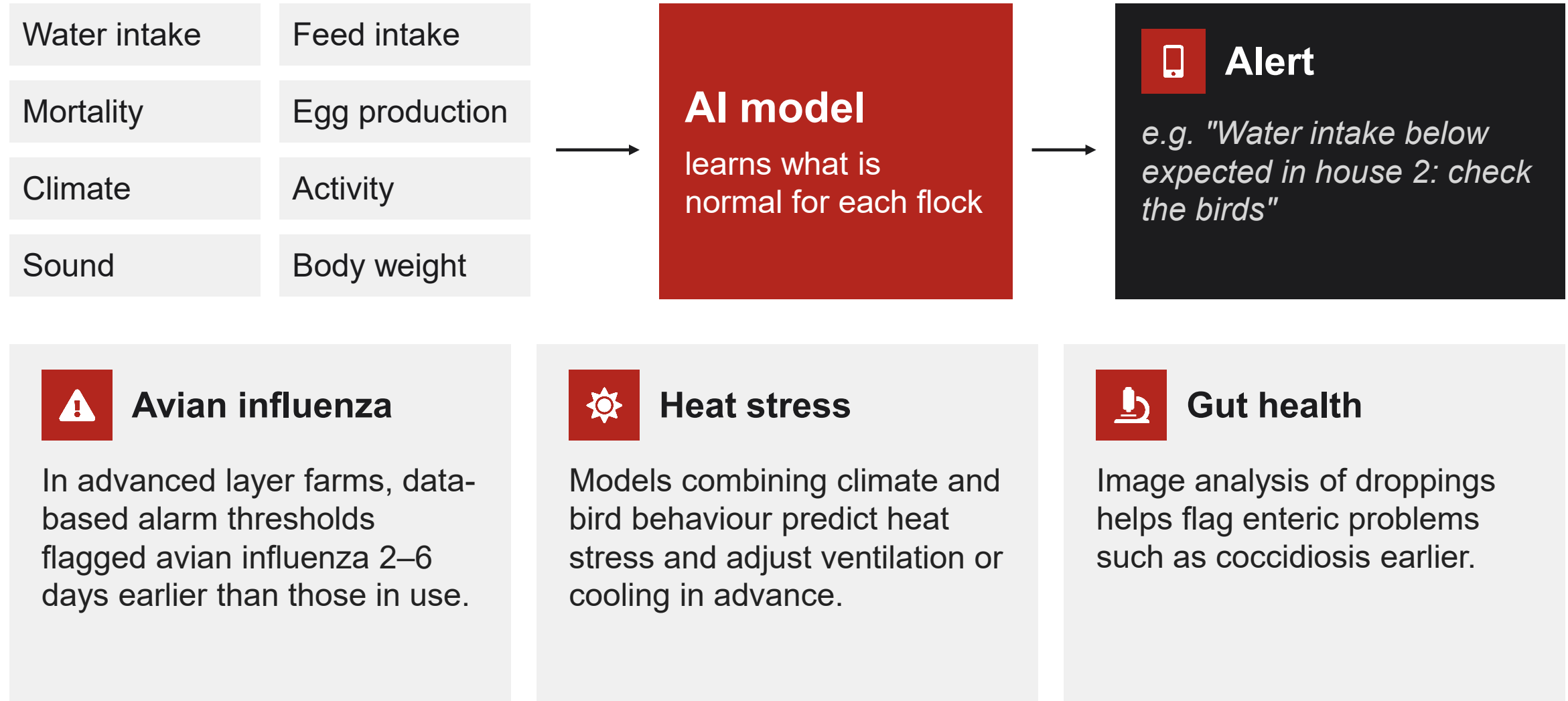
Microphones record continuously; sound is turned into spectrograms, "images" of sound, which deep learning models classify.

■ Limits

Fan and feeder noise, voices changing with age, and few systems validated on commercial farms.

Experimental studies report over 90% accuracy in detecting sick birds.

Early warning for health and welfare



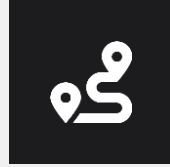
Robots in the poultry house



Ceiling-rail robots

Travel above the birds, measuring climate and using thermal images to find dead birds and abnormal droppings.

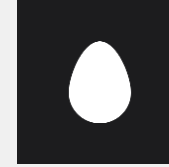
e.g. ChickenBoy (Faromatics)



Floor robots

Move among the birds to keep them active, aerate the litter and discourage floor laying.

e.g. Spoutnic, T-Moov (Tibot)

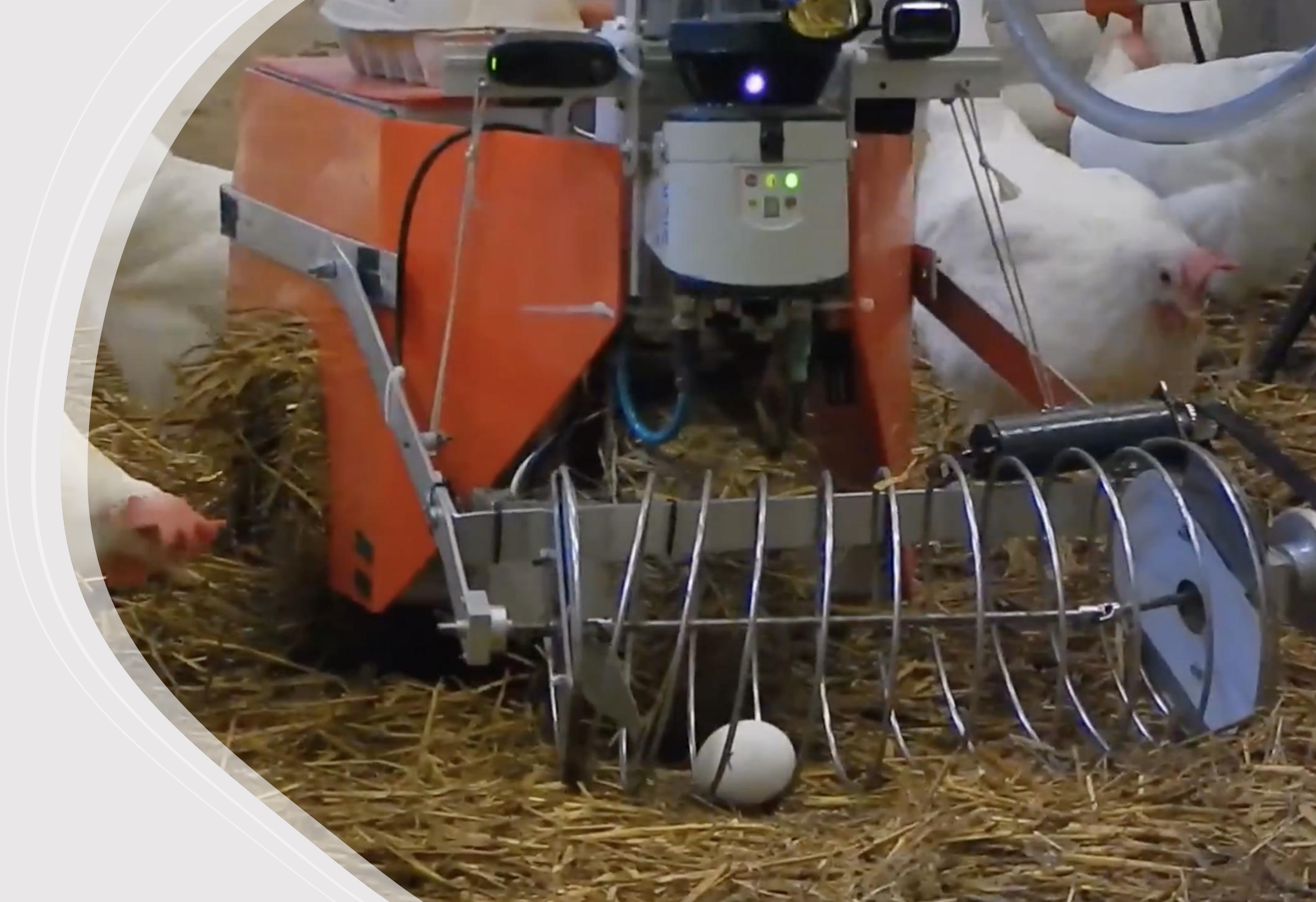


Egg-picking and cleaning robots

Collect floor eggs or disinfect empty houses; several are still at prototype stage.

e.g. PoultryBot (Wageningen), Octopus Robots

AI gives robots their eyes: navigating among birds and recognising eggs, carcasses and litter.



Laying hens and egg quality

On the farm



Floor eggs detected and collected by vision-guided robots



Feather cover and pecking damage scored from images



Laying-rate curves checked daily to flag deviations early



Individual hens tracked with RFID in aviaries (mainly research)



Grading data flow back to the farm as indicators of shell quality and flock health.

In the grading centre

250,000

eggs per hour inspected by deep learning, from 16 images of each egg

AI detects cracks, dirt, leakers and blood spots without touching the egg, and can estimate weight from images.

e.g. SANOVO VisionAI, Moba Omnia PX+

Hatchery: sexing the egg, not the chick

40%

of EU commercial laying hens came from in-ovo sexed eggs by June 2026

>85%

Switzerland

52%

Norway

both without a legal ban on culling

■ Why it matters

Around 7 billion day-old male chicks of laying breeds are culled worldwide each year; Germany and France have banned the practice and Italy is phasing it out.

■ Where AI comes in

Imaging methods such as hyperspectral light and MRI use AI to read the embryo's sex through the shell, without opening the egg.

■ Beyond sexing

Cameras and models check fertility during incubation and score day-old chick quality.

Extra cost: less than 1 euro cent per egg

Feed and nutrition



Diets are formulated on the real composition of each batch, not on table values.



Growth and FCR prediction

Farm data forecast growth and feed conversion, helping to adjust feeding programmes and slaughter timing.



Precision feeding

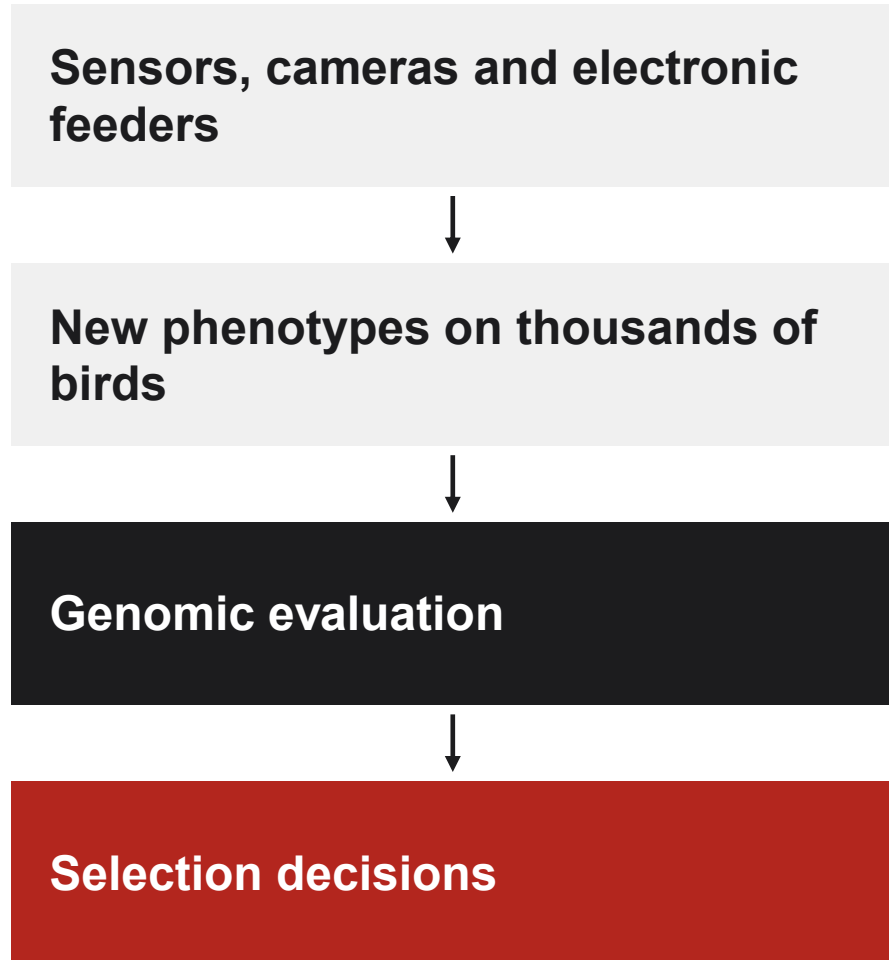
Nutrient supply matched more closely to the birds' needs by age, sex and flock performance.



Feed safety

Weather and harvest data used to predict mycotoxin risk in cereals.

Breeding and genetics



■ Automated phenotyping

Individual feed intake, behaviour and gait recorded continuously, opening the way to new traits for efficiency, robustness and welfare.

■ ML in genomic prediction

Can capture complex, non-linear effects, but so far rarely outperforms standard methods such as GBLUP.

■ Balanced breeding goals

Traits recorded automatically help combine productivity with health and welfare in the selection index.

At the processing plant

Woody breast: a case for machine vision

95%

accuracy in classifying three woody breast levels with hyperspectral imaging and AI

up to 20%

of chicken breast meat can show the defect

> \$1 bn

estimated yearly cost of woody breast to the US poultry industry



Carcass and meat inspection

Vision systems check every carcass at line speed for contamination, bruises and defects, and support grading and portioning.



Welfare monitoring from the line

Cameras score footpad dermatitis and hock burn in every flock; agreement with human assessors is good for lesion size, weaker for mild lesions.

Agentic AI in practice: one night in a broiler house

Illustrative scenario — an AI agent that perceives, reasons and acts, with humans in the loop

02:40 · HOUSE 3

Day 28 · 32,000 broilers



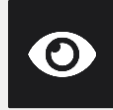
Water intake –12% in the last 3 hours



Coughing index rising (acoustic sensors)



Ammonia 22 ppm and climbing



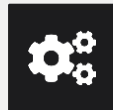
1 PERCEIVE

Fuses sensors, cameras and sound; compares with the flock's own baseline



2 REASON

Ranks likely causes: ventilation, drinker fault or respiratory disease



3 ACT

Raises ventilation within set limits, checks line pressure, alerts farmer and vet

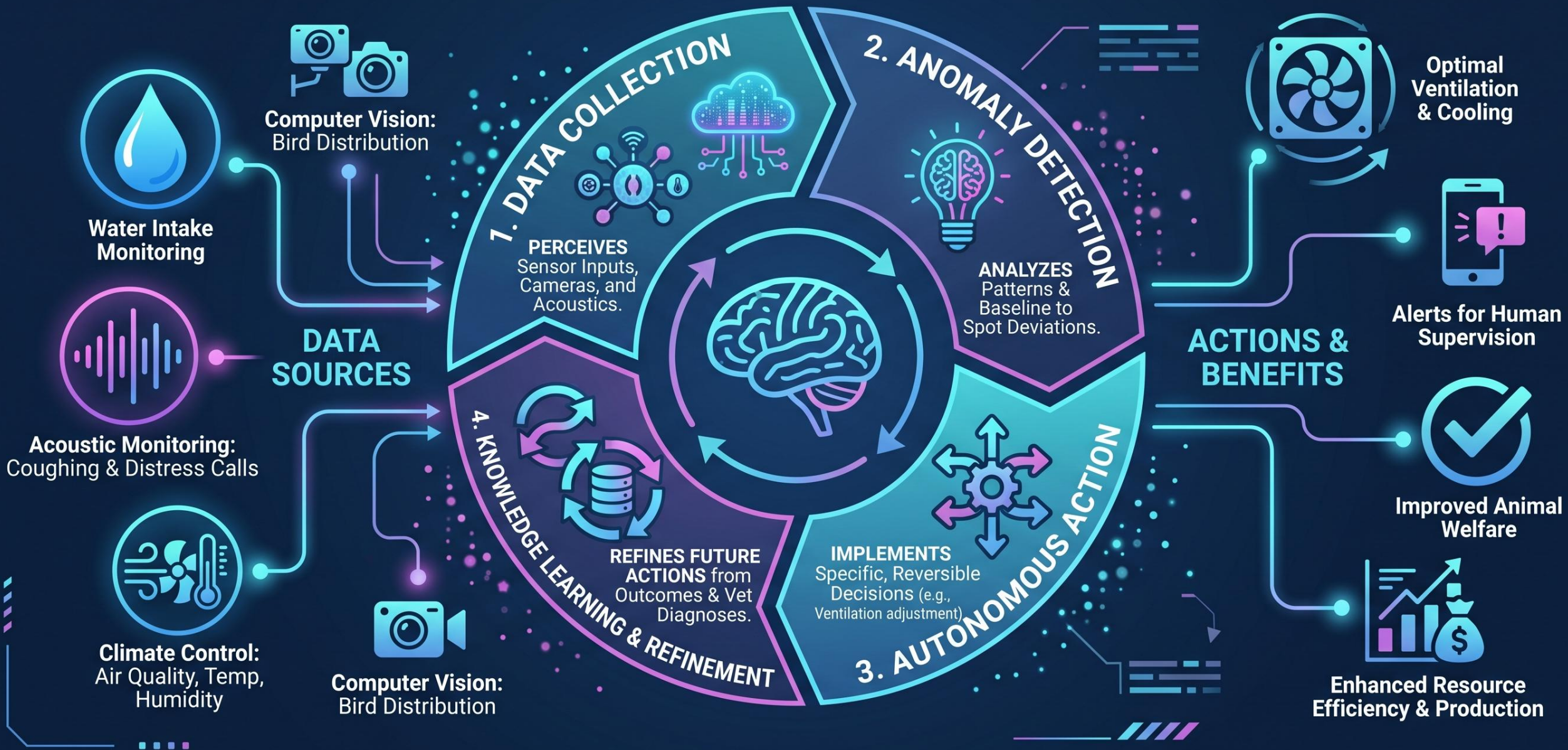


4 LEARN

Logs the vet's diagnosis and the outcome; refines future alerts

Key point: the agent handles routine, reversible actions. Diagnosis and treatment stay with the vet.

AGENTIC AI IN POULTRY FARMING: THE AUTONOMOUS LOOP



Looking ahead (1): the poultry house that runs itself

Speculative outlook — ideas not yet on the market or demonstrated in practice



Autonomous house

An agent runs climate, feed, water and light around the clock. One person supervises dozens of farms remotely.



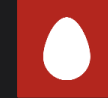
Flock language model

Trained on sounds and movement of millions of birds, it reads the flock's state like a vital sign.



Live gut steering

Sensors read gut health from litter gases; the agent adjusts feed additives day by day.



Per-egg incubation

Every egg is monitored and gets its own conditions, from embryo to hatch.

What changes: the farmer moves from doing the work to setting goals and limits for the machine.

Looking ahead (2): an AI-connected poultry chain

Speculative outlook — ideas not yet on the market or demonstrated in practice



Negotiating agents

Farm, feed mill, hatchery and slaughterhouse agents agree on deliveries, catching and prices by themselves.



Birds' own choices

The house offers options — light, space, enrichment — and learns what each flock prefers.



Generative feed design

AI designs new enzymes and proteins tailored to each genetic line and to local raw materials.



Welfare passport

The consumer scans the pack and sees verified data on how the birds actually lived.

Open questions: who owns the data, who is liable when an agent decides, and who audits it?

Challenges and take-home messages

Challenges

- Data quality and ownership: who controls farm data?
- Validation on commercial farms, not only in research
- Costs and skills, especially for smaller farms
- Interoperability between equipment brands
- Rules: EU AI Act, data governance, liability

Take-home messages

- 1** AI is already at work in hatcheries, grading centres and processing plants.
- 2** On farm, it turns continuous monitoring into earlier health and welfare decisions.
- 3** Farmers and veterinarians remain essential: AI supports their judgement, it does not replace it.
- 4** Good data, independent validation and clear rules decide its success.



Thanks for your Attention

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ARTIFICIAL INTELLIGENCE

ABSTRACT NEURAL NETWORK