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AI4Animals.

Reinventing CCTV surveillance in slaughterhouses using AI – WMC – October 12th 2023

Introduction



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Senior Data Scientist

@ AI4Animals

- 6+ years at Deloitte
- Artificial Intelligence Team
- Background in Econometrics and Mechanical Engineering



AI*4*Animals

Our ambition was and still is…

To reduce avoidable and unnecessary animal suffering through innovative technology and its effective adoption, in close collaboration with committed organizations

Positive media response


THE TIMES | Saturday July 10 2021

Abuse at abattoirs caught on video but no one watches it

Ben Webster Environment Editor

Animals are being abused in slaughterhouses in front of CCTV cameras but no action is being taken because the video is not being checked.

The government had claimed that making cameras compulsory in slaughterhouses in England from 2018 would "cement the UK's position as a global leader in animal welfare standards".

Animal Justice Project (AJP) secretly placed cameras beside official CCTV at Ingham Foods slaughterhouse in Redgrave, Suffolk. At Hewitt it filmed cows being beaten with sticks and struck on sensitive areas with electric prods; animals being cut and kicking, apparently still conscious after being stunned too briefly; and a piglet placed in hot water while apparently still alive.

At Gressingham, which supplies many supermarkets, ducks were seen being pushed into metal foot shackles and left for long periods while waiting to be killed. Workers used live birds to knock off feet from dead birds that had become wedged in the line. Birds were grabbed by the head, neck and wings.

Alick Simmons, a former government deputy chief vet, said the video showed apparent breaches of welfare laws, adding that at Hewitt "the handling, stunning and killing of piglets is barely adequate, the stunning equipment appears to fail on several occasions, repeated shouting by the operatives adds to the animals' distress and at no time are operatives seen to monitor the effectiveness of the stun".

Simmons said that the apparent breaches would have been detected if the recordings had been viewed by their "official vets", which are authorised by the Food Standards Agency (FSA).

Hewitt's vet reported no welfare non-compliances during the eight days AJP was filming, and during which it said it had recorded more than 30 breaches.

The FSA seized CCTV film from Hewitt after being informed by AJP of the abuses. It said that it could not comment as its investigation was continuing. It said that the Gressingham case "is currently under review by the Crown Prosecution Service".

Hewitt did not respond but forwarded questions to the Association of Independent Meat Suppliers, its trade body, which said that it seemed likely from AJP's film that animals had been "treated unacceptably" but many of AJP's allegations were "nonsense".

In November when AJP first made allegations about its slaughterhouse Gressingham said there was no clear evidence of abuse or neglect but that there were "actions that are not representative of the high standards expected of our factory". Yesterday it said: "The incident was a result of human error and disciplinary action has been taken. The CPS are reviewing the incident to determine if there is a case to be answered."

Sainsbury's said it had investigated the Gressingham video and had "outlined a number of actions they were required to take".

Artificial eyes

The government is considering using artificial intelligence to analyse CCTV video at abattoirs to detect abuses more quickly and easily. The system, in use in the Netherlands and Germany, selects clips of incidents that are most likely to involve mistreatment. It can reduce 60 hours of video from six cameras to half an hour of clips then viewed by a vet. In tests it identified 90 per cent of problems. It can detect signs of life after animals have been stunned and spot a bottleneck that causes stress. Officials have met Deloitte, which developed the system with Eyes for Animals, to discuss introducing it.



Incorrect handling of animals at Vion will be detected faster thanks to improved camera surveillance



Intelligent camera surveillance to protect pigs better against pain and stress



Dutch Minister C. van der Wal interested in AI4A at the Grune Woche in Berlin

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AI4A in summary

What it is

AI4A consists of AI models and a dashboard that significantly improves the effectiveness of camera surveillance by automatically detecting **animal handling and welfare issues**

Challenge

- Most slaughterhouses have implemented **camera monitoring systems**
- Everyday, this results in **hundreds of hours of video recordings**
- Slaughterhouse personnel tend to review a **random and small selection** of recordings
- As a result, most **video recordings remains unseen**
- Current camera systems are **not able to identify trends** and structural issues

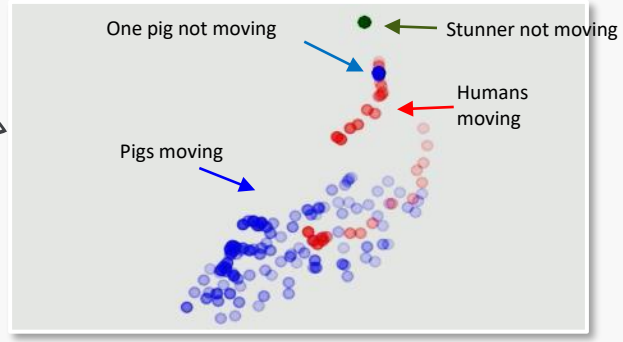
How it works

1 AI solution - detections



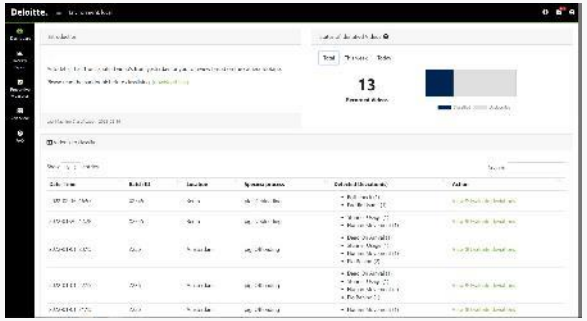
The AI4A algorithm detects animals, people, and objects and how they interact

2 AI solution – movement heatmaps



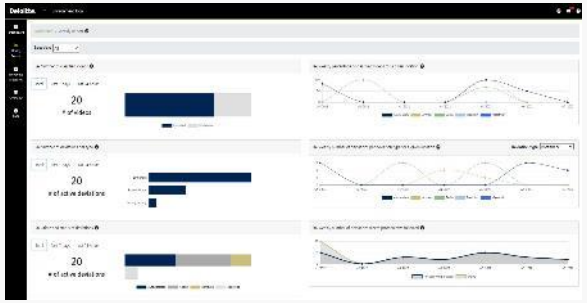
Images are translated into movement heatmaps to detect potential handling issues

3 Dashboard - deviations list review



AI4A selects and aggregates all video recordings containing potential deviations to be reviewed

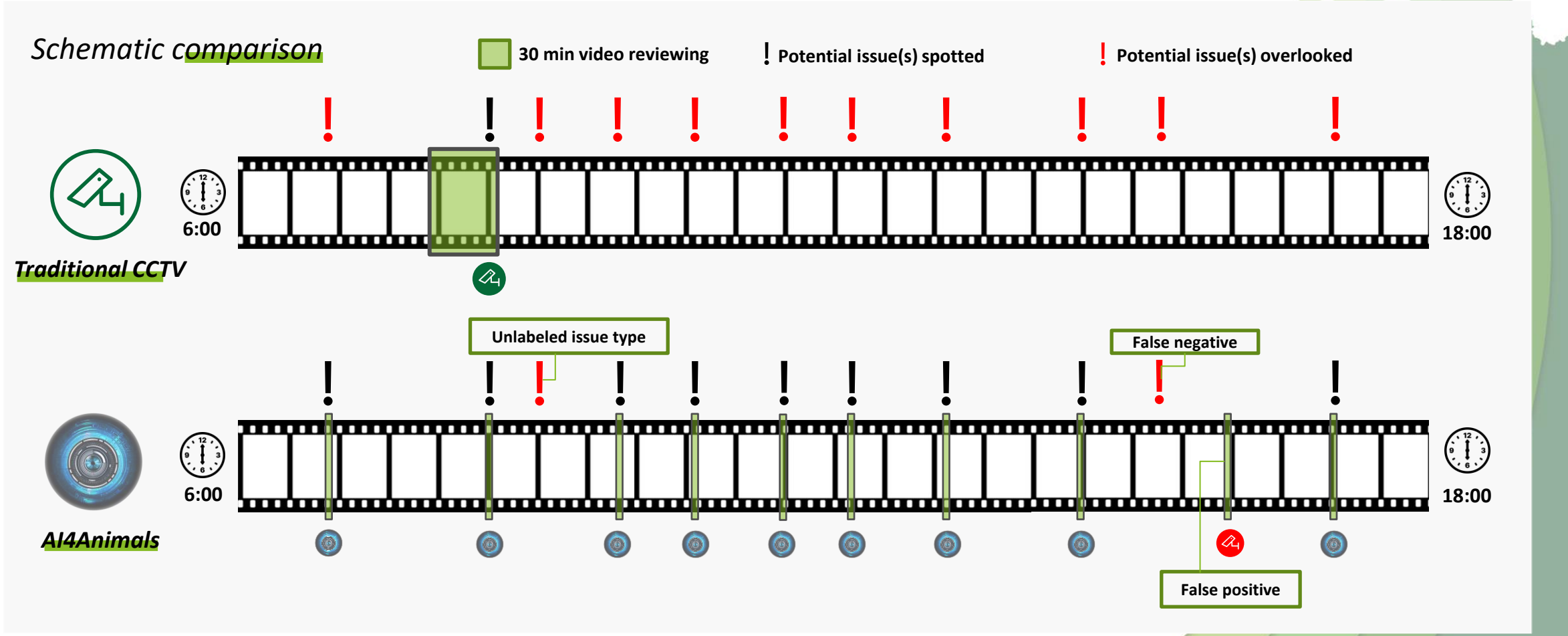
4 Dashboard - trend reports



AI4A includes trends reports outlining deviations over time and per slaughterhouse

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Traditional vs. smart camera surveillance



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AI4A features - pigs



Use of emergency stunner



Immobilized pig



Counting pigs



Stressful human behavior



Use of stimulator / prod



Use of paddle



Congestion



Signs of life / movement
gasping / breathing



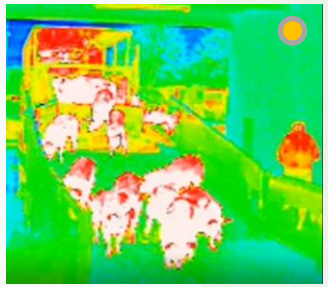
Real time notification



Privacy / blurring



Audio analytics / stress calls



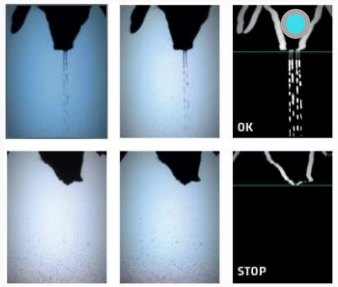
Thermographic / heat issues / wounds



Kicking, hitting, dragging
(not AI4A client)



Reflex after stunning



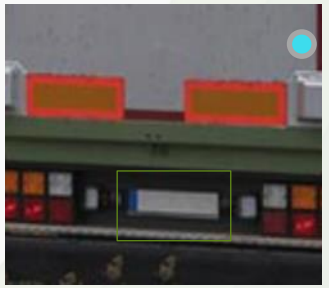
Blood Stream



Cut



Stun – stick interval



Link to transport & farm

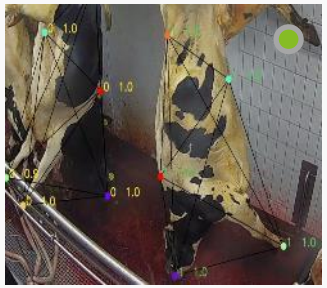
- Production
- Pilot
- Being Developed (Q3/Q4)

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AI4A features - cows, calves and chicken



Immobilized



Signs of life



Congestion



Unnecessary contact

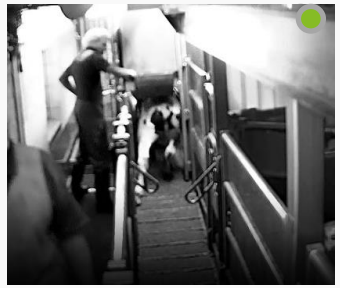


Stunning box issues

- Production
- Being Developed (Q3/Q4)
- PoC



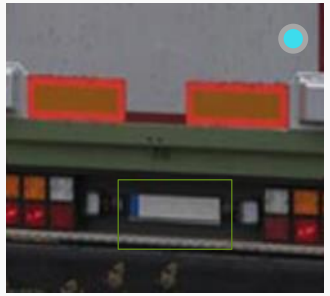
Tail twisting



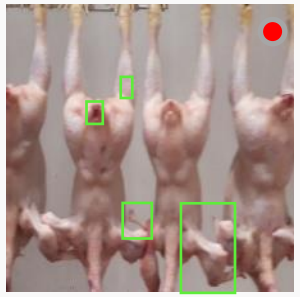
Fence hitting animal



Privacy / blurring



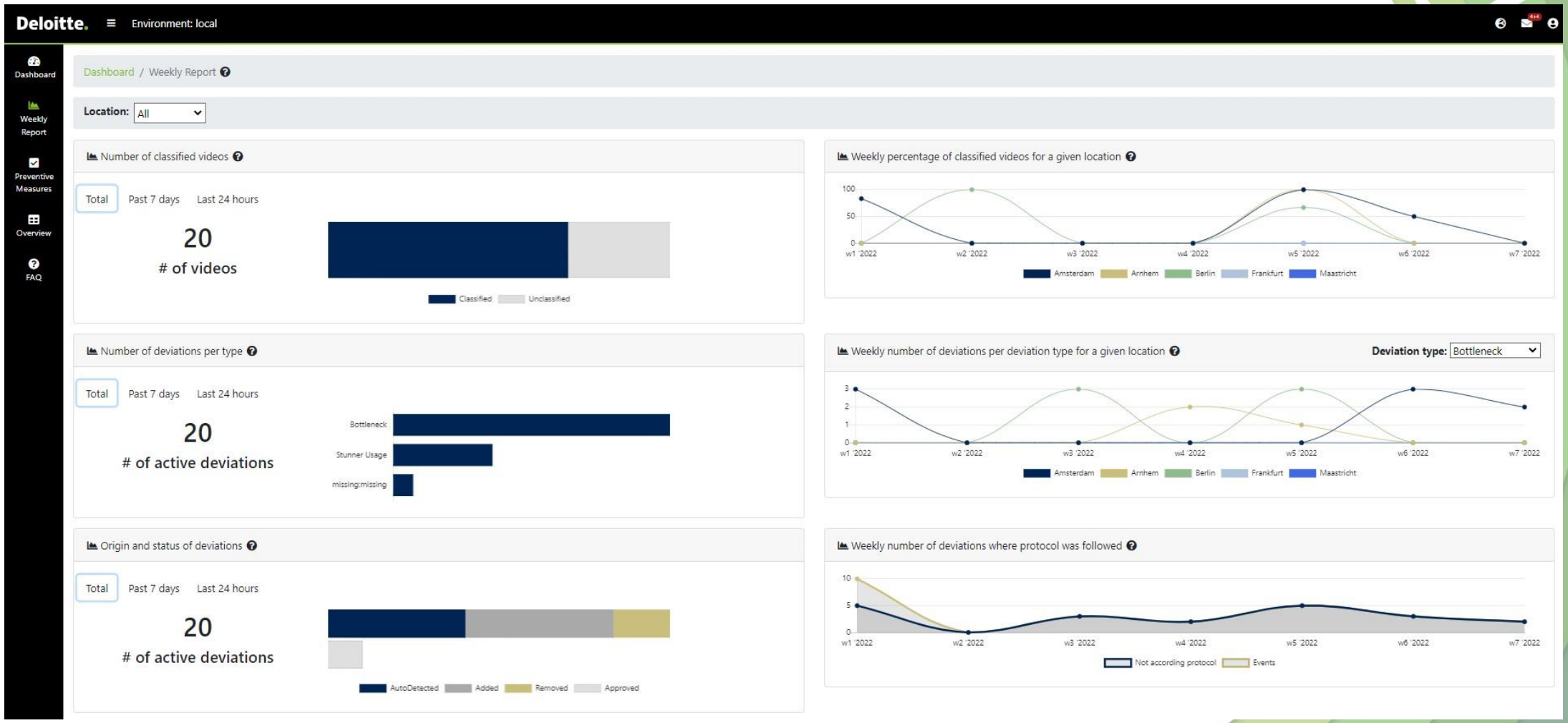
Link to transport & farm



Postmortem chicken PoC

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Dashboard – example report

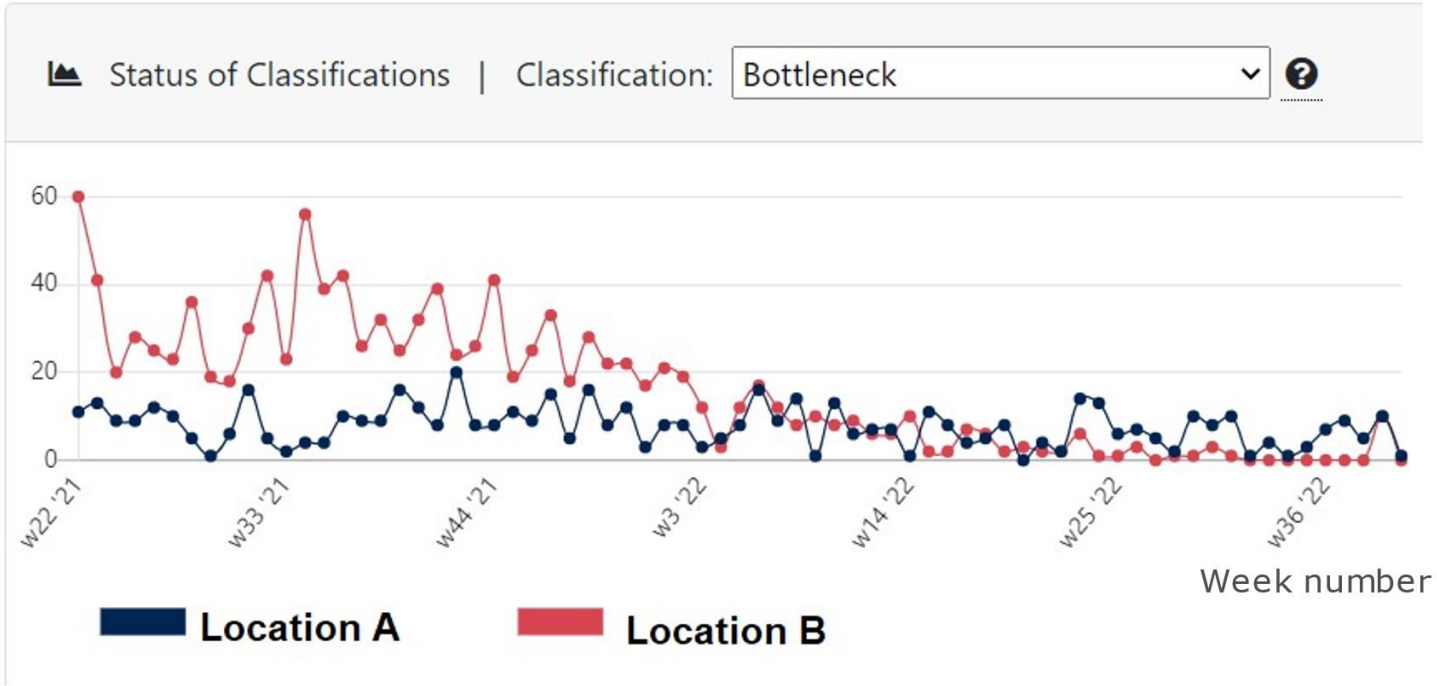


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Example AI*4*A impact

Real impact

AI*4*A allows to monitor whether there is an increasing or declining trend in the number and severity of the animal handling issues



Vion case

- **Too many animals in one area resulting in congestions causes stress**
- With the help of AI4A the client analyzed the **root causes at slaughterhouse B**
- Conclusion: bottleneck- and congestion-related stress situations were primarily caused due to **uncoordinated unloading of animals by truck drivers and use of paddles**
- Based on those observations Vion adjusted the **unloading procedures and phased out paddles.** This resulted in a significant reduction of bottlenecks

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Value according to AI*4*Animals clients

- Incidental and structural animal handling issues identified faster
- Fact based and objective insights and reporting across all plants
- Opportunity for learning and improvement
- Improved animal welfare results into improved operations
- Traceability of improvement measures
- Enables comparison / benchmarking between slaughterhouses
- Avoid incidents becoming structural issues becoming culture

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AI4A Platform

Deloitte.

AI4A scalability

We have a platform which forms a solid basis to further expand on to improve animal welfare surveillance

Sensor input

- **Visual**
- **Thermal**
- **Audio**
- **Other** *(e.g. CO_2, wearables)*

- slaughterhouse sensory input is gathered through **various types of sensors** (currently only visual in operation)
- Potentially **any sensor input** can **be used** and added

On-premise processing

Panorama edge computing device

- AI models **process** the sensory input in **real-time**
- AWS device brings cloud capabilities on-premise, allowing for **local** and **cost-effective** processing
- AI **models** can be **continuously updated** to improve accuracy or include more features

Cloud hosting

- All deviation data is stored in the **highly secured cloud environment**
- All available data could be used to **improve current AI models**
- Model **training occurs in the cloud**, with updated models immediately usable locally through on-premise component

Dashboard



- Dashboard provides **overview of deviations** across locations
- Allows **building of statistics** across time and locations
- **Potential benchmarking** between slaughterhouses

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The benefits of AI4Animals

Existing Infrastructure

A mature platform, AI4Animals offers existing models for 15+ features, CI/CD pipelines to enable quick iterations and off-the-shelf reporting dashboards.

Local & Increased Privacy

Edge AI enhances privacy by containing the data locally and limiting upload to only the analysis and insights to the cloud. Therefore, the data doesn't have to encounter a human



Cost Efficient

By utilizing existing (sensor) infrastructure, such as CCTV cameras and network microphones, AI4A has a low barrier of entry. Additionally, applications need less internet bandwidth due to the close nature, greatly reducing network costs.

MLOps

The AI4Animals platform is built using the core principles of Machine Learning Operations, as developed by Deloitte.

Real Time Insights

Due to the local nature of edge AI, it can give real time insights for crucial and complicated processes.

Short Time to Market

Due to all these factors, Edge AI becomes an easy, cost effective and safe solution to use

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Draft - for discussion purposes

Proof of concept approach and timeline

During our proof of concept, we will gather information on the current situation, select the most suitable hardware for the solution, and train and evaluate the initial models

Throughput time	2~3 weeks	~3 weeks	2~4 weeks
	Preparation and hardware	**Model training and validation**	**Evaluation and follow up**
Purpose	Gather information on process and define hardware setup for solution	Develop models based on video data received with selected hardware setup	Evaluate initial models and define follow up
Activities	• Facilitate kick-off with relevant stakeholders • Define success criteria • Use collected input of locations to define hardware setup • Setup proper hardware • Evaluate quality of video footage collected from selected hardware	• Find and label deviations based on received video data • Train models with AI pipelines • Validate findings of trained models	• Test developed model and gather metrics on its accuracy • Facilitate evaluation session with relevant stakeholders
Results	• Video data received for model training	• Labelled training set for model training • Model trained for decapitation issues	• Model accuracy metrics presented at evaluation session • Follow up actions discussed and defined

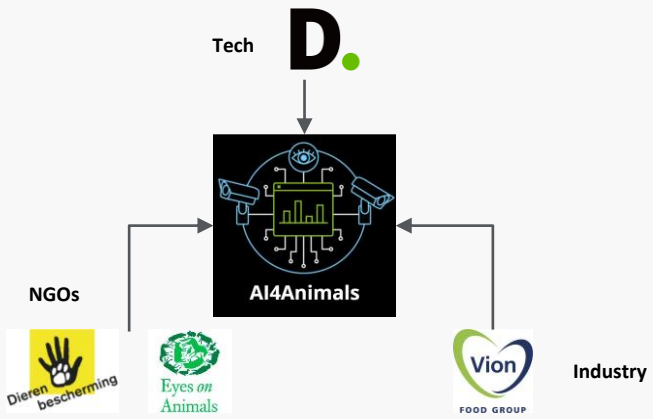
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AI4A Partnerships

Partners of AI4A

Beter Leven Keurmerk | Dieren-bescherming | Eyes on Animals | Vion Food Group | Amazon Web Services

Start of AI4A (2019)



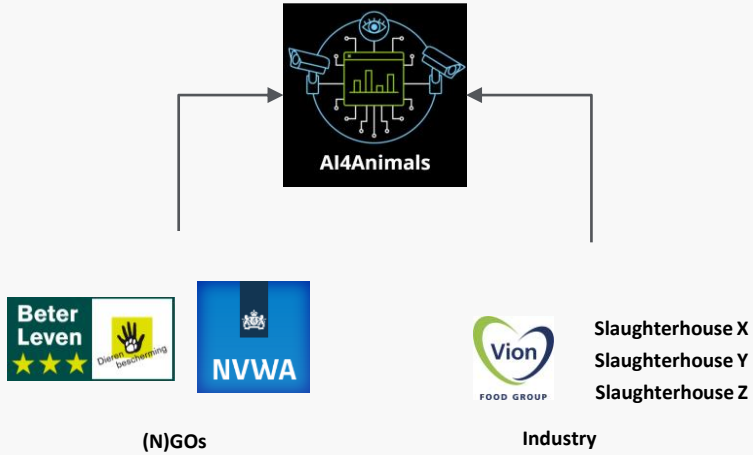
Consortium where all parties invested in building solution

AI4A as a platform (2021)

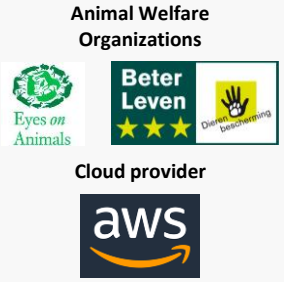


Investment from AWS to build **real time** edge computing **platform**

AI4A at clients (2022-)



Asset with revenue from **license fees** (industry) and investment for **new features** from (N)Gos



Support on 'where to play' from Animal Welfare organizations and platform support from Cloud partner. Both where needed

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Questions?