Tail biting in pigs

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The problem of tail biting

- Growing pigs bite other pigs' tails causing injury
  - Welfare: painful, route for infection
  - Costly: carcass losses (£10.4m/pa UK)
- Multifactorial risk factors
  - Lack of manipulable material, feeder space, various environmental stressors
  - Tail docking reduces risk but industry under pressure to change (EU 'ban')
- Unpredictable outbreaks
  - Regardless of system, starts without warning in an 'outbreak'
  - Quickly spreads to affect other pigs in the pen

Could low tail posture be an early warning sign that reduces unpredictability?

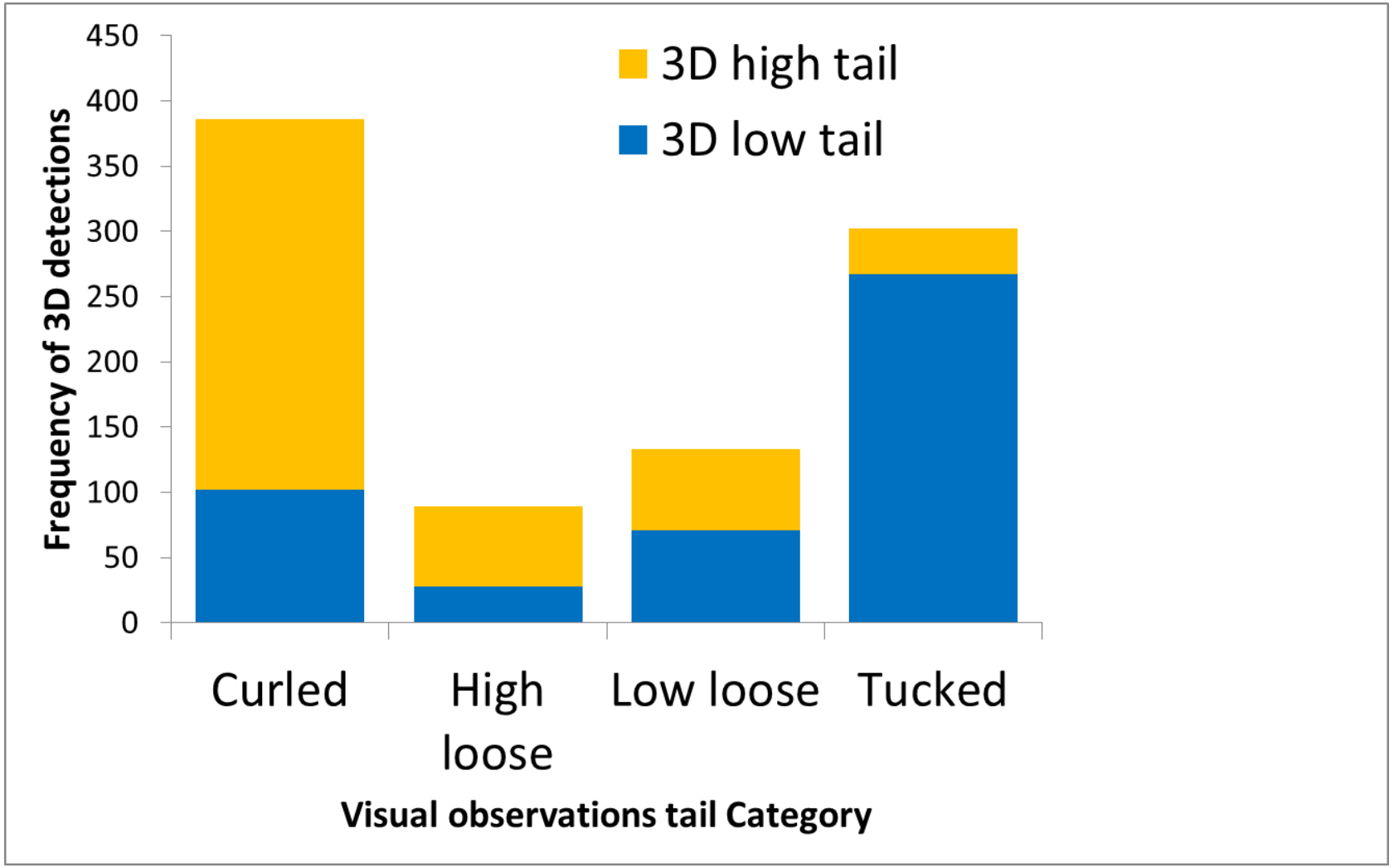
- Research suggests that when biting begins, **bitten pigs lower their tails**

- Can we use **3D cameras** to detect **low tail posture** and use this as an early warning sign of tail biting?

3D Tails project

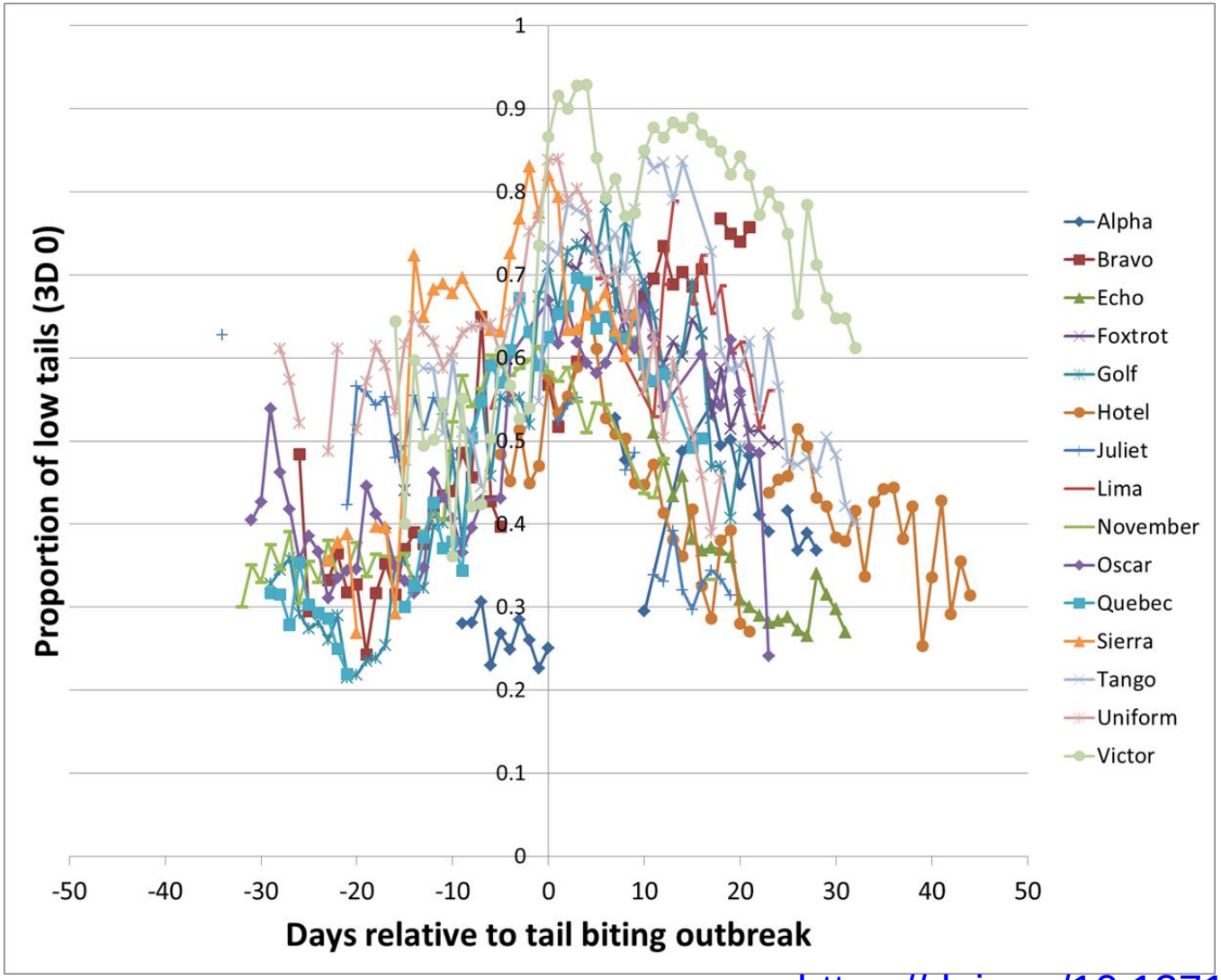
- Can Innovent Technology Ltd develop a ‘machine vision’ algorithm to detect low tail posture?
- Does low tail posture increase pre-outbreak?
- Undocked pigs in a relatively high risk SRUC research farm- 3D, 2D cameras and tail injury scoring
- 15/23 groups had outbreaks

Human vision vs Machine vision: tail posture algorithm worked – 75% accurate



https://doi.org/10.1371/journal.pone.0194524

3D ‘low tails’ increases before tail biting outbreaks



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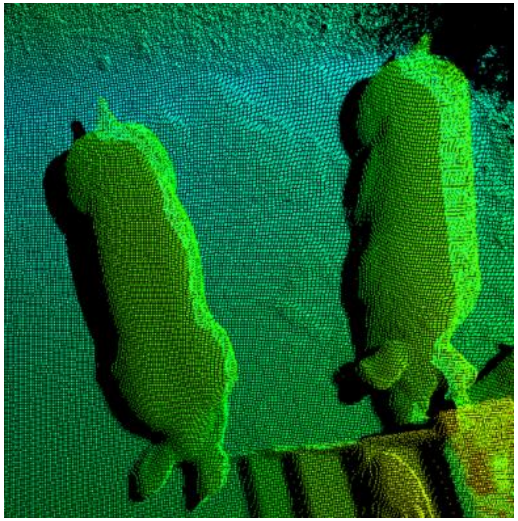
What have we learnt from 3D tails?

- ‘Proof of concept’ - it works as well as we could have hoped:
  - 3D cameras/ algorithms can detect low tails
  - Low tails increase pre outbreak



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TailTech project aim

- To develop a prototype early warning system for tail biting and test its real-world technical performance and economic value

TailTech progress

- 21 months into a 3 year project
  - Diverse farm systems – 8 commercial farms
  - 3D cameras collecting low tails data and regular farm visits for validation by tail scoring
  - Injury-low tails relationship still seen
  - Developing farmer interface / reporting / early warning system and improving it with farmer feedback

Collaborative research on tail biting

- Comparing different methods to stop an outbreak once it begins
  - Removing victims, removing biters, adding enrichment

https://www.pigprogress.net/Health/Articles/2019/11/What-to-do-when-tail-biting-occurs-504764E/
https://doi.org/10.3390/ani9080582 https://doi.org/10.3390/ani9060365

- Showing that intervention is more effective the sooner it is (early warning signs)

https://doi.org/10.1016/j.livsci.2018.06.010

- Enrichment to reduce risk, even in pens with slatted floors

https://doi.org/10.3390/ani9040139

Summary

- Low tail posture is an early warning sign of tail biting
- Increasing low tails (and minor tail injuries) can be detected by inspecting pigs
- We are developing a prototype early warning system for farmers using 3D cameras
- How to reduce risk, and how to respond to prevent or stop outbreaks remain challenges

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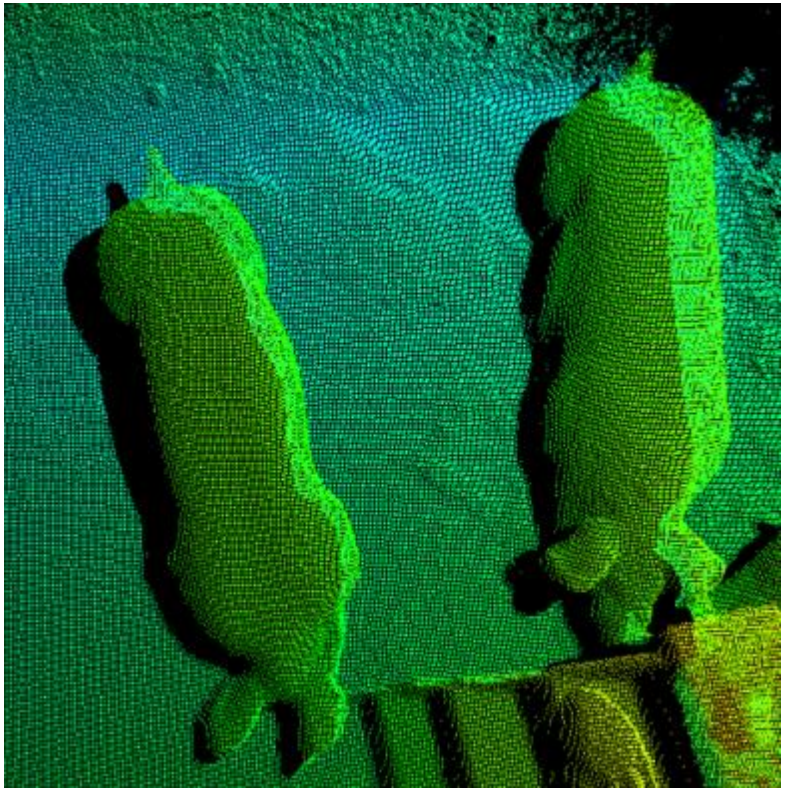
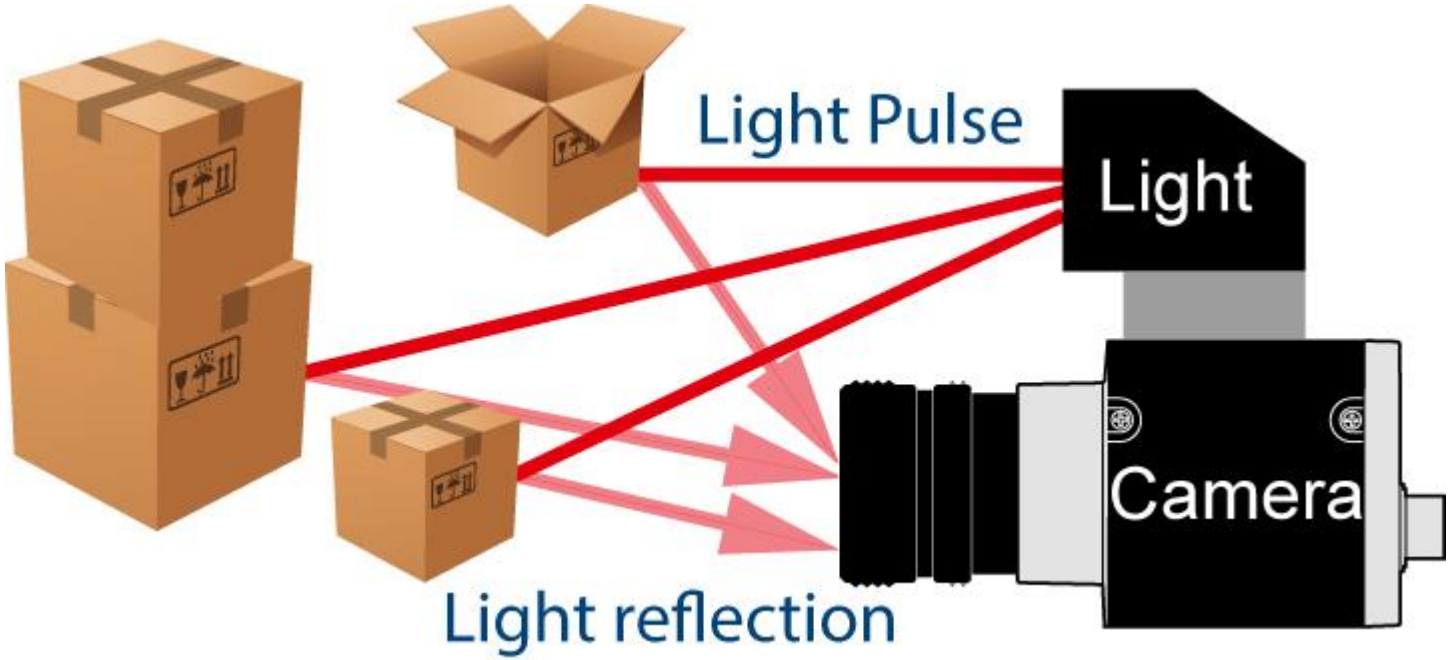
Technology collaboration



- Camera-based system to weigh pigs in pen (to monitor growth) qscan / ProGrow

How 3D cameras work

- We use ‘time of flight’ 3D cameras:
  - Light pulse sent by camera returns to each pixel at slightly different times depending on distance



TailTech:
Developing an early warning system for pig tail biting

Need

Tail biting in pigs causes poor welfare, costs, waste, inefficiency, increased carbon footprint

TailTech Concept

Farmer acts early to prevent tail biting

Tail biting in pigs is unpredictable

Automatically warning the farmer

Low tails are an **early warning sign**

3D video system measures tail posture in real time

Processed via algorithms

TailTech developed

Innovate UK

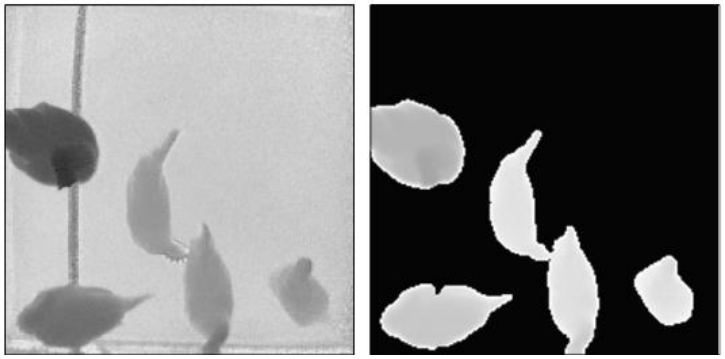
SRUC

Advantages of 3D vs 2D cameras for machine vision

- Not affected by **lighting** conditions, or changes in animal or background colour
- **Depth** information to distinguish pigs from each other and from background
- Simpler detection of **body posture**- stand, sit, lie
- **But** can cost £ several hundred per camera

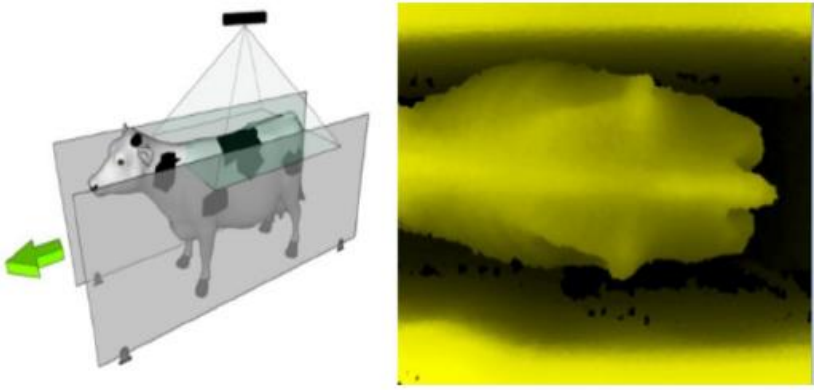
Other research groups are using 3D cameras on farm

- Pigs and poultry – **improved location tracking**, gait/lameness



e.g. Nakarmi et al 2014 (Iowa State)
https://core.ac.uk/download/pdf/38933139.pdf

- Cattle- weight, gait/lameness an **condition scoring**



e.g. Hansen et al 2018 (UWE Bristol)
https://doi.org/10.1016/j.compind.2018.02.011