Australian Poultry CRC

The Animal Welfare Science Centre

www.animalwelfare.net.au

Using machine vision (automatic video image analysis) to monitor hens in cages.

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What is machine vision?

- *Ability of the computer to 'see'*
  - *Also termed automatic video image analysis*

Camera(s)

↓

High speed computer

- **video frame grabber**

↓

Software

- **image catalogue**
- **recognition capability**
- **decision-making logic**

➢ **take action or inform**

MV System Goals:

Recognise target(s)

Track target(s)

Measure, etc

Decide

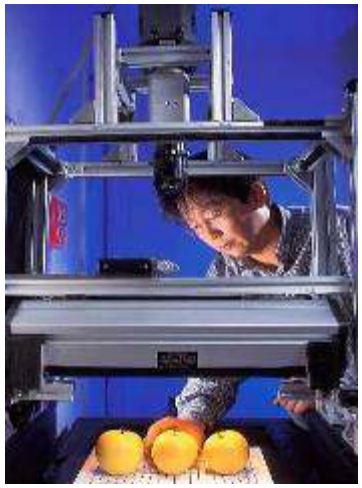
AUTOMATIC

ACCURATE

RELIABLE

What is machine vision?

Examples



Benefits

Objective measurement

- **Automatic, reliable, accurate**
- **Stationary or moving objects**
- **Rapid**
- **Range of environments**

Replace humans in the performance of certain mundane, repetitive or difficult tasks

A current application with poultry - automatic inspection of moving carcasses

- **Objective measurement of carcass size and shape**
- **Identify damaged carcasses (tears, bruises) and surface contaminants**
- **Automatic and rapid sorting of carcasses (140 carcasses per min)**

Egg industry opportunities

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Improved monitoring

- more frequent
- automatic
- reduce error

Production processes

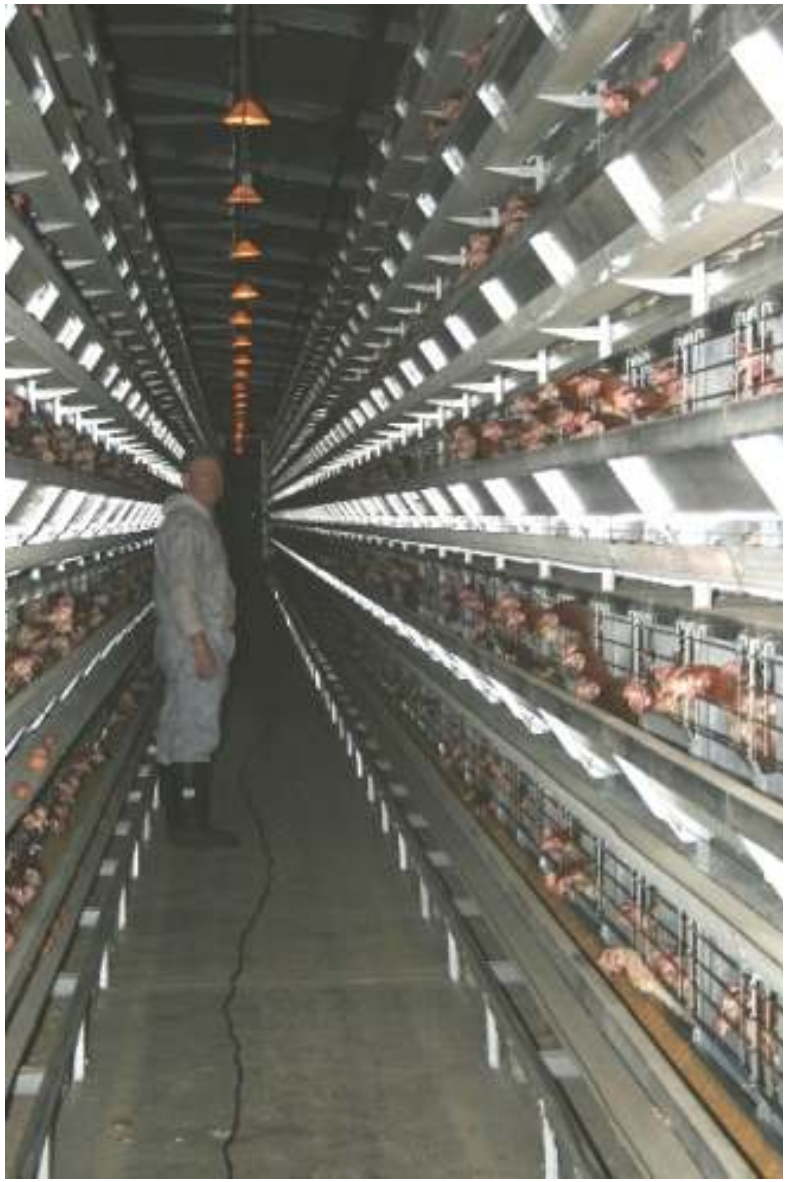
- shed activities, eg. egg belt blockages
- bird responses, eg. feed or water

Bird health and welfare

- better monitoring of all birds
- detect sick birds sooner

Better use of stockperson time

- targeted to risk birds or shed activities
- reduced labour costs



Goals of project

Can machine vision be used to?

1) Count hens in cages

2) Identify egg belt blockage

1) Counting hens - First step in the project logic

Can MV determine when a hen is dead?

Two approaches: **(i) count live hens per cage**

(ii) recognise dead birds

→ eg. the MV system alerts the stockperson to check a specific cage

2) Identify egg belt blockage

Can MV detect foreign objects on the egg belt?

Approach: scan egg belt to identify eggs and foreign objects

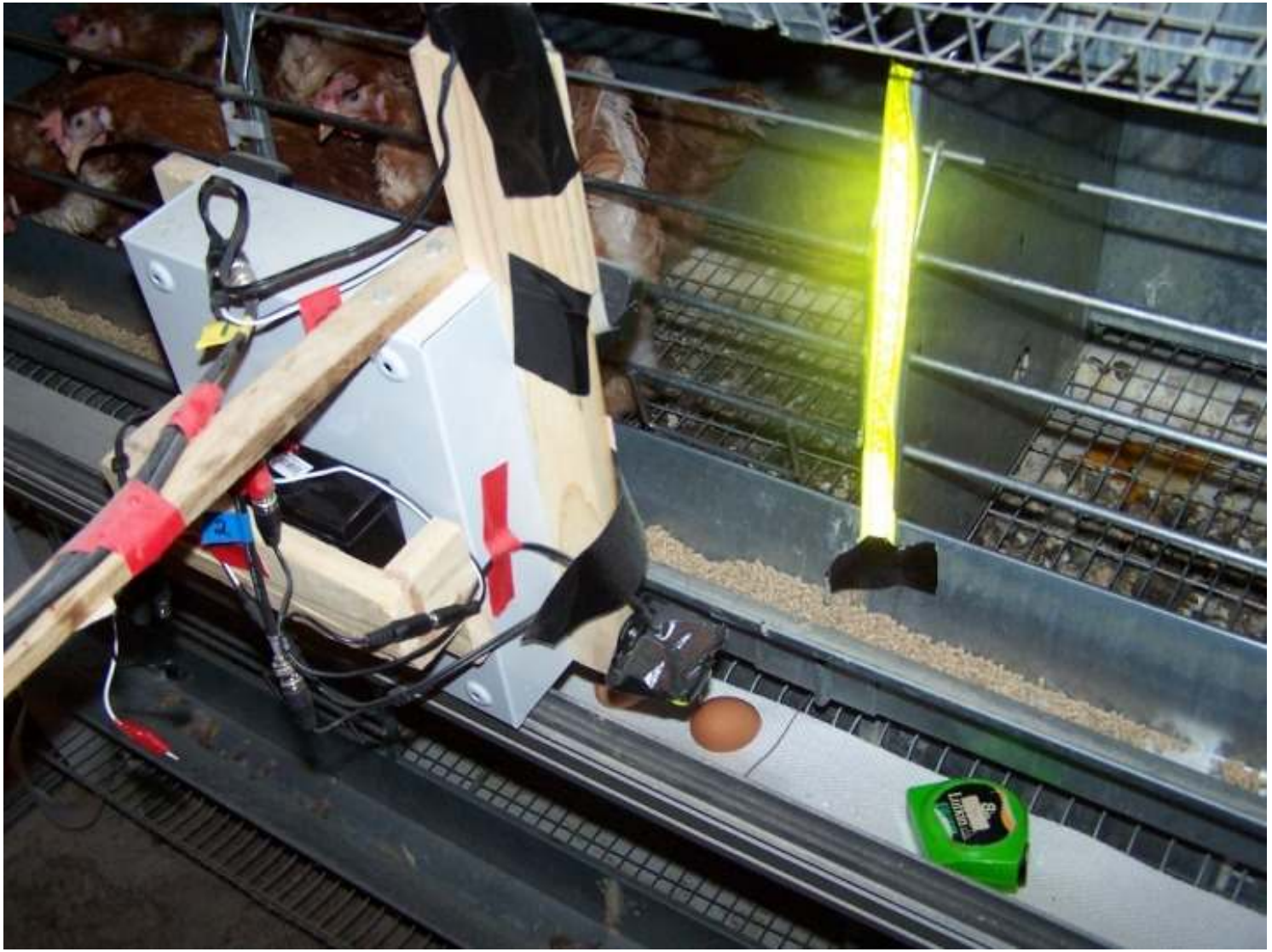
→ eg. the MV system prevents the egg belt moving

→ alerts the stockperson of the foreign object and its location

Feeding robot

Methods (identifying egg belt blockage)

Attach camera to robot



Methods (identifying egg belt blockage)

Attach camera to robot

Place eggs and non-egg objects on the collection belt

Methods (identifying egg belt blockage)

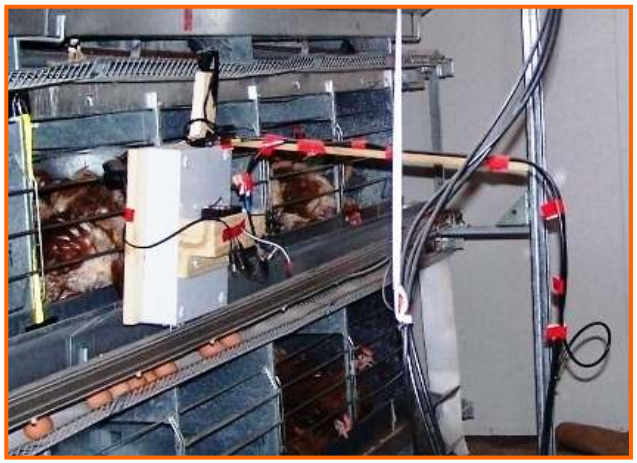
Attach camera to robot

Place eggs and non-egg objects on the collection belt

Make a digital video record of the length of egg belt

Analyse using the egg-belt scan software

Refine the software ('teach' the software)

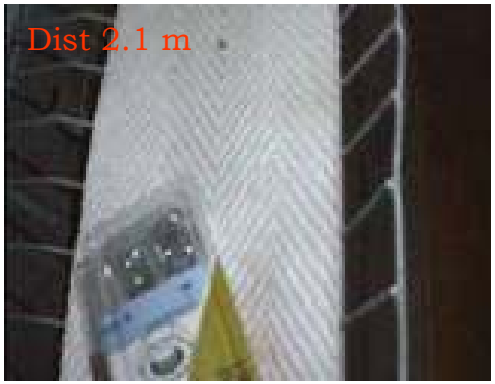


Methods (identifying egg belt blockage)

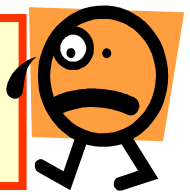
Outputs from software

Picture and location of 'foreign' objects detected

True negatives:



False negatives:
= foreign objects not detected



True positives:
= eggs detected as eggs

Results (identifying egg belt blockage)

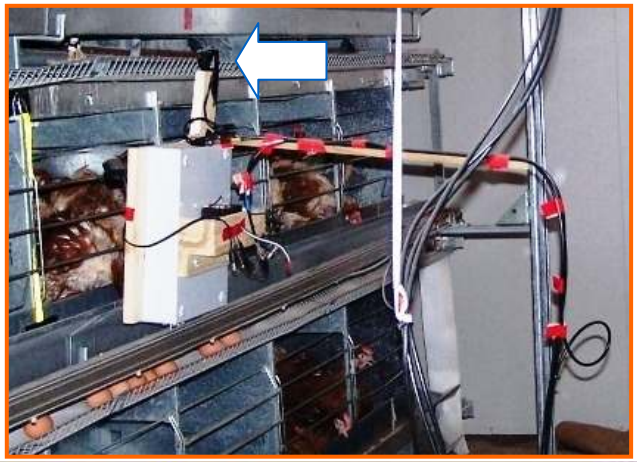
Software evaluated at commercial farm

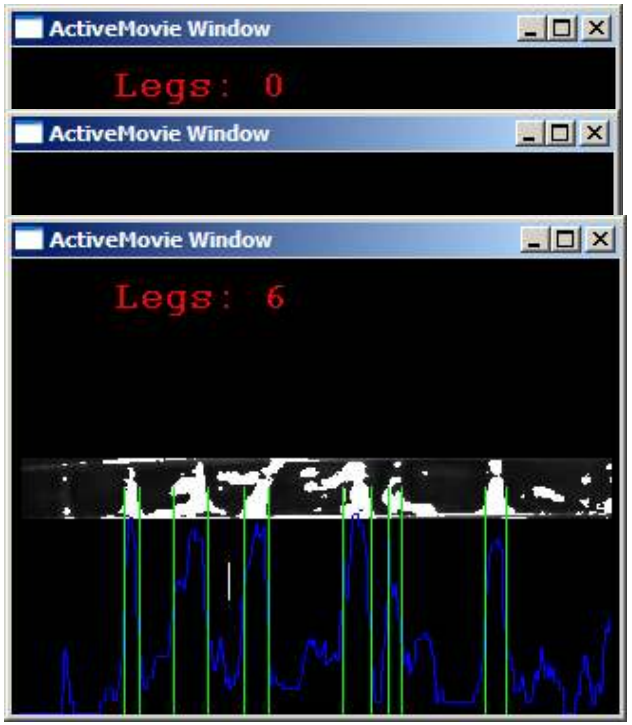
Goal - Identify objects on the egg collection belt

- **20 scans over 18 m (25 cages per scan)**
- **N=278 foreign objects and 5,200 eggs**

Foreign objects detected (True negatives)	*95%*
Foreign objects 'missed' (False negatives) 	*5%*
Eggs recorded as foreign objects (False positives)	*0.5%*

Methods (counting hens)





Results (counting hens)

79% accuracy in counting legs

Confusion matrix showing the frequency of visible legs detected by the leg-scan software.

No. of legs visible on the video monitor	No. of legs detected by the software				
	3	4	5	6	7
4	1	2	-	-	-
5	1	1	1	1	-
6	1	3	2	-	-
7	-	-	-	5	-
8	-	-	-	2	-

From: Cronin GM, Borg SS and Dunn MT (2008). Using video image analysis to count hens in cages and reduce egg breakage on collection belts. Aust J of Exp Agric vol 48 [in press].

Conclusions

Machine vision was successfully applied.

- 2 prototype MV systems were developed and evaluated.
- Counting hens in cages had a 79% accuracy.
- Able to identify dead hens.
- 95% of foreign objects were detected on the egg belt.

Implications

Machine vision may assist the cage egg industry.

Eg. ~50% of stockperson's time used for direct checks on birds.

The remaining labour costs are associated with:

cleaning, checking and maintenance of equipment.

Use MV to perform mundane, repetitive tasks (often low risk)

Economic and social benefits of MV

Stockpeople can focus more on higher priority work tasks

- less time spent performing 'unprofitable' & mundane activities
- lower incidence of egg breakage from blockage of egg belts
- general reduction in labour units per cage or per shed

Potential to increase retention of stockpeople

- *improved job satisfaction*
- *less menial work*

Bird welfare

- *increased monitoring of birds should improve bird welfare*
- *Governments and the public have increased confidence*

Opportunities

Limited by one's imagination

Other applications for the poultry industries?

Other livestock industries?

Project team

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Philip Szepe

Thank you