Automated detection of lameness in dairy cows compared with claw diagnosis and mobility score

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Lameness – Widespread & Unnoticed by Many

- 37% (range 0-79%) lame cows in the UK (data collected 2006-07)
- Only 20-25% of lame cows are noticed by farmers
- Lame cows are estimated to be in severe pain for ~3 months

Archer et al, 2010 In Practice 32: 492-504
Bruijnis et al 2012 Animal 6: 962-970
Lameness Reduces

- **Yield:** 270-857 l milk lost over a lactation
- **Oestrus behaviour:** mounting period shortened from 5.2 to 1.8 h
- **Reproduction:** first ovulatory oestrous delayed by 19 days
- **Longevity:** increased culling risk (HR=1.45 for MS>3, HR=1.74 for MS>4)

Huxley, 2013, Livestock Science 156: 64-70
Lameness affects Behaviour

- Lying time: 119%
- Number of steps: 95%
- Leg activity: 80%

And we can measure behaviour automatically

Thorup et al, 2015 Animal 9: 1704-12
The DASIE Project

- Dairy Animal Sensor Integrated Engineering
- August 2014 – 2017
- Budget 1.8 m £
- Supported by the UK government
- 4 partners
- Data from 6 commercial farms & 1 research herd
Lameness Model Development

- 7 farms visited in 2016, 1 farm bi-weekly
- 6755 visual mobility scores (MS)
- 1 of 2 trained observers
- Scale 1-5

Lameness Detection model

One objective Automated Lameness Probability (ALP) per cow per day

### Compare ALP & Claw Diagnosis

- 5 commercial farms visited in 2017
- MS-observer picked 50% lame and 50% non-lame cows (AHDB 0-3 scale) for trimming
- Vet performed claw diagnosis blind to MS and ALP

<table>
<thead>
<tr>
<th>Farm</th>
<th>Herd size</th>
<th>IceQube cows</th>
<th>MS cows</th>
<th>IceQube, MS &amp; trimmed</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>1,500</td>
<td>500</td>
<td>325</td>
<td>108</td>
</tr>
<tr>
<td>C</td>
<td>145</td>
<td>137</td>
<td>115</td>
<td>95</td>
</tr>
<tr>
<td>D</td>
<td>467</td>
<td>462</td>
<td>378</td>
<td>52</td>
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<tr>
<td>F</td>
<td>200</td>
<td>181</td>
<td>166</td>
<td>56</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,886</strong></td>
<td><strong>1,467</strong></td>
<td><strong>375</strong></td>
<td></td>
</tr>
</tbody>
</table>
Mobility Scores by Farm

Farm lameness prevalence from 24 to 62%.

Aim: to trim 50% non-lame and 50% lame cows.
Claw Diagnoses

Total = 375 cows with complete data
Many cows with severe diagnoses
Detection Examples

Cow #354.756. ALP 2 weeks prior to SU diagnosis, MS=3

Cow #349.285. ALP 2 weeks prior to SU/CN diagnosis, MS=3

All agree
Detection Examples

Cow #348.766. ALP 2 weeks prior to Good Feet diagnosis, MS=2

ALP and Diagnosis agree
Conclusions

• Lameness remains a very severe welfare problem which MUST be addressed on every farm
• Behavior-based detection – some alerts due to other types of disease
• Develop appropriate filtering of alerts
• Ongoing validation on several farms
• PPV of ALP and MS are similar
• ALP is objective
• ALP runs every day

– what do you use as gold standard when modelling?
Further Development

UK research herd, ~100 cows, 2 milkings/day

4 commercial Danish farms, 366 cows, 2 milkings/day

Thorup et al, 2016 Proc. 4th DairyCare Conference, Lisbon, p 16

Any questions

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