The future of Precision Livestock Farming

Daniel Berckmans

M3-BIORES KU Leuven
Measure, Model & Manage Bio Responses

Agriculture 4.0
Feeding the next generation

11 May 2017
Brussels
Overview

• Challenges of livestock production
• Precision Livestock Farming (PLF)
• Examples of PLF technology
• Future of PLF
• Conclusions
Challenges for livestock production

- Over 60 billion animals are slaughtered every year, increase with up to 75% by 2050?

- **Health**: Relationship between animal health and healthy food

- **Animal welfare** (e.g. EU)

- **Environmental Issues**

- **Social importance**

- **Economic importance** including Valorisation of knowledge
Resulting in

- High number of animals per farm
- Less available time per individual animal
- More welfare and other problems
Precision Livestock Farming (PLF)

Management of livestock by continuous automated real-time monitoring of production/reproduction, health and welfare of livestock and environmental impact.
Examples of PLF Technology

Real-time algorithms generating advice and feedback
Example: Infection Monitoring by Real-time Sound Analysis
i.c.w. University of Milan, SoundTalks NV, Fancom BV
PCM: Results

Animals treated

Animals upon entering

Animals again ill

Pigs ill again

Cough Index (# coughs / 24h)

Time (day)

MAIN FUTURE APPLICATIONS
REDUCING THE USE OF ANTIBIOTICS

- Sound analysis
- Infection
- Therapeutic decision
- Climate controller
- Antibiotics

\[ V(t) \]
\[ Q(t) \]

micro

Climate controller

Therapeutic decision

Antibiotics

Sound analysis

Infection

Climate controller

Antibiotics

Therapeutic decision

Sound analysis

Infection
Example: Real time alarms for problems in a broiler house

i.c.w. Fancom BV
Vision-based Early Warning System for Broiler Houses

• Solution?
• Farmers can use automatic tools to continuously monitor the welfare and health of their broilers

Farm manager dashboard

M3-BIORES KU Leuven
Measured vs. modelled animal distribution

Predicted distribution

Measured distribution

Prediction window: 1 light period = 5 hours
Event detection

Feeder line

Defect Feeder line

Measured values
Smoothed values within 25% range
Smoothed values out of 25% range
Predicted values

Normal situation

Problem in feeding lines

Date(dd/mm)

Distribution (%)

16/05
17/05

M3-BIORES KU Leuven

13
Detected events in the validation experiment over 42 days

**Conclusion**: Events in a broiler house could be detected using top-view image analysis with an accuracy of 95.24%
Future of PLF – 1

Real-time algorithms generating advice and feedback
**Cow lameness monitor**: i.c.w. Volcani, DeLaval, Wur

**Aggression monitor**: Umil, TIHO, Fancom BV

**Scratching behaviour**: Ughent, ILVO

**Weight estimation**: Fancom BV, Agrifirm
Data reduction by real-time algorithms

Image

Sensors e.g. Heart Rate

Sound

Heart rate monitor
(Polar S610i)

1920 x 1080 numbers/image = 2 M numbers
25 images/second
51,840,000 numbers/second

Would give
1,036,800,000 numbers are pushed every 20 seconds

Real-time algorithm calculates activity and distribution number every second

Or 2 numbers every second + time IN REAL TIME

3 numbers/second or 60 numbers are pushed every 20 seconds

20,000 samples/second
Real-time algorithm
Number of coughs

M3-BIORES KU Leuven
Example: Continuous automated monitoring of feed intake of broilers by sound technology
Continuous recording of sounds (top) and individual pecking sounds (bottom) as extracted by the algorithm.
## More Results

<table>
<thead>
<tr>
<th>Chickens</th>
<th>Exp.</th>
<th>Minutes</th>
<th>Number of peckings per experiment</th>
<th>feed uptake per experiment (g)</th>
<th>Feed loss per experiment (g)</th>
<th>Feed intake per experiment (g)</th>
<th>Feed Intake Per Pecking (g)</th>
<th>Feed Intake Per Pecking (Mean±Std)</th>
<th>Feed loss per experiment (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>13</td>
<td>1193</td>
<td>28,63</td>
<td>0,325</td>
<td>28,31</td>
<td>0,024</td>
<td><strong>0.025±0.0015</strong>a</td>
<td>1,14</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>12</td>
<td>759</td>
<td>18,98</td>
<td>0,198</td>
<td>18,78</td>
<td>0,025</td>
<td>0,198</td>
<td>1,04</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>10,3</td>
<td>895</td>
<td>24,17</td>
<td>0,222</td>
<td>23,94</td>
<td>0,027</td>
<td>0,222</td>
<td>0,92</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>15</td>
<td>1250</td>
<td>32,50</td>
<td>0,236</td>
<td>32,26</td>
<td>0,026</td>
<td><strong>0.025±0.0012</strong>a</td>
<td>0,73</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>13,5</td>
<td>1283</td>
<td>30,79</td>
<td>0,365</td>
<td>30,43</td>
<td>0,024</td>
<td>0,365</td>
<td>1,19</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>15</td>
<td>1460</td>
<td>35,04</td>
<td>0,348</td>
<td>34,69</td>
<td>0,024</td>
<td>0,348</td>
<td>0,99</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>7,04</td>
<td>651</td>
<td>16,28</td>
<td>0,168</td>
<td>16,11</td>
<td>0,025</td>
<td><strong>0.025±0.0006</strong>a</td>
<td>1,03</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4,35</td>
<td>468</td>
<td>12,17</td>
<td>0,111</td>
<td>12,06</td>
<td>0,026</td>
<td>0,111</td>
<td>0,91</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>7,26</td>
<td>533</td>
<td>13,33</td>
<td>0,124</td>
<td>13,20</td>
<td>0,025</td>
<td>0,124</td>
<td>0,93</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>6,54</td>
<td>583</td>
<td>13,99</td>
<td>0,145</td>
<td>13,85</td>
<td>0,024</td>
<td><strong>0.025±0.0015</strong>a</td>
<td>1,04</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>7,43</td>
<td>654</td>
<td>16,35</td>
<td>0,165</td>
<td>16,19</td>
<td>0,025</td>
<td>0,165</td>
<td>1,01</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>6,65</td>
<td>573</td>
<td>15,47</td>
<td>0,155</td>
<td>15,32</td>
<td>0,027</td>
<td>0,155</td>
<td>1,00</td>
</tr>
<tr>
<td>Total-Average</td>
<td></td>
<td>300,10</td>
<td>25285</td>
<td>633,26</td>
<td>6,22</td>
<td>627,04</td>
<td><strong>0,025±0.0011</strong>a</td>
<td>0,98</td>
<td></td>
</tr>
</tbody>
</table>
The relation between number of peckings and feed intake of chickens

Number of Peckings per Minute

Feed Intake per Minute (g)

Time (minute)
Future of PLF – 2
Business models to be tested in the field
The PLF Business Model?

Cost of PLF investment & operation shared along the value creation chain by payment for access to data pool
Future of PLF – 3
New PLF collaboration models
Global sustainable Livestock Production

Nutrition
- Multi-national feed companies

Animal Health
- Multi-national pharma company

Farmers cooperative
- Research groups
- Innovative SMEs
- Farm Technology Companies
Conclusions

• PLF will offer fully automated continuous real time detailed monitoring and management of animals in the livestock sector.
• PLF brings the farmer to the individual animal that needs his/her attention, active management tool.
• PLF will develop new business models for farmers and stakeholders.
• PLF allows more sustainable livestock production.
• Worldwide implementation of PLF needs a collaboration model between industry, researchers, farmers and stakeholders.
Acknowledgments and Disclaimer

The EU-PLF project has received funding from the European Union’s Seventh Framework Programme for research, technological development and demonstration under grant agreement n° 311825.

The views expressed in this presentation are the sole responsibility of the author(s) and do not necessarily reflect the views of the European Commission.
Thanks for your attention!
Daniel.Berckmans@kuleuven.be

www.m3-biores.com