How farmers make ‘sense’ from sensor data

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Lely International Farm Management Support

innovators in agriculture

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Introduction

• Van der Tol, 2010
  • “It reached an SN and SP of 84.62% and 99.43%, respectively. It indicated a practical feasible and accurate CM detecting model for using in AMS”

• Buma, 2012
  • “74% of the clinical mastitis cases was not detected by the farmer”

• So what goes ‘wrong’?
  • What triggers a farmer to start treatment on a cow?
Farmers interpretation

• Cow in heat
  • Voluntary waiting period
  • Expected culling of the cow
  • Recent disease
Worldwide data collected
Filtered on treated for mastitis

Information on:
  • Conductivity
  • Milk yield
  • Lactation
  • Attention

79230 treatments left
  • 2504 farms
  • Seven countries
Explanation

- Conductivity
  - Measured in ms but displayed as normalized value
  - Attention when increase for 20%
- Interval
  - Days difference between first attention and treatment
  - Negative means attention occurred before treatment
Statistics

- Survival analysis
- Cox Hazard test
Severity on treatment day

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Std. Error</th>
<th>p &lt; 0.001</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>96.63</td>
<td>0.295</td>
<td>*</td>
</tr>
<tr>
<td>TreatmentDay_MilkYield</td>
<td>-1.08</td>
<td>0.012</td>
<td>*</td>
</tr>
<tr>
<td>TreatmentDay_ExpectedYield</td>
<td>0.65</td>
<td>0.012</td>
<td>*</td>
</tr>
<tr>
<td>LactationNumber</td>
<td>1.34</td>
<td>0.035</td>
<td>*</td>
</tr>
<tr>
<td>LactationDay</td>
<td>-0.02</td>
<td>0.001</td>
<td>*</td>
</tr>
<tr>
<td>Interval_Cdt</td>
<td>-0.13</td>
<td>0.005</td>
<td>*</td>
</tr>
<tr>
<td>Attention_BigMilkDrop</td>
<td>-0.83</td>
<td>0.204</td>
<td>*</td>
</tr>
<tr>
<td>Attention_Color</td>
<td>-2.69</td>
<td>0.117</td>
<td>*</td>
</tr>
</tbody>
</table>

- Linear model
  - \( r = 0.46 \)
# Survival time to treatment

<table>
<thead>
<tr>
<th></th>
<th>coefficient</th>
<th>exp(coef)</th>
<th>effect</th>
<th>sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactation number</td>
<td>0.019</td>
<td>1.020</td>
<td>2.0%</td>
<td>*</td>
</tr>
<tr>
<td>Lactation day</td>
<td>0.001</td>
<td>1.001</td>
<td>0.1%</td>
<td>*</td>
</tr>
<tr>
<td>TreatmentDay MilkYield</td>
<td>0.024</td>
<td>1.025</td>
<td>2.5%</td>
<td>*</td>
</tr>
<tr>
<td>TreatmentDay ExpectedYield</td>
<td>-0.018</td>
<td>0.982</td>
<td>-1.8%</td>
<td>*</td>
</tr>
<tr>
<td>Attention BigMilkDrop</td>
<td>-0.208</td>
<td>0.813</td>
<td>-18.7%</td>
<td>*</td>
</tr>
<tr>
<td>Attention Color</td>
<td>-0.700</td>
<td>0.497</td>
<td>-50.3%</td>
<td>*</td>
</tr>
<tr>
<td>TreatmentDay Cdt</td>
<td>0.006</td>
<td>1.006</td>
<td>0.6%</td>
<td>*</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Lactation</th>
<th>Day</th>
<th>Yield</th>
<th>Exp. Yield</th>
<th>Milk drop</th>
<th>Color</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>20</td>
<td>35</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>200</td>
<td>20</td>
<td>25</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>3 * 2 = 6</td>
<td></td>
<td></td>
<td>14 * 0.1 = 14</td>
<td>0 * 2.5 = 0</td>
<td>-10 * -1.8 = 18</td>
<td>0</td>
</tr>
</tbody>
</table>

- Cow 2 has 88% chance to have an extra day between first attention and treatment
Effect of lactation

- $p = 1.11 \times 10^{-15}$
- High lactation cows are longer on list before treatment
- Fact: older cows have longer interval between first attention and moment of treatment.
High yielding cows and cows with low yield are treated faster

- high potential (expected > 30)
- severe cases (expected < 10)
Effect of days in milk

- Linear regression showed effect of -0.007 day/day
- Cows further in lactation are longer on the attention list before treatment
Conclusion

- Farmers make an economic decision to treat
  - Farmers are triggered to treat by low and high yielding cows
  - Lactation stage affects the treatment trigger
  - First lactation cows are treated faster compared to older cows
Thank you for your attention

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