Automated lameness monitoring in dairy cows

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("*Plane b": Presented by **Ilan Halachmi)**

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- **Introduction**
- Objective
- Materials and Methods
- Results and discussion
- Conclusion

Feature variables to detect lameness

- Deviation in gait and posture…

Gait

Uneven Gait
Reluctance Bear Weight
Speed
Short Strides
Tracking-up
Affected Leg Evident
Abduction-Adduction
Joint Flexion

Posture

Arched-Back
Head-Bob
Hip Hick

Others

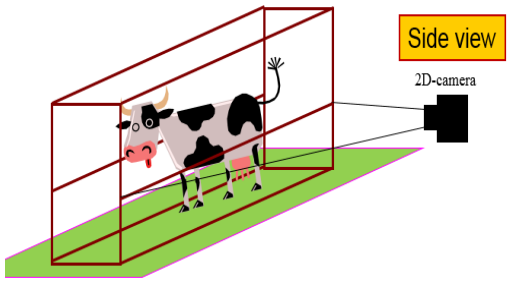
Difficult turning
Difficult rising
Tenderness
Affected behaviour

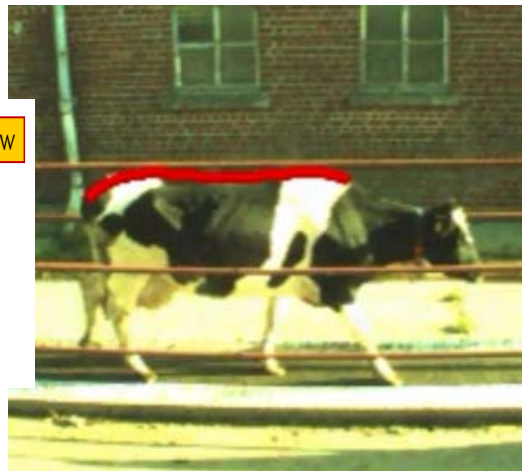
Previous work (Bio-Business)

ARO, Volcani Research Centre (Israel), WUR (The Netherlands), KU Leuven

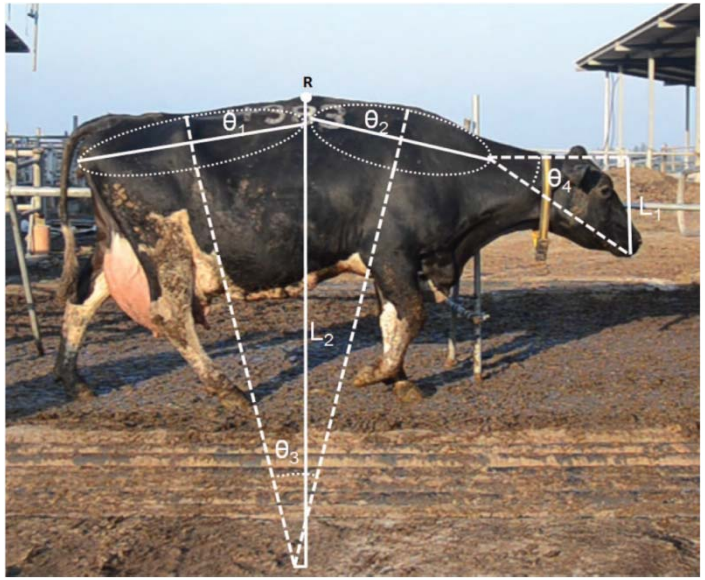
Published by Viazzi et al. (2014) & Van Hertem et al. (2014)

2D video recordings for back posture as main feature variable





Picture taken at KU Leuven (before The project start)

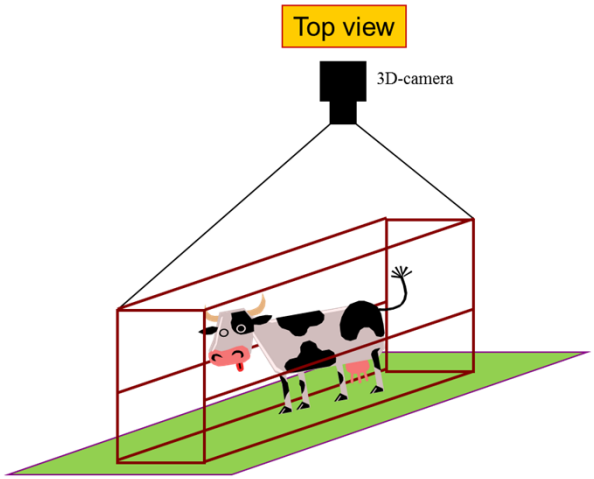


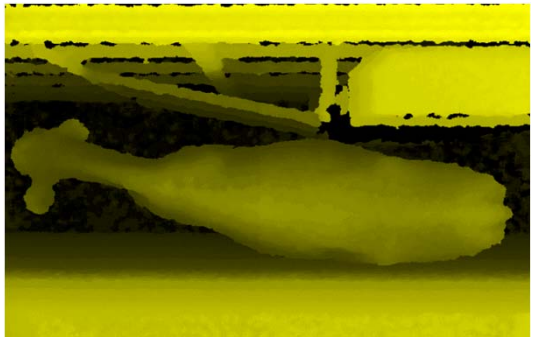
Picture taken at Kibbutz Yefat, ARO Volcani Research Centre (Israel),

Previous work - Continuation

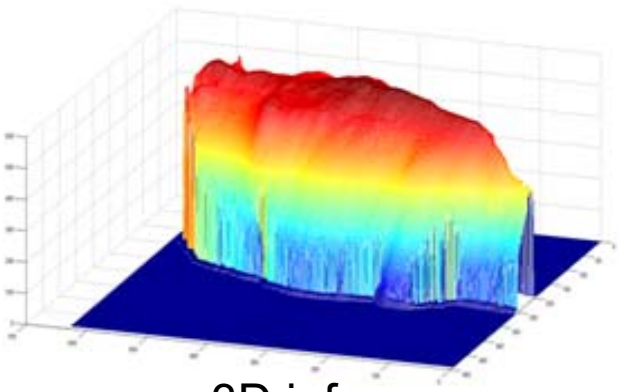
Published by by Viazzi et al. (2014) & Van Hertem et al. (2014)

3D video recordings for back posture





Real-Time image analyses

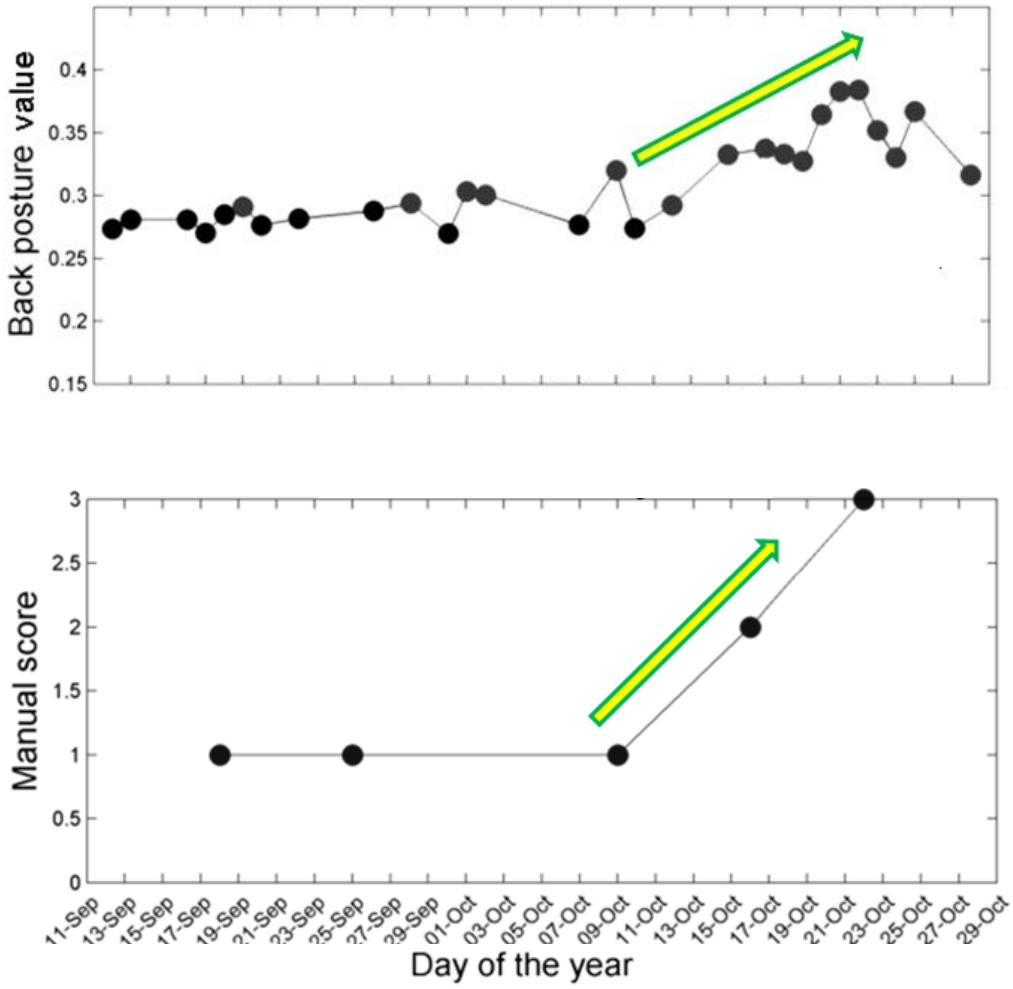


3D info

Based on pictures taken at Kibbutz Yefat, ARO (Israel),

Evolvement of back posture values in time

- Back posture values
- Gold standard



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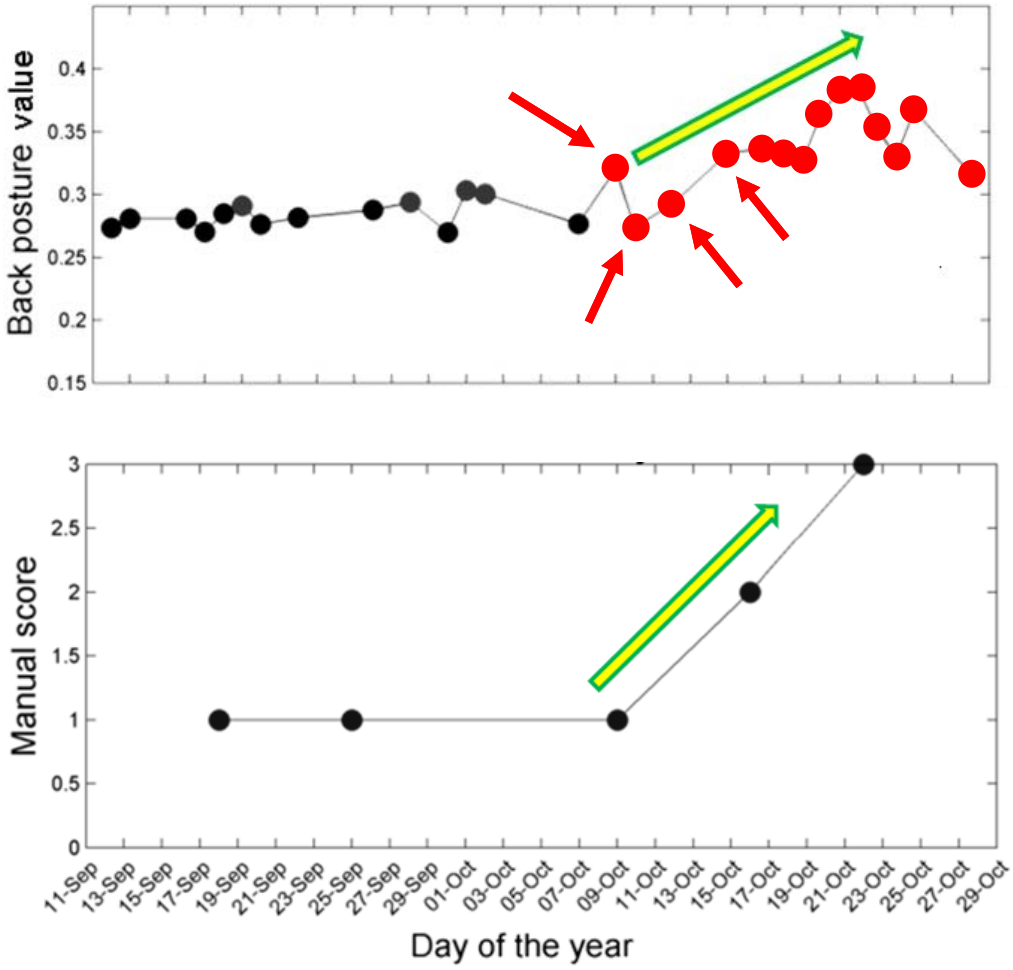
Develop a prototype of an early warning system



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Materials and Methods

Subjects & infrastructure

Commercial dairy farm with 2500 cows

Data collection

Back posture values collected daily August 2014 – October 2015

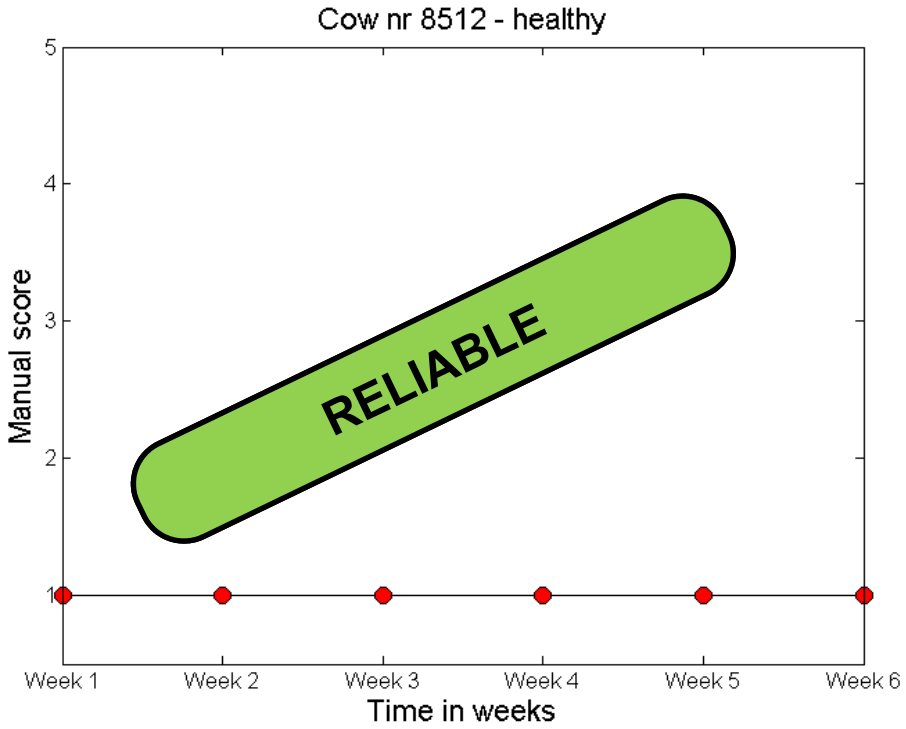
Data from 1908 different cows

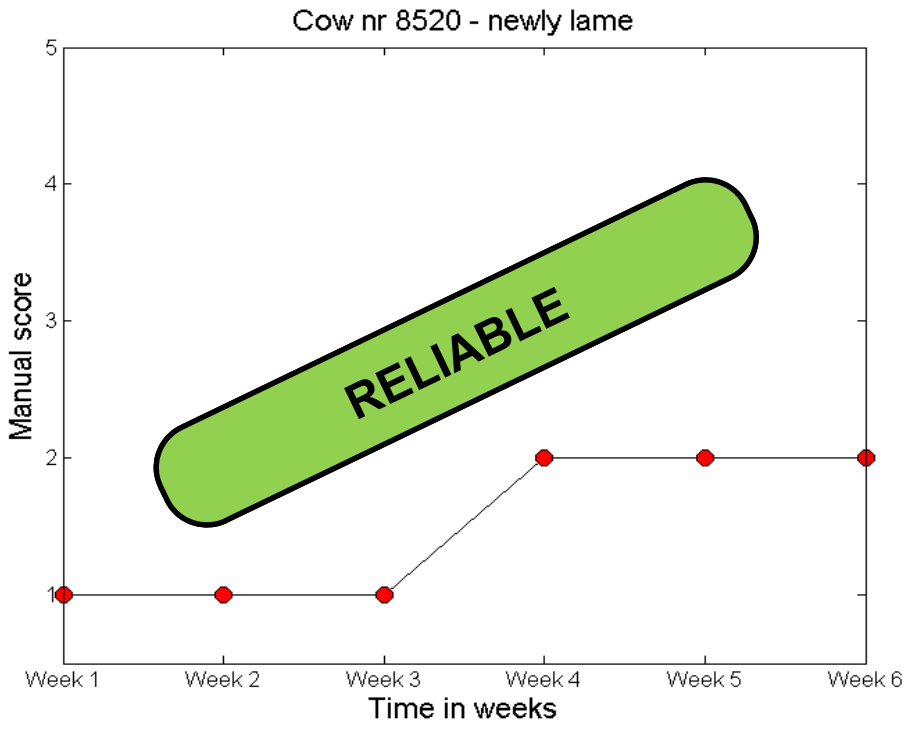
5592 manual scores from 1465 different cows

Gold standard

Manual scores collected weekly September 18th 2016 – October 23rd 2016

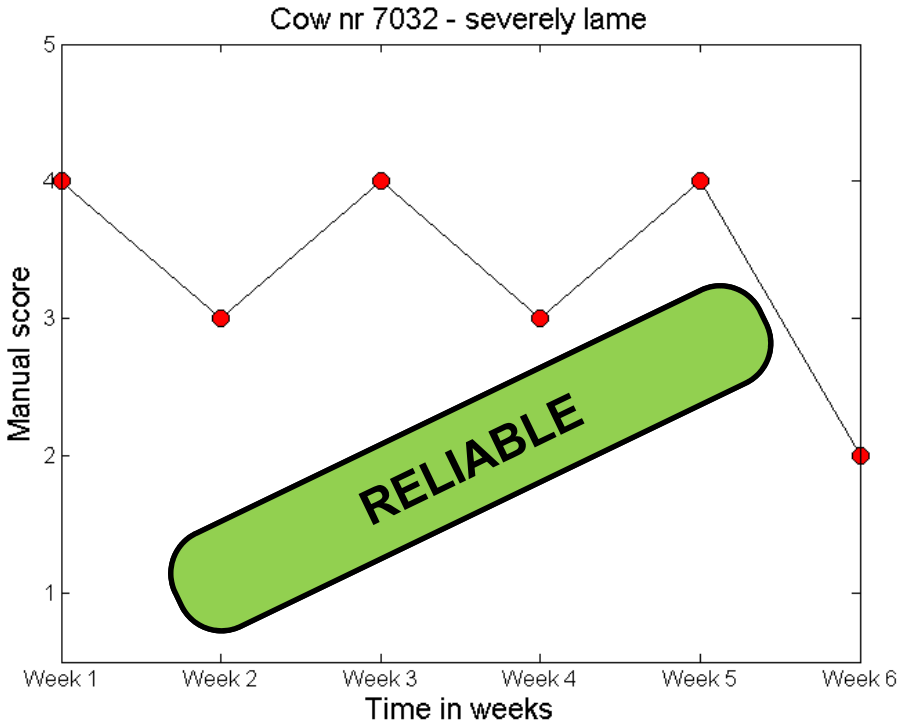
- Selection of a **reliable dataset**

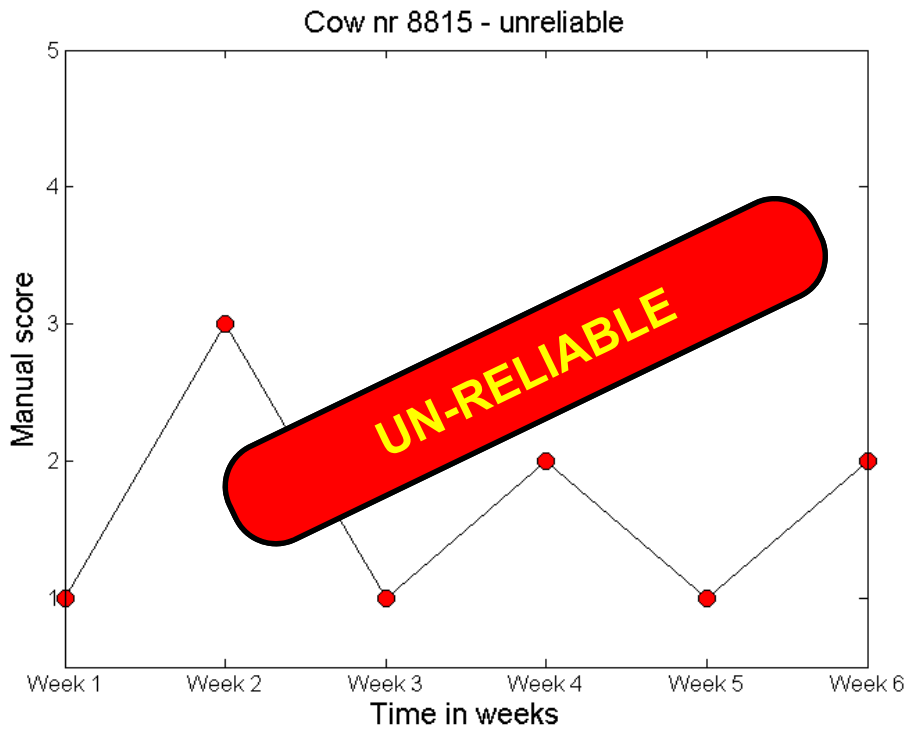




Newly lame: a cow becomes lame

- Selection of a **reliable dataset**





- Selection of a **reliable dataset**

From 1908 cows, with at least 4 manual scorings over a period of 6 weeks,

209 cows were withheld for further analysis

- Define a **group** level **baseline**

The healthy baseline on group level is calculated

- Define a **group** level **threshold**

An alarm is generated when a back posture value exceeds the group level baseline

Performance evaluation:

	Alarm generated by the algorithm (lame)	No alarm generated by the algorithm (not lame)
Manual score of 1 or 2 (not lame)	FP	TN
Manual score of 3 or higher (lame)	TP	FN

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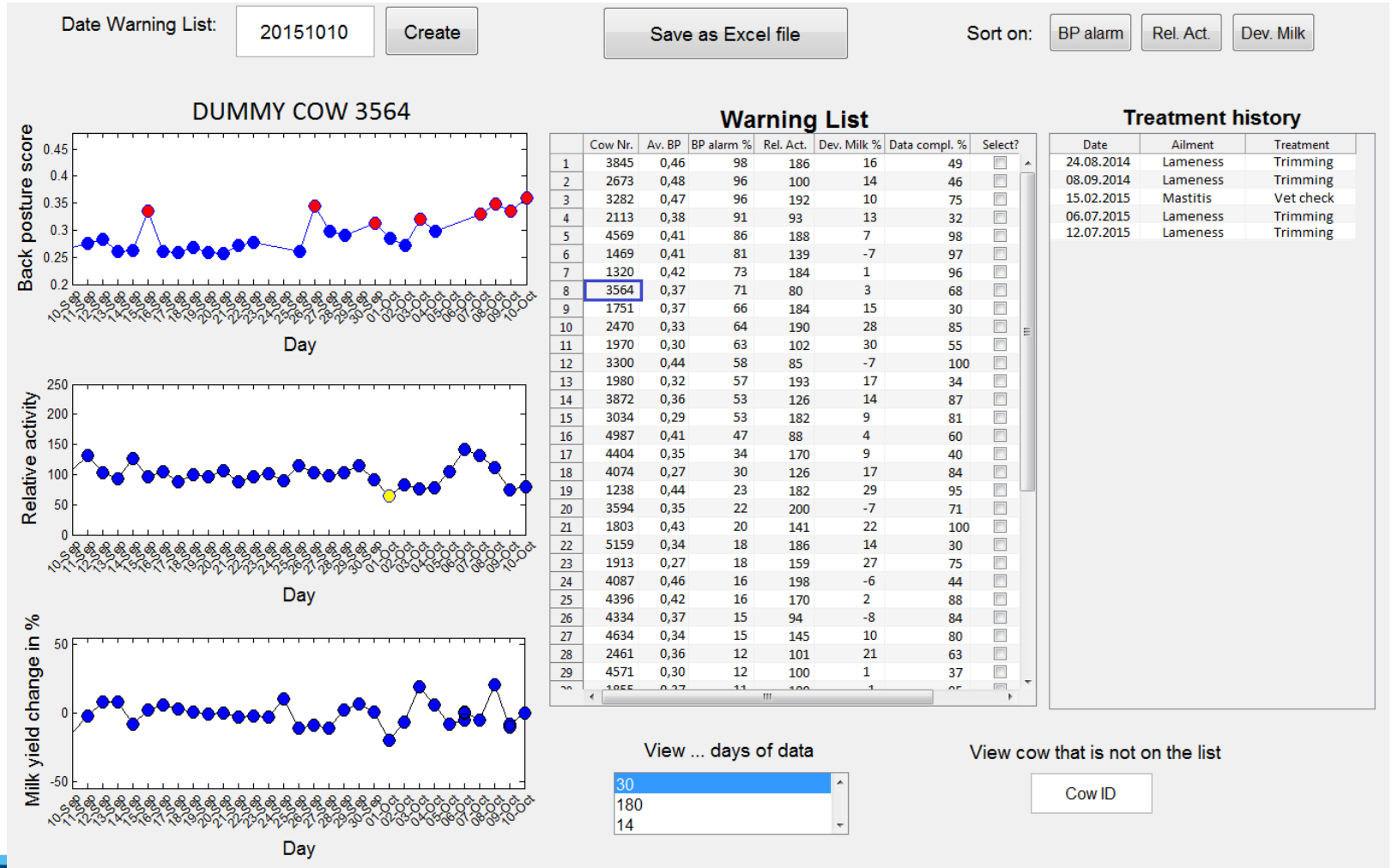
Alarm generation **performance**

Group level baseline

Sensitivity 76.1%
Specificity 83.9%

Developing a **prototype** that can be used on a commercial farm and that **brings value to the farmer**

Graphical User Interface

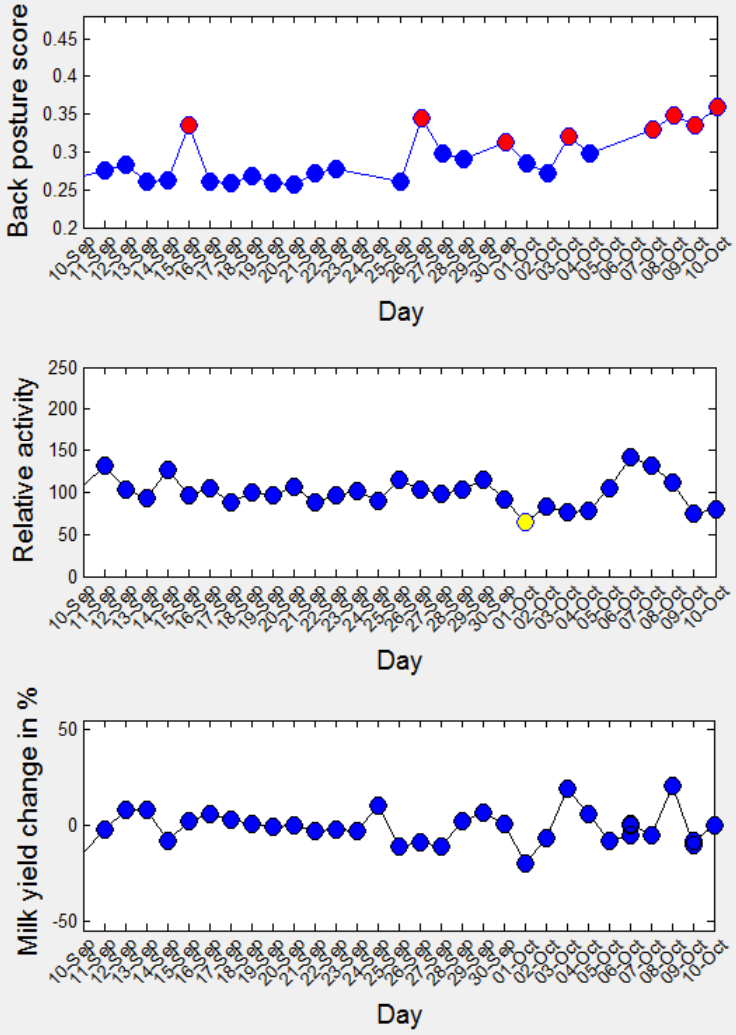


Date Warning List: 20151010 Create

Save as Excel file

Sort on: BP alarm | Rel. Act. | Dev. Milk

DUMMY COW 3564



Warning List

	Cow Nr.	Av. BP	BP alarm %	Rel. Act.	Dev. Milk %	Data compl. %	Select?
1	3845	0,46	98	186	16	49	
2	2673	0,48	96	100	14	46	
3	3282	0,47	96	192	10	75	
4	2113	0,38	91	93	13	32	
5	4569	0,41	86	188	7	98	
6	1469	0,41	81	139	-7	97	
7	1320	0,42	73	184	1	96	
8	3564	0,37	71	80	3	68	
9	1751	0,37	66	184	15	30	
10	2470	0,33	64	190	28	85	
11	1970	0,30	63	102	30	55	
12	3300	0,44	58	85	-7	100	
13	1980	0,32	57	193	17	34	
14	3872	0,36	53	126	14	87	
15	3034	0,29	53	182	9	81	
16	4987	0,41	47	88	4	60	
17	4404	0,35	34	170	9	40	
18	4074	0,27	30	126	17	84	
19	1238	0,44	23	182	29	95	
20	3594	0,35	22	200	-7	71	
21	1803	0,43	20	141	22	100	
22	5159	0,34	18	186	14	30	
23	1913	0,27	18	159	27	75	
24	4087	0,46	16	198	-6	44	
25	4396	0,42	16	170	2	88	
26	4334	0,37	15	94	-8	84	
27	4634	0,34	15	145	10	80	
28	2461	0,36	12	101	21	63	
29	4571	0,30	12	100	1	37	

Treatment history

Date	Ailment	Treatment
24.08.2014	Lameness	Trimming
08.09.2014	Lameness	Trimming
15.02.2015	Mastitis	Vet check
06.07.2015	Lameness	Trimming
12.07.2015	Lameness	Trimming

View ... days of data

30
180
14

View cow that is not on the list

Cow ID

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- Using historical back posture animal data, a **healthy baseline** can be defined.
- Deviations from this baseline based on a **threshold** result in **alarms** that can be raised with **76,1% sensitivity** and **83.9% specificity**.
- Alarms can be **translated into useful information** that can be implemented on a commercial farm through a GUI.

Contact

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