

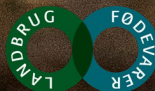
Modeling weight data of individual finishers

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SEGES



Svineafgiftsfonden

Noget at leve af. Noget at leve for.





PigIT

SPATIAL MODELING OF DRINKING
PATTERNS AS A TOOL FOR REDUCING
ALARMS IN PIG PRODUCTION

KATARINA NIELSEN DOMINIAK
PHD THESIS - 2017



SEGES
Svineproduktion

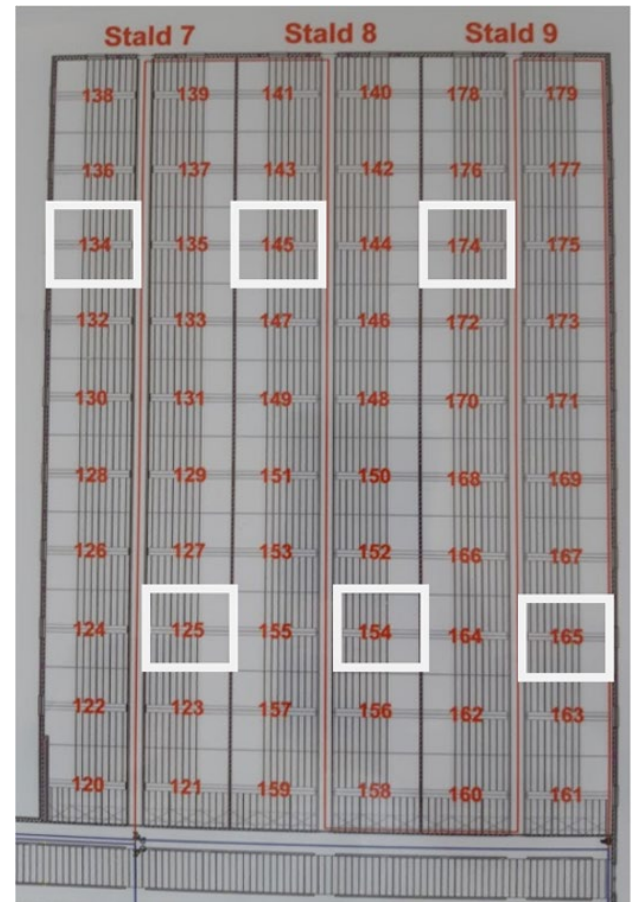
PigSys and project 'Production monitoring and optimization'

- PigSys is an international project with participants from Sweden, UK, France, Germany, Latvia and Denmark
- The overall aims are to improve productivity and sustainability of pig production as a whole system – including building optimization, emission handling and the animal productivity itself
- In SEGES we use PigSys data from the two Danish field test herds as input for models in the daughter project 'Production monitoring and optimization'



Herd description

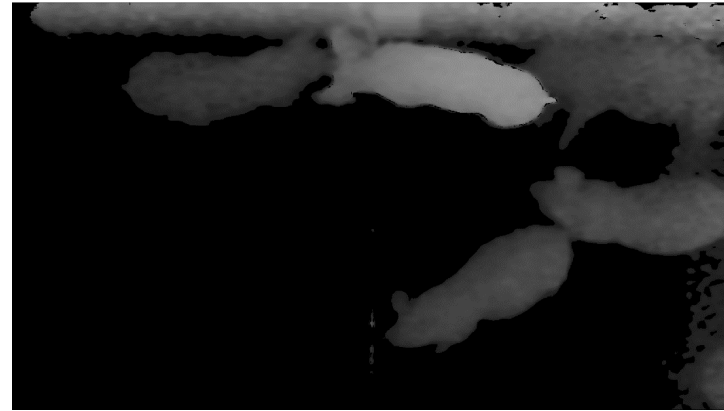
- 40 pens per section
- 880 pigs inserted per section (22 per pen)
- Reduced to 640 after three weeks (16 per pen)
- All pigs inserted simultaneously and at same age in all sections
- Restrictive liquid feed
- 4 focus pens (2 double pens) in each of sections 7, 8, and 9



Sensors in PigSys



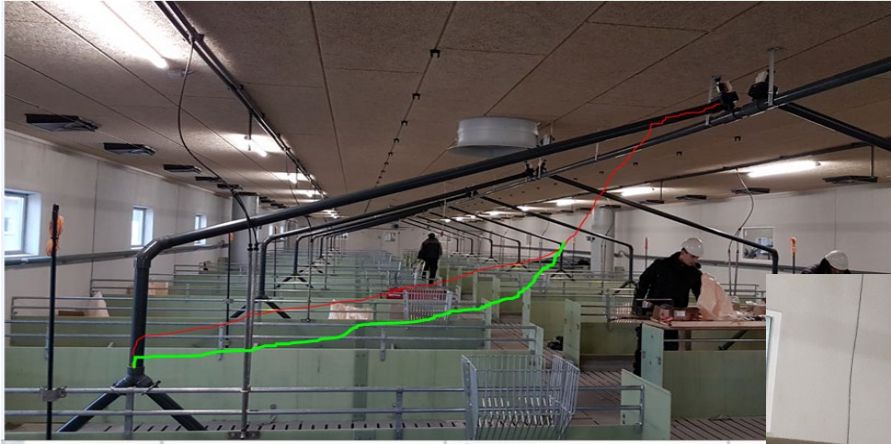
Weight estimates using 3D cameras – prototype setup



Initial setup – one camera for two pens Feed pipe was a challenge



One camera for two pens – feeding pipe adjustment



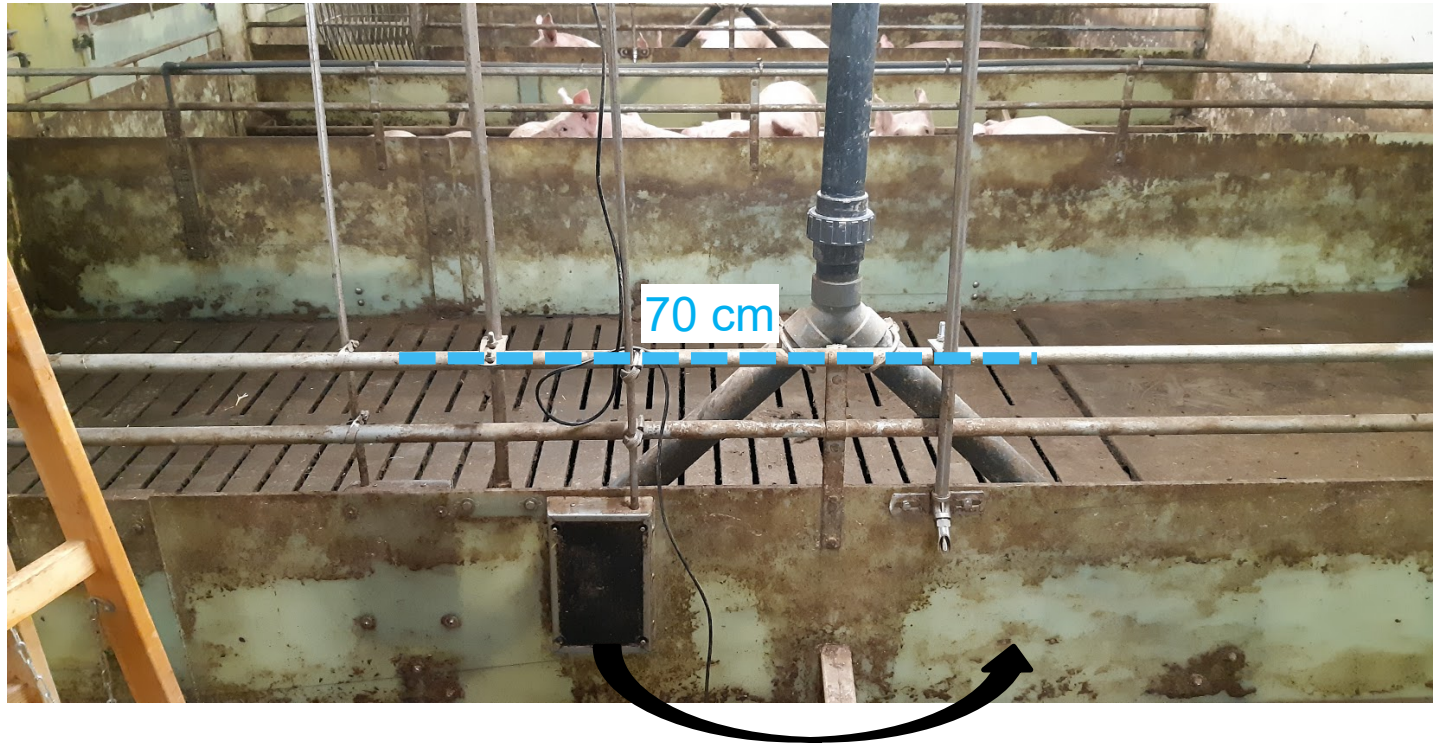
Pigs are too big for half a camera width

Original feeding pipe placement restored

Thankfully we worked with one demo-setup!



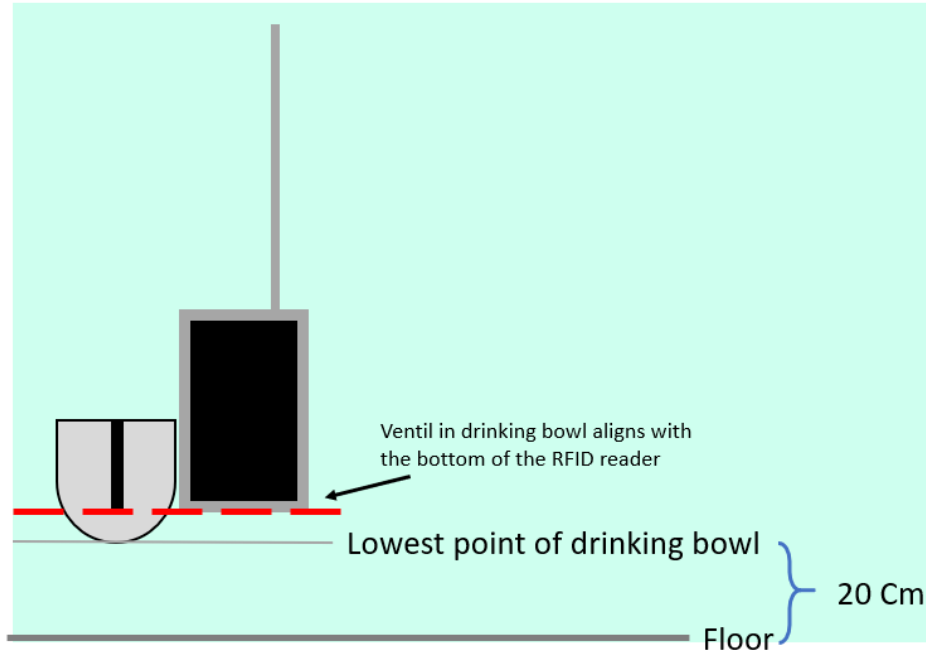
One camera per pen – drinking nipple



Challenge – drinking nipple



RFID reader and drinking bowl



Final camera setup



Data

Parameter	Sensor	Level	Remarks
Water	RS/VENG	Double pen	Installed at May 9 (sec 7+9) and May 23 (sec 8) 5 min intervals
Temperature	VENG	Pen	Manure and resting areas 5 min intervals
Temperature	SKOV	Section	Outdoor and indoor average/day
Weight	DOL64 prototype	Individuals in focus pens	Installed ultimo August 2019 RFID readers next to drinking bowls
			We currently have data from 1½ batch

No manual registrations available

- No insertion weight
- No manual weighings during growt period
- No registrations of diseases or behavioural changes (tail biting or fouling)
- No efficiency report
- No data from the abbatoir

Aims for 'Production monitoring and optimization'

- To detect reduced growth of finishers based on camera-based weighings of individual pigs automatically
- To describe growth of finishers in double pens based on water consumption and temperature
- To develop an alarmsystem which identifies reduced growth of finishers in double pens based on changes in water consumption and temperature

The last aim allows for an affordable scenario with cameras in few pens and water meters in all pens

There are large variations in growth and weight both within and between pens – sentinel pens are not representative

– We do not know whether it is possible to predict growth changes from water and temperature

Initial data handling and considerations

- How can we define 'reduced growth' as an event we wish to identify?
- How does data look and how does it behave – explorative analyses
- Which methods should we use?
- How do we communicate alarms to the farmer?



Defining reduced growth as an event

Main conclusions from workshop held with 7 colleagues from SEGES:

- 3 Standard Deviations from reference growth curve
- 3-4 days in a row below the reference growth curve



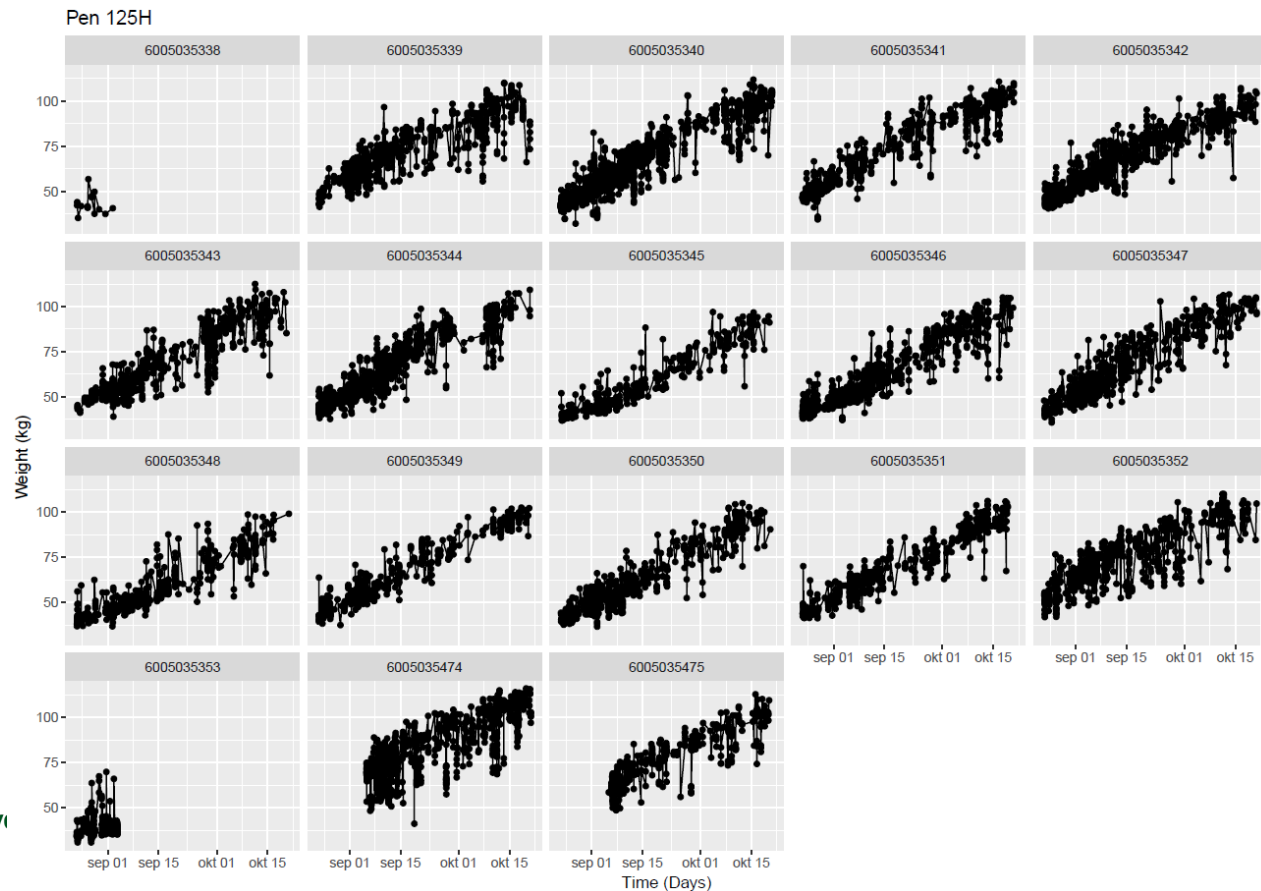
Defining reference curve

- Reference growth curves should be defined separately for
 - Gilts and barrows
 - *Ad libitum* and restrictive feeding
- Each curve should be calculated with respect to insertion weight (average of three first days)
- Finishers are expected to grow 900-1000 g a day
- The reference curve may also be the farmer's goal or the average of the pen

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Explorative analyses – camera based weight estimates



Noget at lev

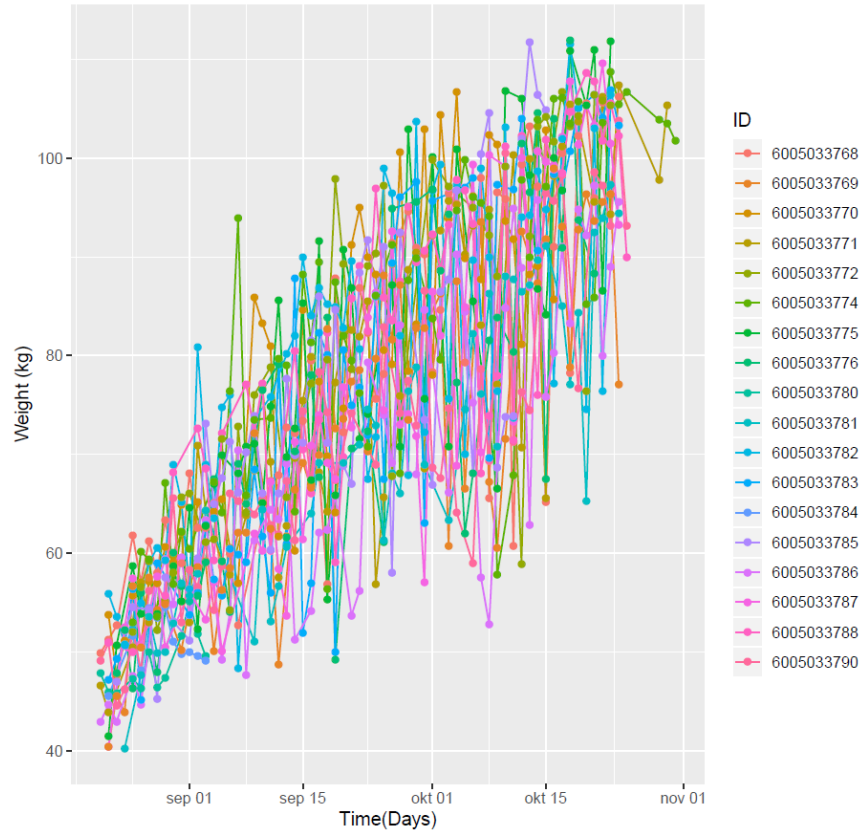


Variation within pens

Average Daily weight of pigs in Pen nr 125H Insert date 2019-05-08

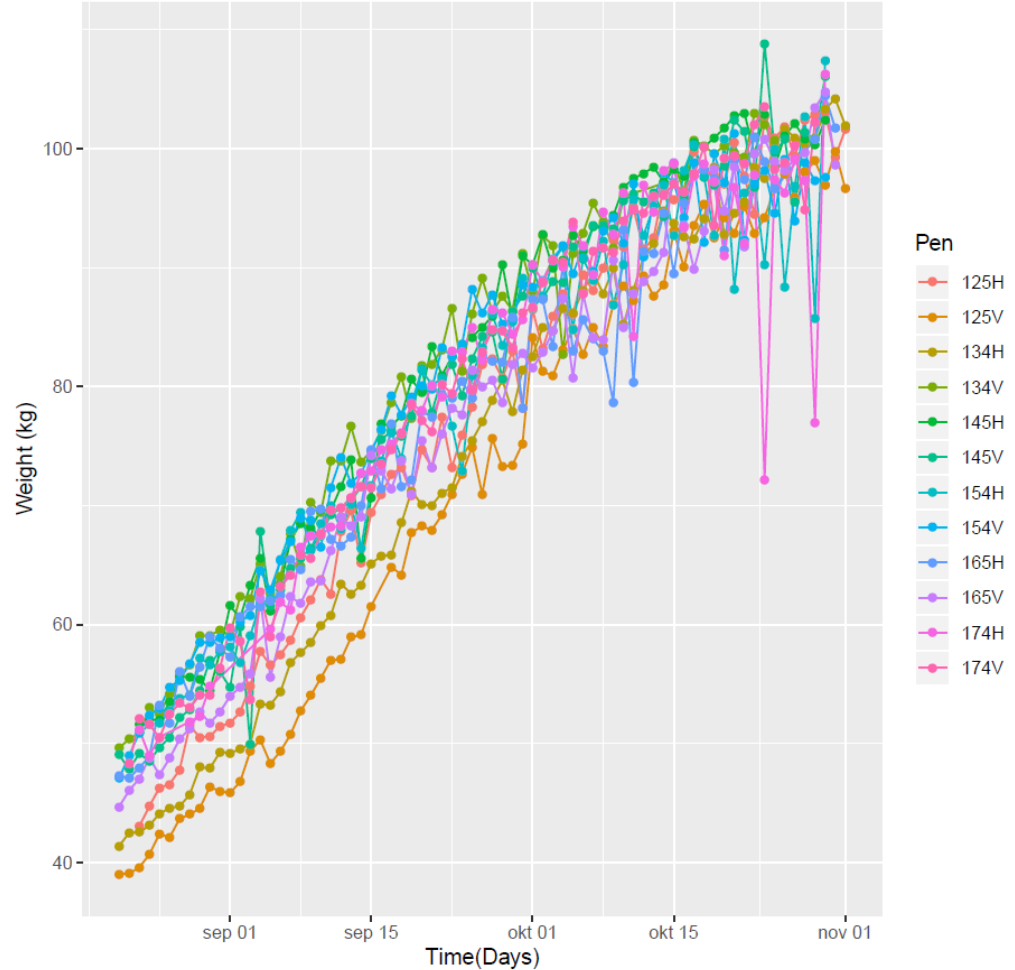


Average Daily weight of pigs in Pen nr 165H Insert date 2019-05-08



Variation between pens

Average Daily weight of Pens Insert date 2019-05-08

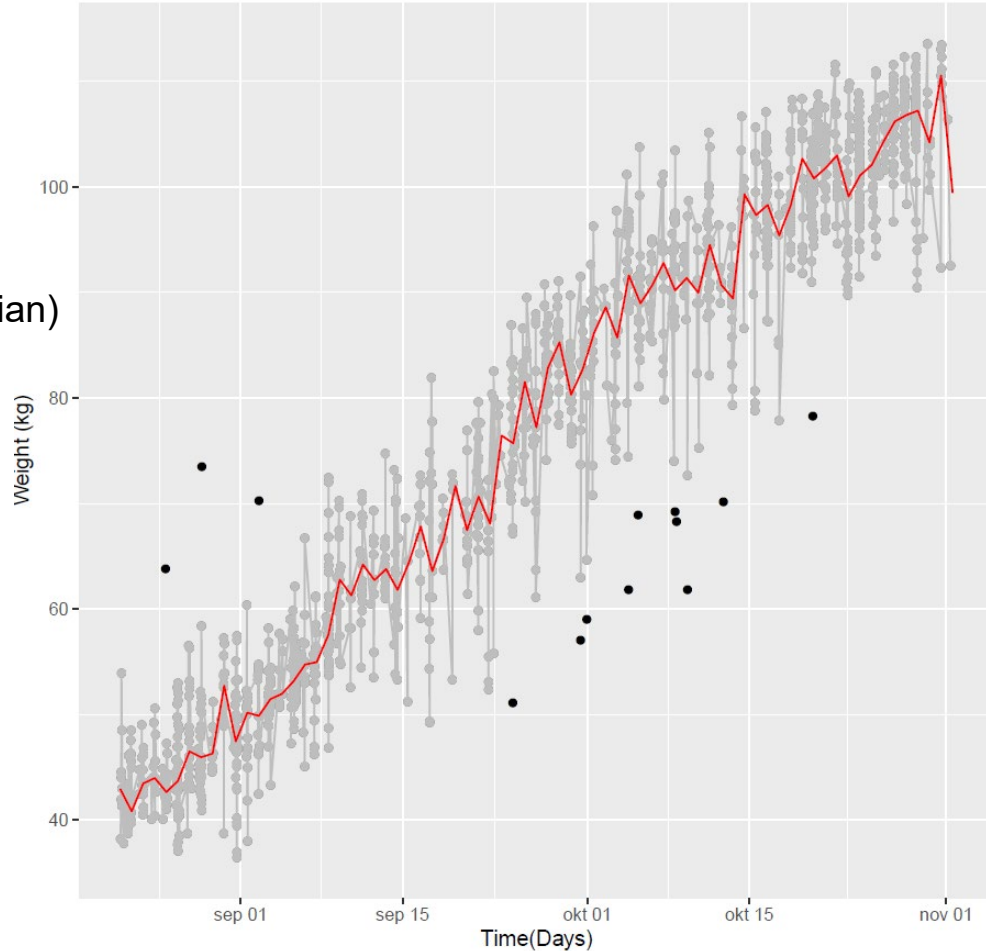


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Raw data – one pig

- Outlier (+/- 20 kg from median)
- Raw observation
- Median



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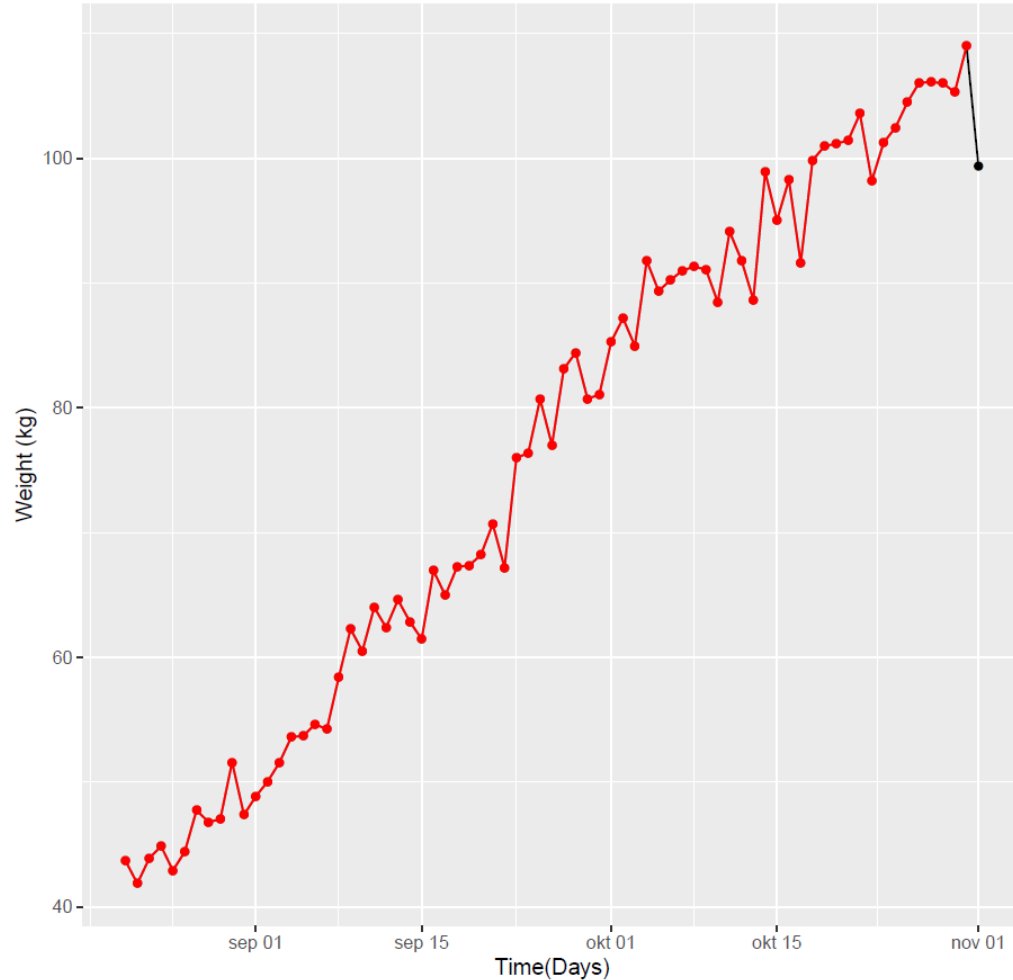


ADW - one pig

Outliers removed

— Average daily weight for days with less than three observations

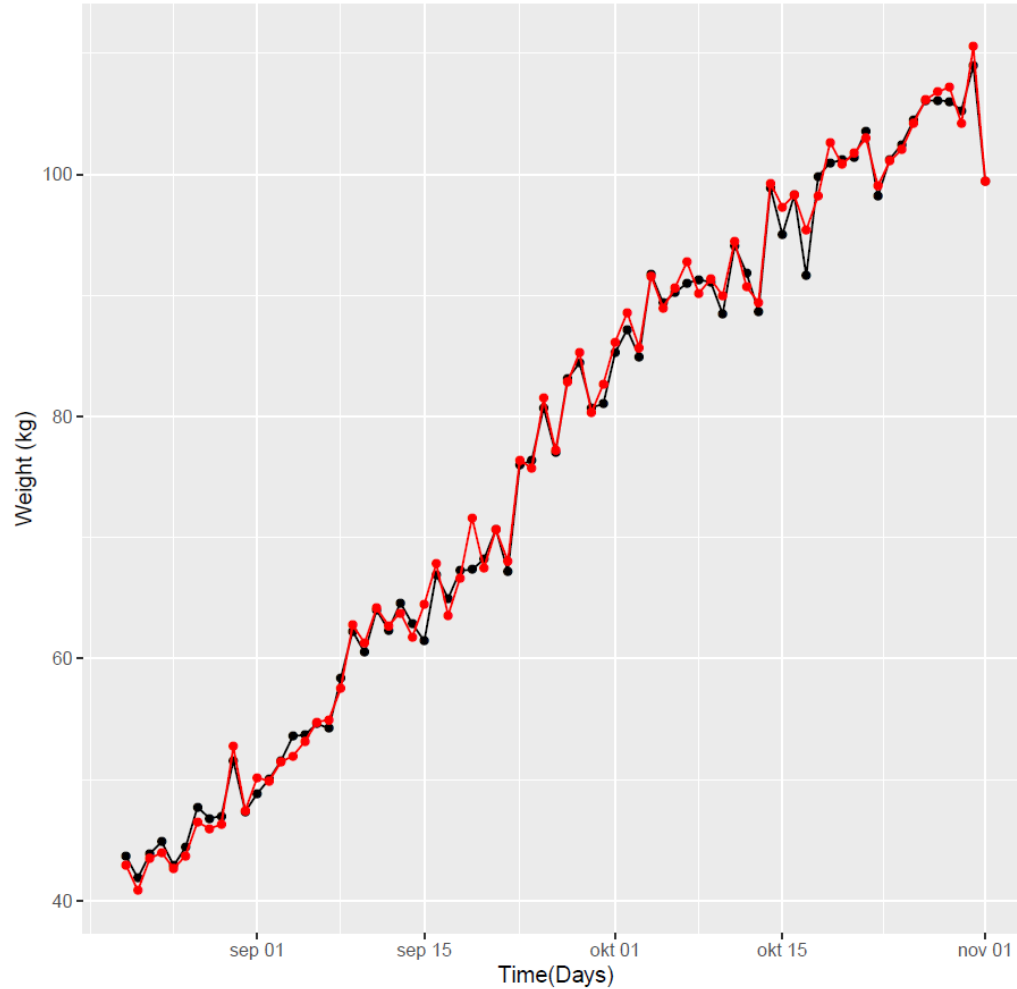
— Average daily weight for days with minimum three observations



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Mean vs median



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Smoothed curve - one pig



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Method consideration – Univariate DLM

A DLM aims to predict the next observation based on all previous observations

- Describe the growth of each pig individually in a *linear growth model* DLM $F_t = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ and $G_t = \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$
- Filter and smooth data in order to reduce amount of noise
- Estimate variance components
- Compare observed growth to reference curve (slope or exact value)
- If observed growth is more than X g lower than the reference curve 3 days in a row – put pig on alarm list
- **If Y pigs in the same (double)pen are on the alarm list – generate an alarm for that (double)pen**
- Go simple? Shewhart control chart monitoring smoothed observations?

Communication to the farmer

- **If more than X pigs in a pen show reduced growth – an alarm will be generated for that pen**
 - The managerial setup – and time costs – does not allow for extra feed or handling of a single (healthy) pig which doesn't grow as fast as expected
 - The farmer can choose to see exactly which pigs have reduced growth and which fulfill their genetic potential
 - At the moment prices for pig meat are historically high due to ASF in China so higher feed conversion ratio, increased daily gain and shorter growth periods are very valuable
- **If more than Y pigs in a pen or in a double pen show simultaneous changes in growth – an alarm will be generated for that pen or double pen**
 - The cause of simultaneous reduced growth is likely to be in the feed formula or in the water supply. Errors in feed formulas are of great concern since they have big consequences but are often found with a delay

TAK og husk!

Vær altid opdateret på den seneste faglige viden

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