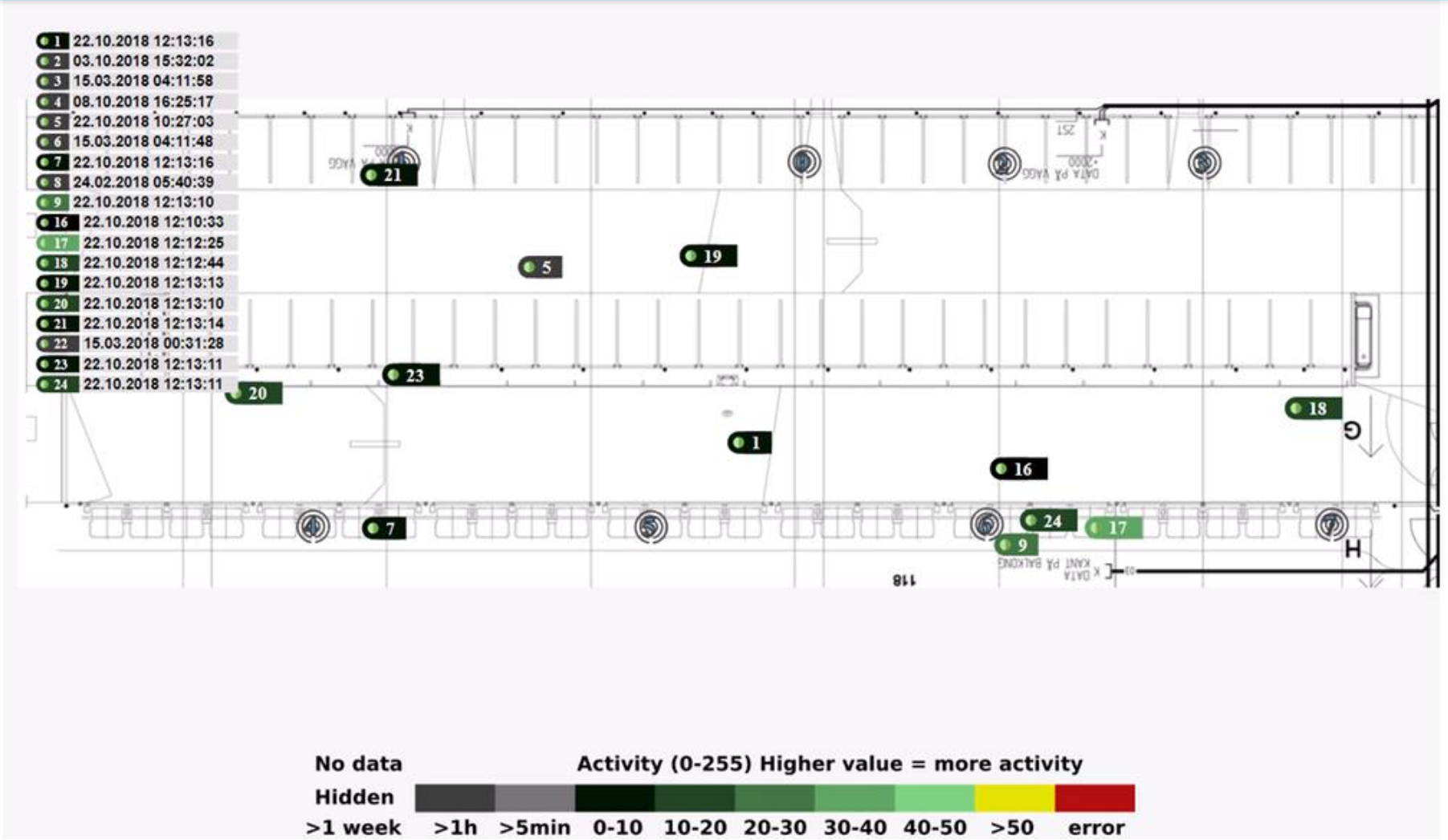
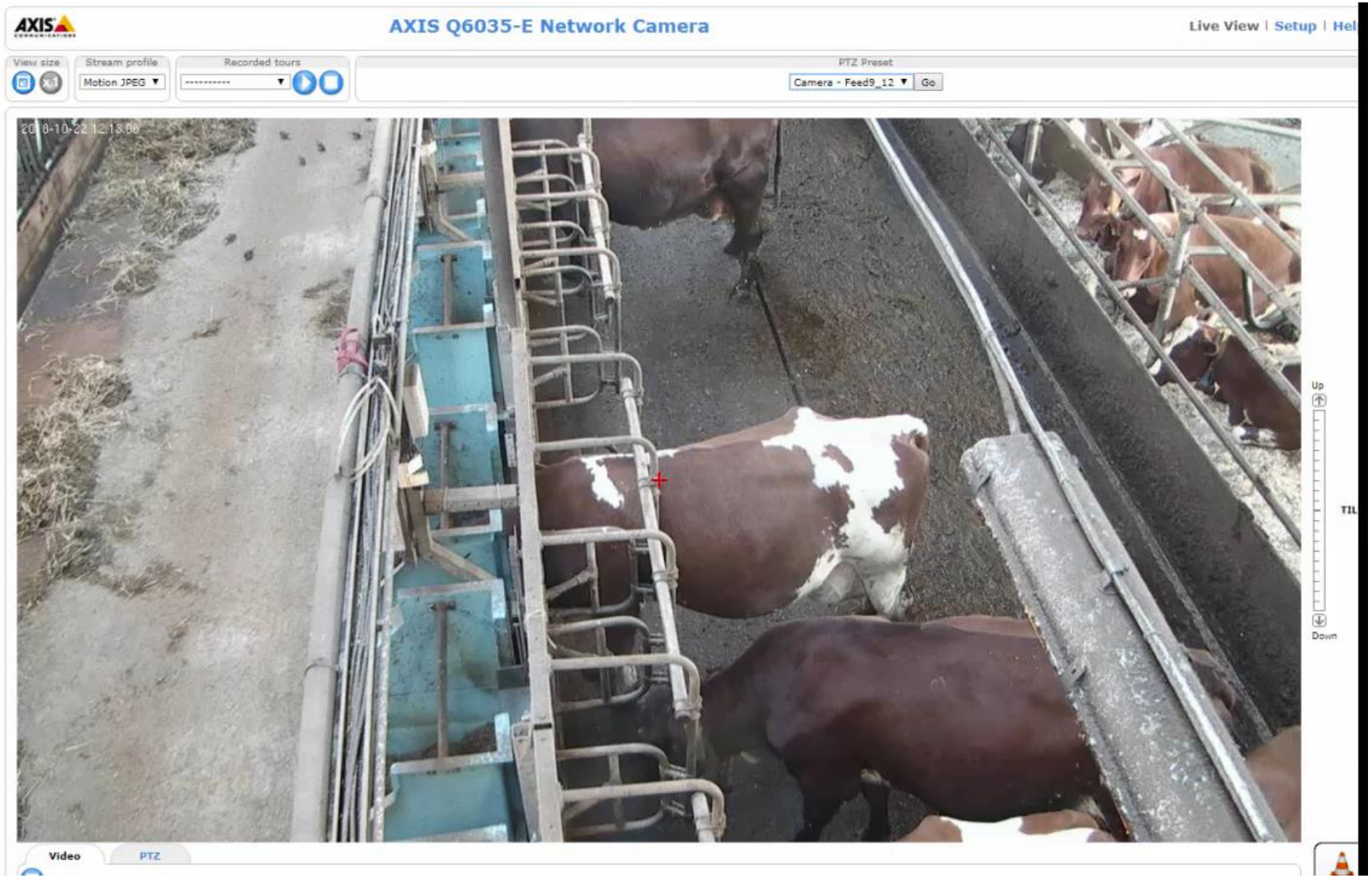
Time Budget Analysis

Keni Ren

AnimalSense - Umea testing site

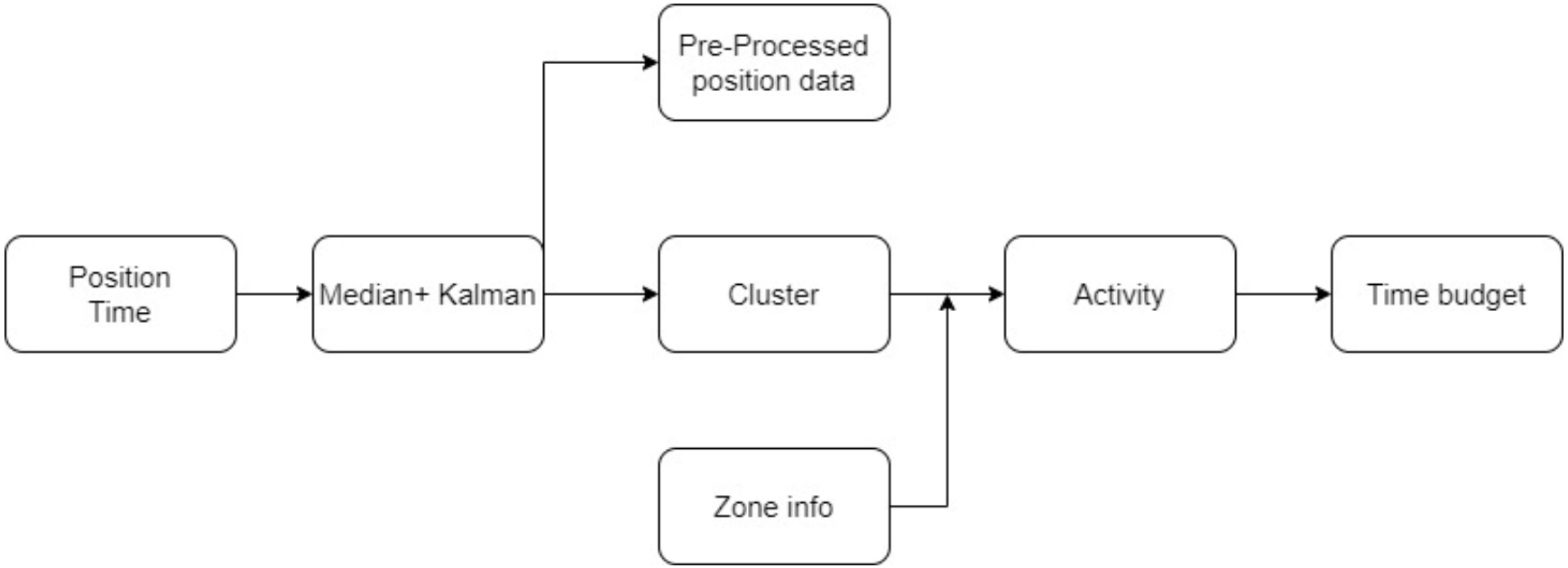




Ren, Keni, et al. "Tracking and analysing social interactions in dairy cattle with real-time locating system and machine learning." *Journal of Systems Architecture*

Indoor RTLS data

- ID, Timestamp, x, y ,(z).
- Blueprint with function zones



Data

DATA FROM POSITION SYSTEM

- FA, PA, PAA, PC
- .csv
- Everyday
- Around 800Mb/day

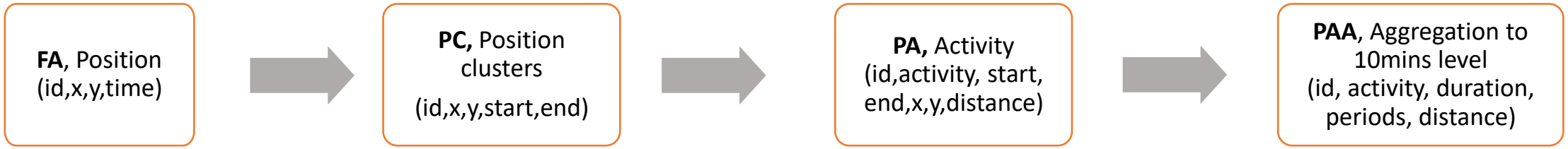
DATA FROM FARM

- Cow traits, insemination records , productions traits
- KO info, Översikt hälsotillstånd X, Avkastn 14 dag…
- .txt
- Every week or longer period

1	data_entity	tag_id	tag_string	time	x	y	z
2	FA	2428773	00250F65	1.57E+12	107	4756	198
3	FA	2428044	00250C8C	1.57E+12	13	4752	198
4	FA	2433145	252079	1.57E+12	3105	1732	198
5	FA	2428747	00250F4B	1.57E+12	2240	3098	198

KO	RESP	TAG	GR	STAT	LAKT	KALVN	DIM
601	13418550	00250cdd	11	DRÄKT	3	4-12-19	285
607	13419990	00250c8c	11	DRÄKT	3	7-01-20	251
611	14966783	00250de6	11	DRÄKT	3	15-07-19	427
659	13418482	00250dcc	21	TIDIG	3	3-09-20	11

DATA FROM POSITION SYSTEM



Sloth, Karen Helle, and Daniel Frederiksen. "Computer system for measuring real time position of a plurality of animals." U.S. Patent No. 10,234,535. 19 Mar. 2019.

FA
(id,time,x,y,z)

data_entity,tag_id,tag_string,time,x,y,z

FA,2198225,00218AD1,1427847365285,2170,2376,137

FA,2200003,002191C3,1427847361618,2827,6220,137

FA,2199224,00218EB8,1427847365333,433,6159,137

FA,2200407,00219357,1427847365379,3091,6972,137

FA,2201318,002196E6,1427847363445,404,5903,137

FA,2199144,00218E68,1427847361227,2731,2114,137

FA,2199938,00219182,1427847350225,2186,5239,137

FA,2201146,0021963A,1427847365635,1148,7545,137

FA,2201418,0021974A,1427847355830,2799,2424,137

FA,2199316,00218F14,1427847365300,1588,3090,137

FA,2196981,002185F5,1427847360796,731,2757,137

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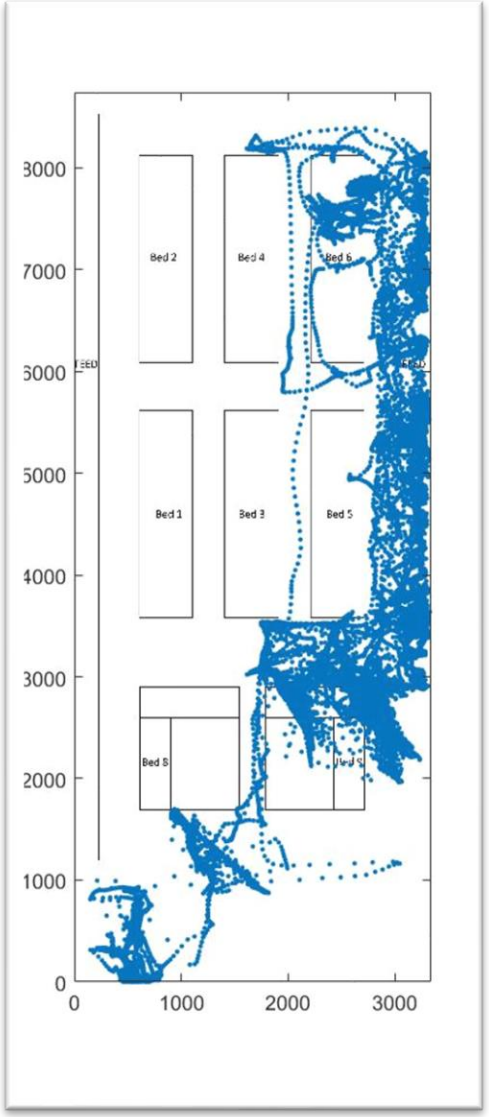
Time in epoch

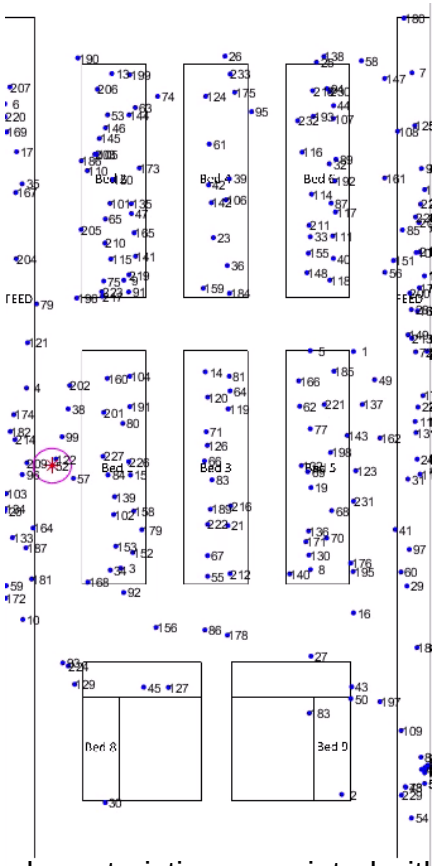


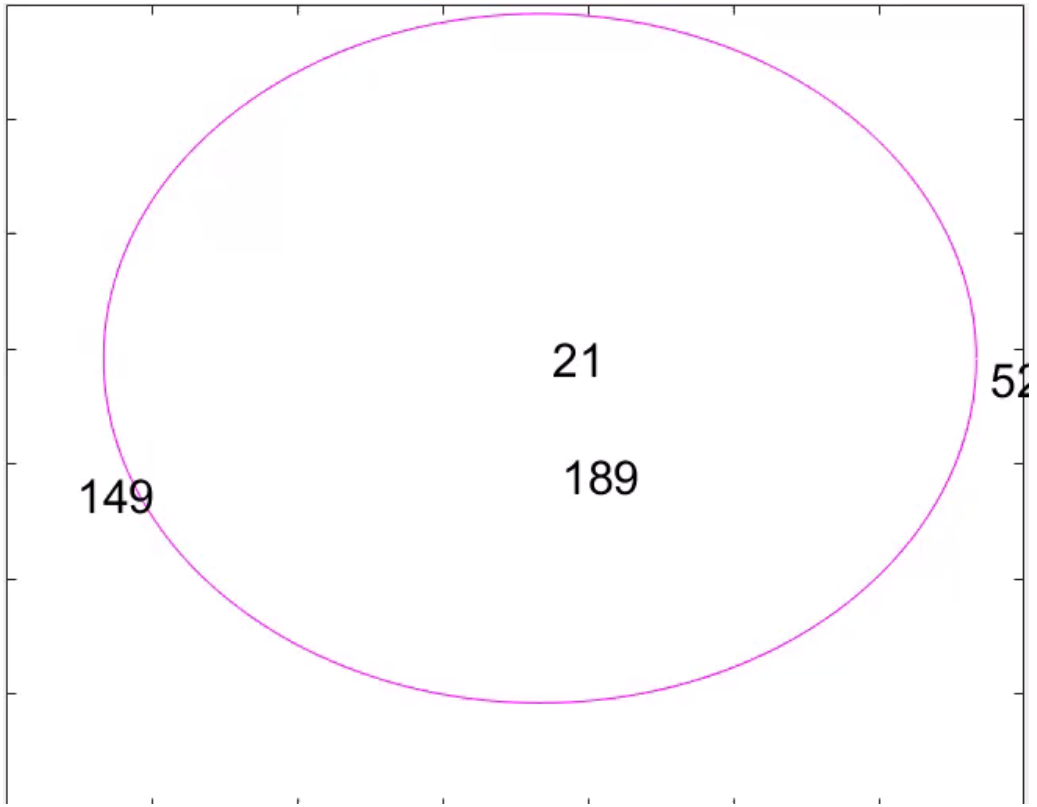
ID=2421875

15-Nov-2019 00:00:00-23:30:00

How we use FA data?

An example: Social contact





Hansson, Ida, et al (2022). Cow characteristics associated with the variation in number of contacts between dairy cows. Journal of Dairy Science.
Marina, Hector, et al. (2023) Social Network Analysis of Dairy Cow Interactions Journal of Dairy Science

PC

(id,start,end,x,y,z)

data_entitiy,tag_id,tag_string,start,end,x,y,z

PC,2198225,00218AD1,1427847365285,1427847365285,2170,2376,137

PC,2200003,002191C3,1427847361618,1427847365259,2827,6220,137

PC,2199224,00218EB8,1427847365333,1427847365333,433,6159,137

PC,2200407,00219357,1427847365379,1427847365379,3091,6972,137

PC,2201318,002196E6,1427847363445,1427847364673,404,5903,137

PC,2199144,00218E68,1427847361227,1427847364819,2731,2114,137

PC,2199938,00219182,1427847350225,1427847365511,2186,5239,137

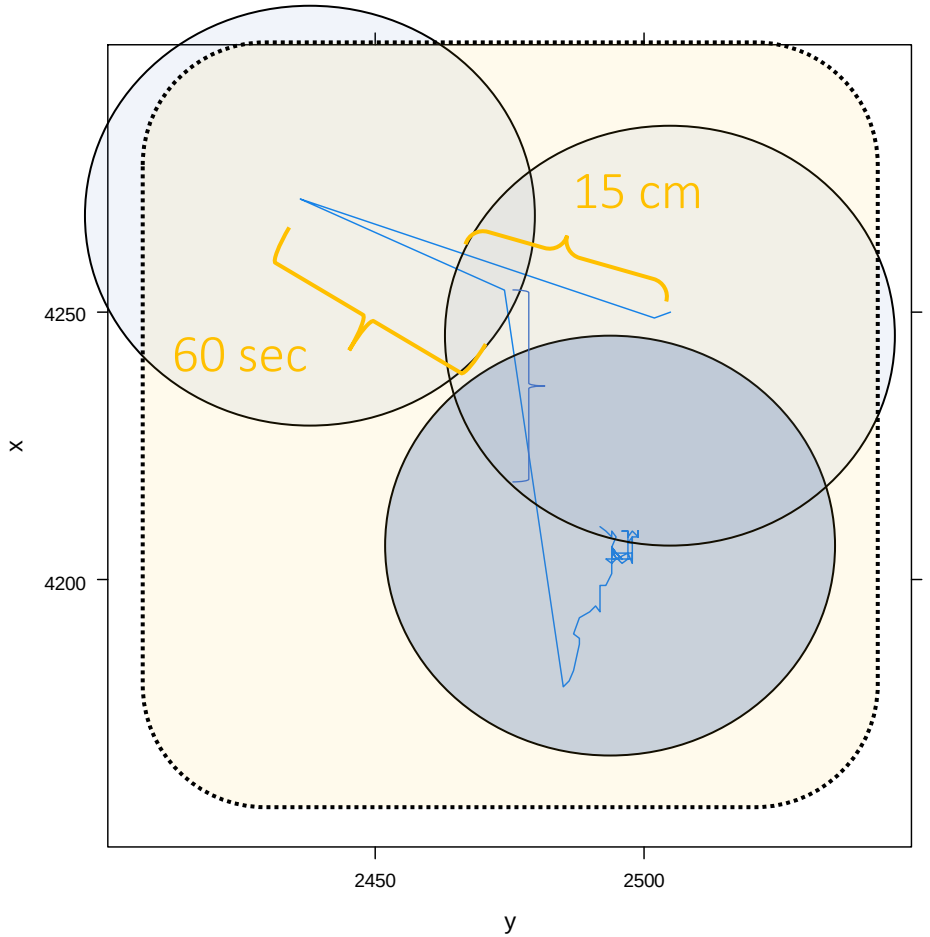
PC,2201146,0021963A,1427847365635,1427847365635,1148,7545,137

PC,2201418,0021974A,1427847355830,1427847365494,2799,2424,137

PC,2199316,00218F14,1427847365300,1427847365300,1588,3090,137

PC,2196981,002185F5,1427847360796,1427847360796,731,2757,137

PC,2199374,00218F4E,1427847364776,1427847365923,1337,3720,137



New cluster if radius > 15 cm or time between two points > 60 sec.

PA
(id, start, end, x, y, z, activity type, distance)

data_entity,tag_id,tag_string,start,end,x,y,z,activity_type,distance

PA,2196869,00218585,1427847353100,1427847376698,3222,5504,137,1,0

PA,2196869,00218585,1427847376698,1427847379119,3221,5522,137,2,25

PA,2196869,00218585,1427847379119,1427847381544,3221,5522,137,1,0

PA,2196869,00218585,1427847381544,1427847383959,3202,5490,137,2,15

PA,2196869,00218585,1427847383959,1427847385171,3202,5490,137,1,0

PA,2196869,00218585,1427847385171,1427847393644,3258,5679,137,2,52

PA,2196869,00218585,1427847393644,1427847413007,3277,5702,137,1,0

PA,2196869,00218585,1427847413007,1427847416637,3230,5686,137,2,26

PA,2196869,00218585,1427847416637,1427847437212,3206,5662,137,1,0

PA,2196869,00218585,1427847437212,1427847442656,3244,5717,137,2,8

PA,2196869,00218585,1427847442656,1427847486835,3216,5682,137,1,0

PA,2196869,00218585,1427847486835,1427847489255,3156,5713,137,2,25

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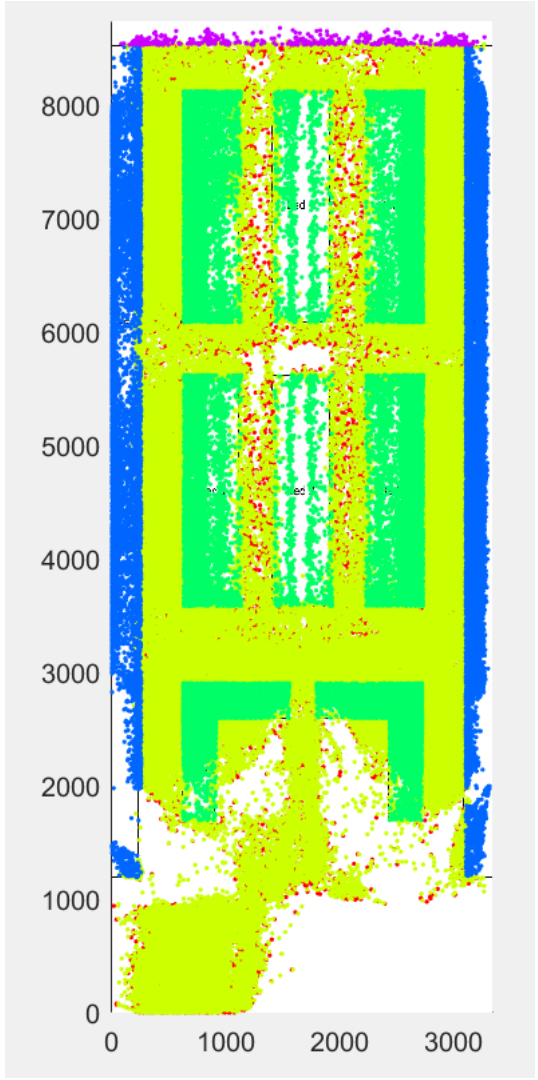
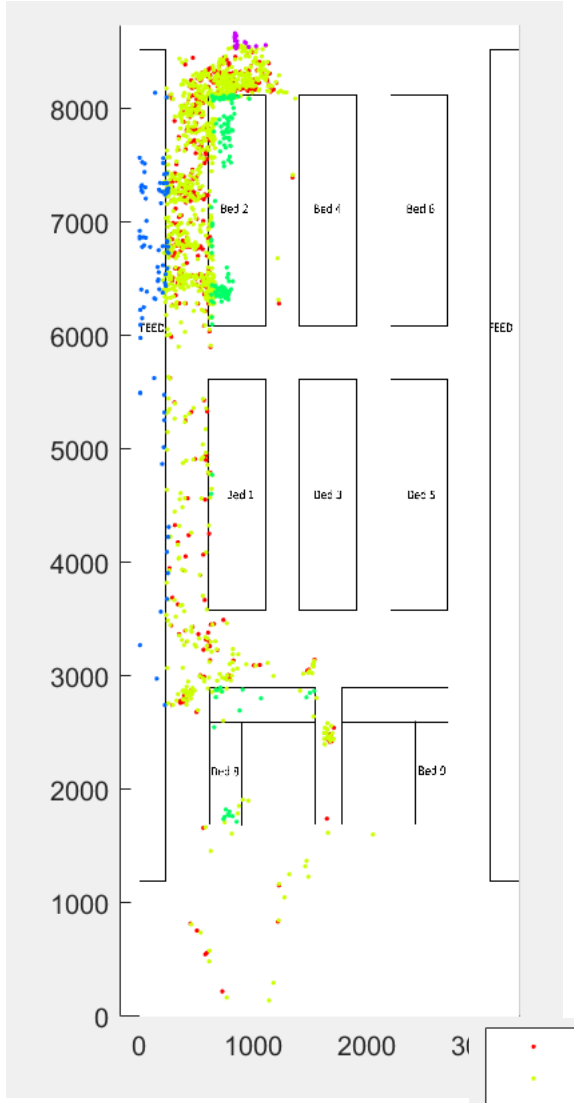
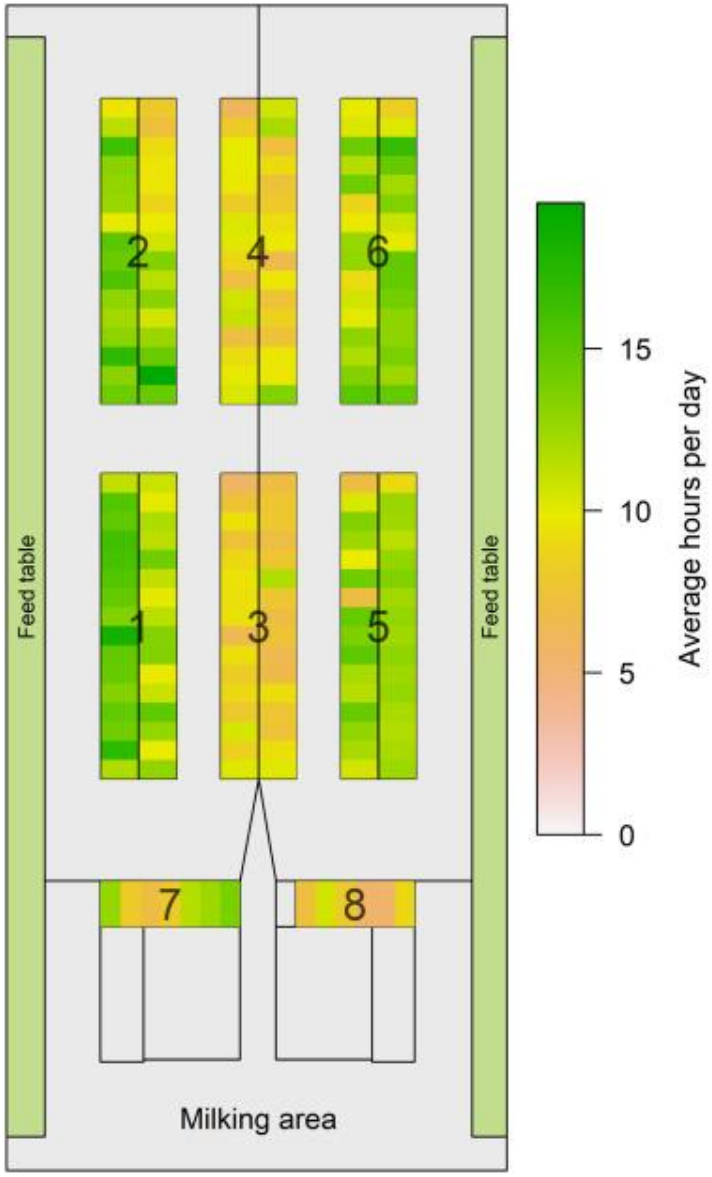




1 Standing
2 Walking
3 Bed
4 Feeding
999 Out range

How we use PA data?
An example: Cubic Choice



Churakov, M., Silvera, A. M., Gussmann, M., & Nielsen, P. P. (2021). Parity and days in milk affect cubicle occupancy in dairy cows. *Applied Animal Behaviour Science*, 105494.

Gussmann, Maya, et al. “Variations in cow behavior after regrouping in a conventional Swedish dairy herd”

PAA
(id, span, interval, activity type, duration, periods, distance)

data_entity,tag_id,tag_string,span,interval,activity_type,distance,periods,duration

PAA,2197312, 00218740,1381755600000,3600000,1,0,88,1204757

PAA,2197312, 00218740,1381755600000,3600000,2,2710,92,1352724

PAA,2197312, 00218740,1381755600000,3600000,3,0,3,555727

PAA,2197312, 00218740,1381755600000,3600000,4,0,2,486791

PAA,2197139, 00218693,1381755600000,3600000,1,0,29,209335

PAA,2197139, 00218693,1381755600000,3600000,2,3502,58,186696

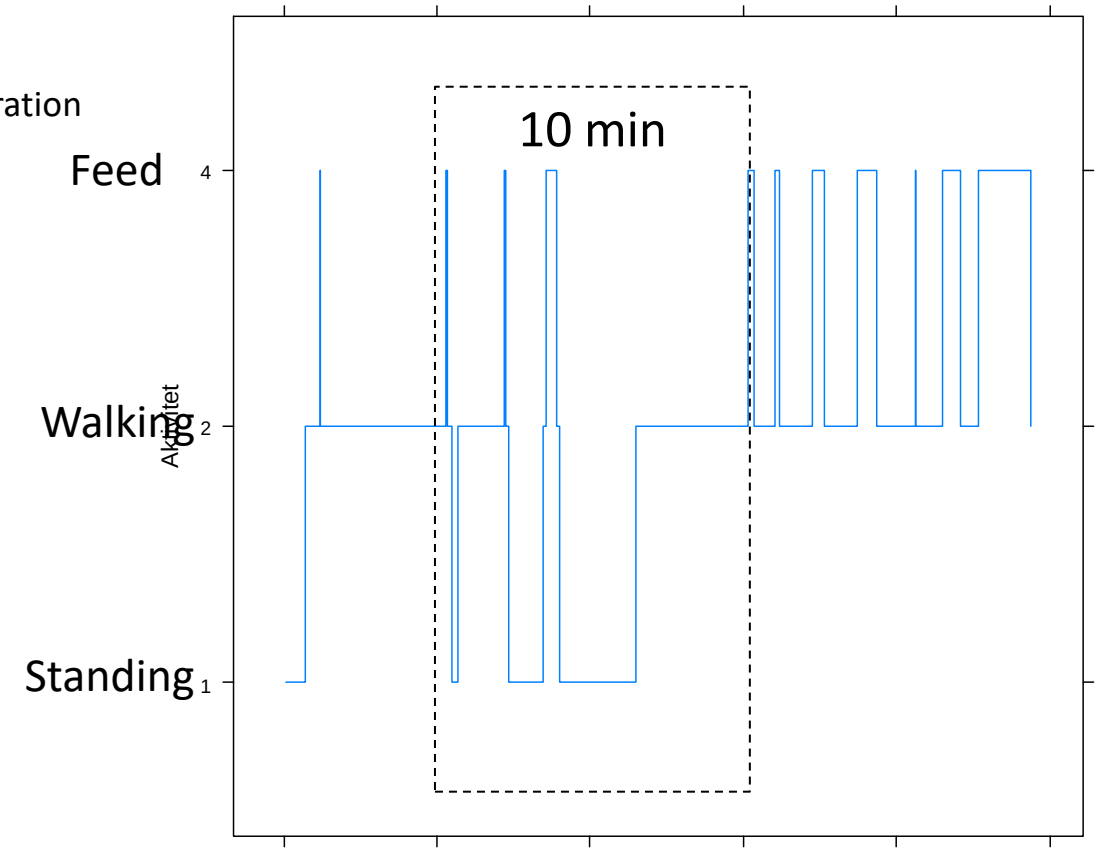
PAA,2197139, 00218693,1381755600000,3600000,3,0,29,3203968

PAA,2196892, 0021859C,1381755600000,3600000,1,0,19,194937

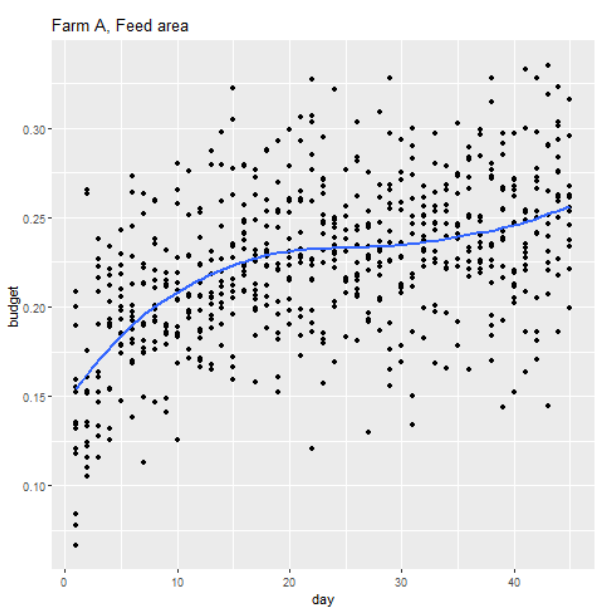
PAA,2196892, 0021859C,1381755600000,3600000,2,2055,30,388698

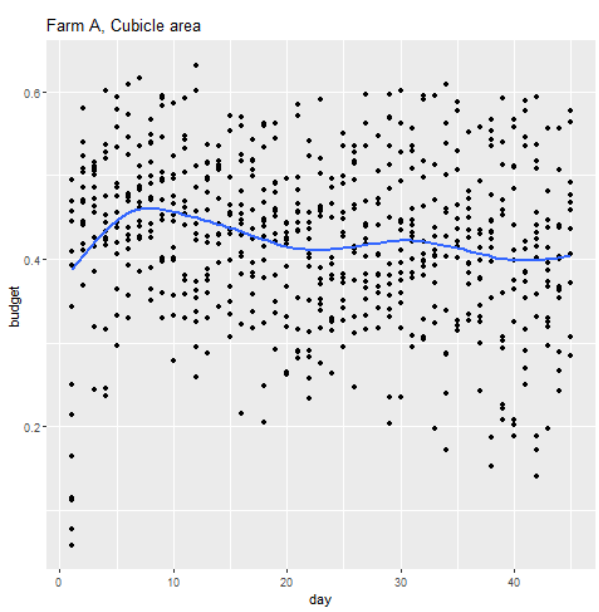
PAA,2196892, 0021859C,1381755600000,3600000,3,0,4,58709

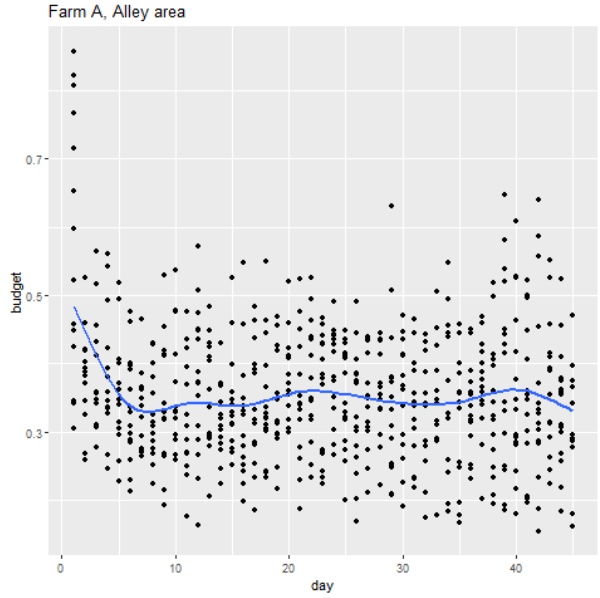
PAA,2196892, 0021859C,1381755600000,3600000,4,0,8,2957655



How we use PAA data?
An example: Activity budget







Johansson, Teresa, et al. “Development of stability in heifer time budgets after introduction to the milking herd.”
Ren, Keni, et al. “Time budgets differ between lactation periods after the calving period ”

Exercise time

A few questions after you finished go through the script:

- From the *analysis. R* you have the *getMeanPos* function to get the mean position of an individual (or a group).
- You can compare one individual's mean position with the cubic preference. Compare the cubic preference differences between Mid-lactation &&Parity 1 and Mid-lactation Parity 3+.
- Get the average time each cubicle was occupied of the day.