Technology for catching data on animal movement

Keni Ren

Let’s play some games!

- Pink and Yellow posters with numbers
- Different zones
- Timer says ”BEEeeP”+number (1,2,3…)
- Note

Game 1: Stand by me

- 2 people wear Pink posters; the rest wear Yellow. Pink have notes.
- Pink stand in different zones, within a circle 2m in diameter
- Yellow can free moving
- Timer every 20 second says ”BEEeeP” ”+number (1,2,3…)
- Pink write down the time number and who are inside circle whenever they hear ”BEEeeP” (example: 1, 5 2; 2,0; 3,9 10;…)

RFID

(a) RFID reader module

(b) RFID reader antenna

(c) Ear tag RFID transponder

(d) Implant RFID transponder

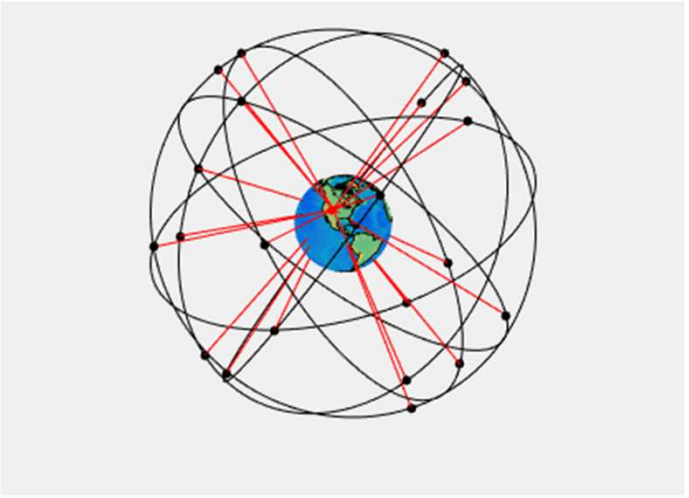
Tracking and identification of animals for a digital zoo
Karlsson et.al. 2010

Game 2: Talker and Listener

- 4 people wear Pink posters and one of them is Pink_0. Pink stand in each corner of the area. 1 Yellow free moving. Yellow have note.
- Timer say ”BEEeeP” ”+number (1,2,3…) every 20 seconds
- Yellow says ”Attention!” whenever he/she hears ”BEEeeP”. Pink respond with rising hand.
- If Yellow could see more than 3 Pink’s responds, write down the time number and which zone you stand in. (example: 1, 1; 2,1; 4,2;…)
- Yellow sends the note to Pink_0.

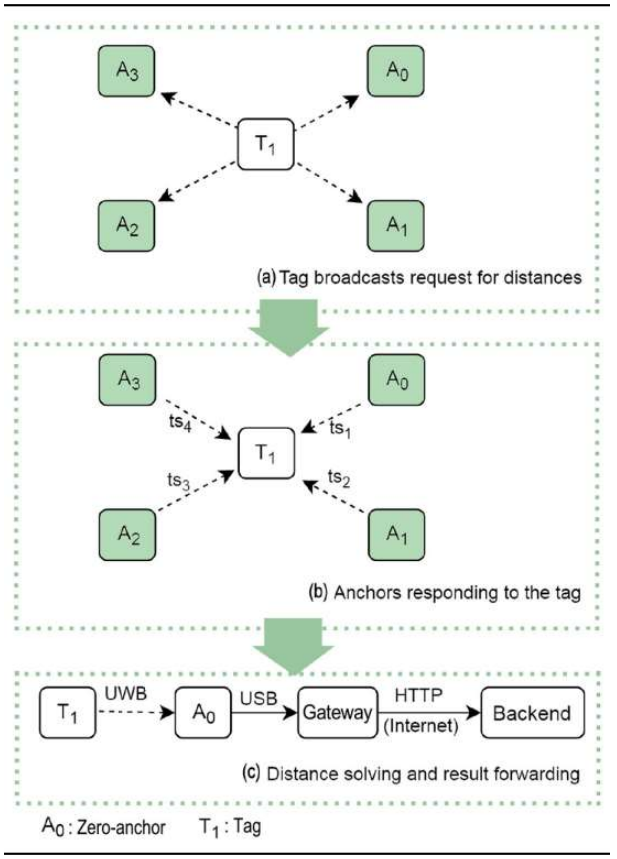
Transmitters, Receivers

- Radio Telemetry: global positioning system (GPS) tracking, and satellite tracking.



Transmitters, Receivers

- Ultra-wideband (UWB)



A sensor-fusion-system for tracking sheep location and behaviour
Ren et al. 2020

Game 3: Now I can see you

- 1 Pink stand in the corner, with two paper shields, keeping the eyesight 120 degrees. 5 yellow free moving.
- Timer say ”BEEeeP” ”+number (1,2,3…) every 20 seconds
- Pink speaks loudly of the time number and everything they see

Cameras

Identification and tracking

Others

Acoustic Tracking

VHF

Ultrasonic Tracking

Pressure Sensors

Offline, Online/Real-time

Missing Data

15-Nov-2019 00:00:15'	NaN	NaN	'15-Nov-2019 00:00:36'	NaN	NaN
'15-Nov-2019 00:00:16'	NaN	NaN	'15-Nov-2019 00:00:37'	NaN	NaN
'15-Nov-2019 00:00:17'	NaN	NaN	'15-Nov-2019 00:00:38'	3138	4102
'15-Nov-2019 00:00:18'	NaN	NaN	'15-Nov-2019 00:00:39'	NaN	NaN
'15-Nov-2019 00:00:19'	NaN	NaN	'15-Nov-2019 00:00:40'	NaN	NaN
'15-Nov-2019 00:00:20'	NaN	NaN	'15-Nov-2019 00:00:41'	3169	4122
'15-Nov-2019 00:00:21'	NaN	NaN	'15-Nov-2019 00:00:42'	NaN	NaN
'15-Nov-2019 00:00:22'	NaN	NaN	'15-Nov-2019 00:00:43'	NaN	NaN
'15-Nov-2019 00:00:23'	NaN	NaN	'15-Nov-2019 00:00:44'	NaN	NaN
'15-Nov-2019 00:00:24'	NaN	NaN	'15-Nov-2019 00:00:45'	NaN	NaN
'15-Nov-2019 00:00:25'	NaN	NaN	'15-Nov-2019 00:00:46'	NaN	NaN
'15-Nov-2019 00:00:26'	NaN	NaN	'15-Nov-2019 00:00:47'	NaN	NaN
'15-Nov-2019 00:00:27'	NaN	NaN	'15-Nov-2019 00:00:48'	NaN	NaN
'15-Nov-2019 00:00:28'	NaN	NaN	'15-Nov-2019 00:00:49'	NaN	NaN
'15-Nov-2019 00:00:29'	NaN	NaN	'15-Nov-2019 00:00:50'	NaN	NaN
'15-Nov-2019 00:00:30'	NaN	NaN	'15-Nov-2019 00:00:51'	NaN	NaN
'15-Nov-2019 00:00:31'	NaN	NaN	'15-Nov-2019 00:00:52'	NaN	NaN
'15-Nov-2019 00:00:32'	NaN	NaN	'15-Nov-2019 00:00:53'	NaN	NaN
'15-Nov-2019 00:00:33'	NaN	NaN	'15-Nov-2019 00:00:54'	NaN	NaN
'15-Nov-2019 00:00:34'	NaN	NaN	'15-Nov-2019 00:00:55'	NaN	NaN
'15-Nov-2019 00:00:35'	NaN	NaN	'15-Nov-2019 00:00:56'	NaN	NaN

1

Examining the data quality

Used the random 69 cows to determine the location and duration of missing data

K Ren, PP Nielsen, M Alam, L Rönnegård - JDS Communications, 2021

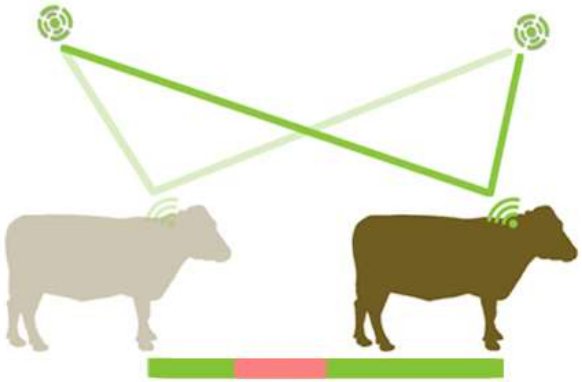
2

Work on the interpolation method.

Using the 20 cow with high performance tags to compare the effects of four different interpolation methods

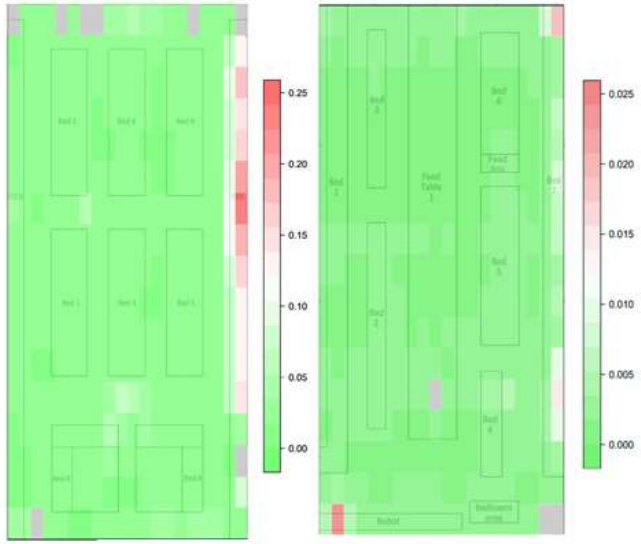
Ren, K., Alam, M., Peetz Nielsen, P., Gussmann, M., & Rönnegård, L. - *Frontiers in Animal Science*, 2022

Ultra-wideband RTLS



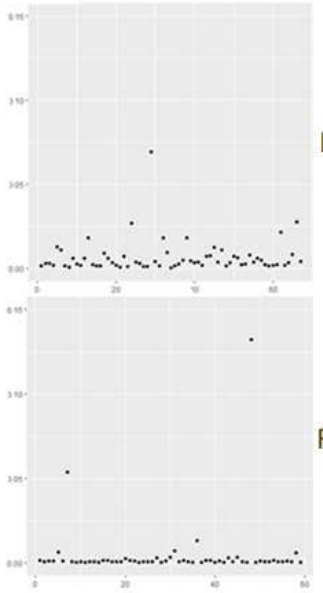
Missing
Position Data

Missing Data Locations



Farm 1 Farm 2

Variation between Cows

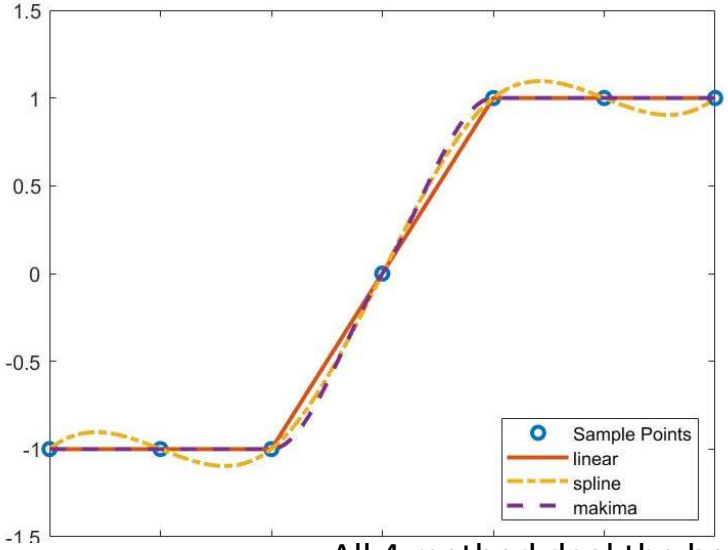


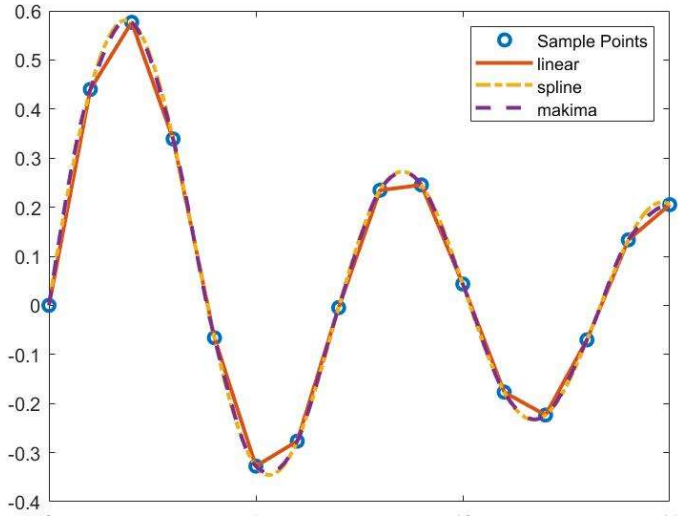
Farm 1

Farm 2

Data interpolation

- Previous
- Linear
- Spline
- Makima

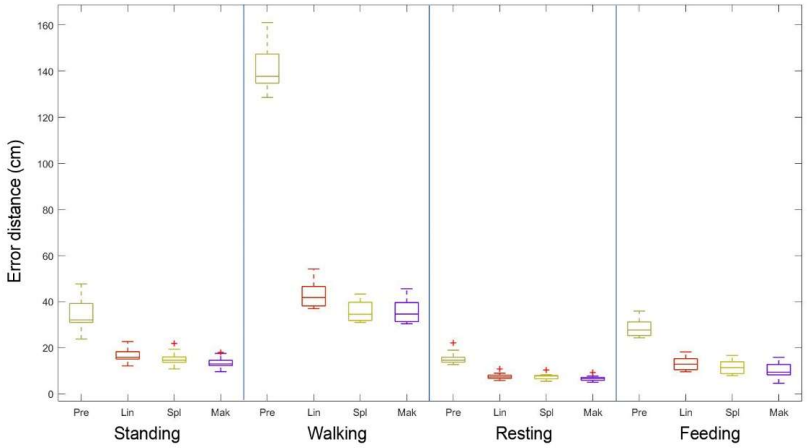


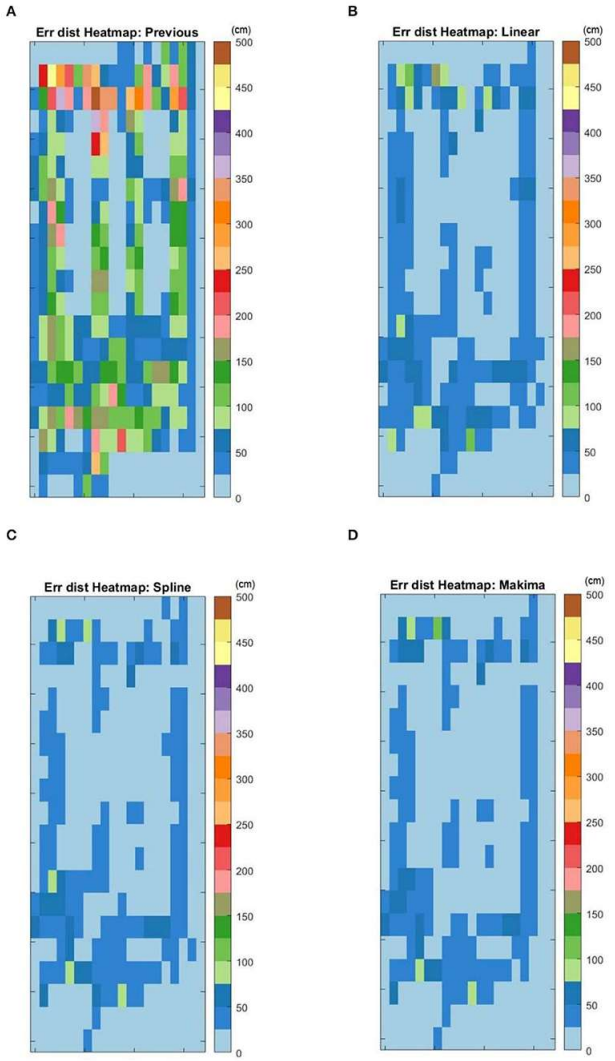


All 4 method deal the beginning missing using the first non-missing values, and end values as the previous non-missing values

All 4 method drag the interpolated data back from the barn boarder.

	Mean (cm)	Standard deviation (cm)
Previous	55.1	51.1
Linear	20.2	14.2
Spline	17.7	11.5
Makima	16.6	11.9





Ren, K., Alam, M., Peetz Nielsen, P., Gussmann, M., & Rönnegård, L. - *Frontiers in Animal Science,* 2022