

Additional file 1: Description of the accelerometry and magnetometry variables used for behavioural classification and the output of the random forest models.

Table A1: A list of the accelerometry and magnetometry variables that are used or calculated for the random forest model. Including the name, and label, the description of the variable and its calculation.

Variable	Description	Reference
Static acceleration (Static X, Static Y, Static Z)	The static acceleration of each axis, representing the orientation of the device and thus the subjects' posture. Calculated as the running mean of acceleration for each orthogonal axis over 2 seconds.	(Wilson, Shepard and Liebsch, 2008)
Pitch and Roll	To define the change in this posture, the change in acceleration of the X axis representing 'sway' movement (Pitch) and Y axis representing 'surge' movement (Roll). Calculated as the arcsine of the X and Y axis respectively.	
Overall Dynamic Body Acceleration (ODBA)	The sum of the absolute dynamic acceleration of all three orthogonal axes.	(Halsey, Shepard and Wilson, 2011)
Vectorial Dynamic Body Acceleration (VeDBA)	Provides values closer to the true acceleration experienced. Unlike ODBA it is not sensitive to device orientation. It is calculated as the square root of the sum of each acceleration axes squared.	(Bidder, Qasem and Wilson, 2012; Qasem <i>et al.</i> , 2012)
VeDBA smoothed (smVeDBA)	To remove noise and reduce the variation in the VeDBA signal, an additional variable of smoothed VeDBA was used. VeDBA was smoothed using a running mean of 1 sec, was calculated over 1 second using a running mean to remove the variation in VeDBA at 40Hz.	
Magnetic smoothed (Mag X, Mag Y, Mag Z)	The magnetic orientation of the device in relation to the magnetic field of the earth for three axes, smoothed over 40 data points (1 sec).	(Williams <i>et al.</i> , 2017; Chakravarty <i>et al.</i> , 2019)
Magnetic vectoral sum smoothed (MagVecSum)	The smoothed sum of the vectoral magnetometry for three axes, depicting overall absolute change in magnetic orientation.	
Magnetic pitch and roll (MagPitch, MagRoll)	A measure of magnetic rotation in the X axis (pitch) and Y axis (roll), calculated using the arcsine of each axis respectively.	

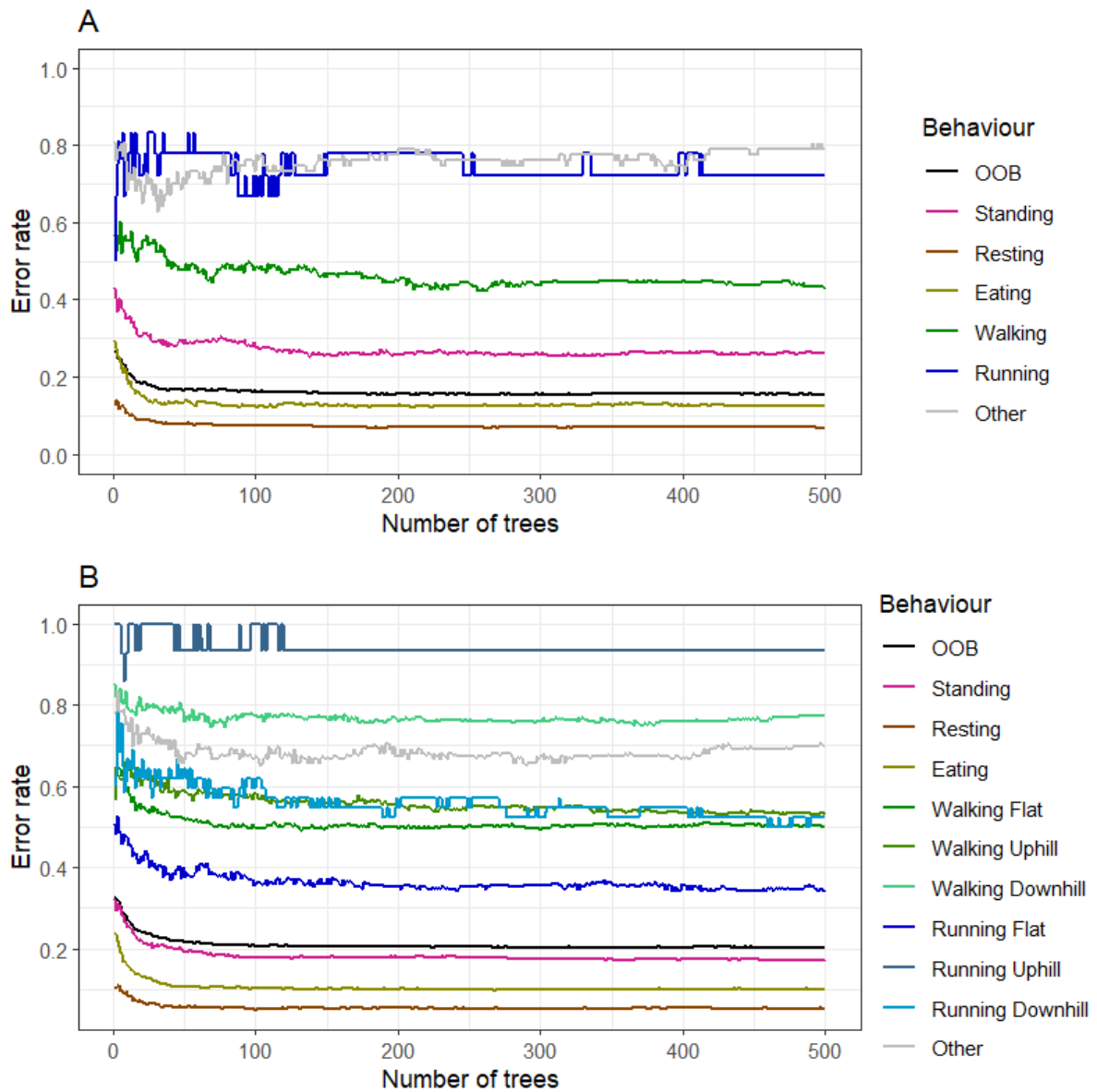


Figure A1: Random forest error plots across 500 trees for classifying behaviours showing the Out-of-bag (OOB) error estimates and error estimates for each of the five behavioural states; Standing, Resting, Eating, Walking, Running and Other. Plotted for predicting five behaviours (A) and five behaviours including the terrain slope for locomotion behaviours (B).

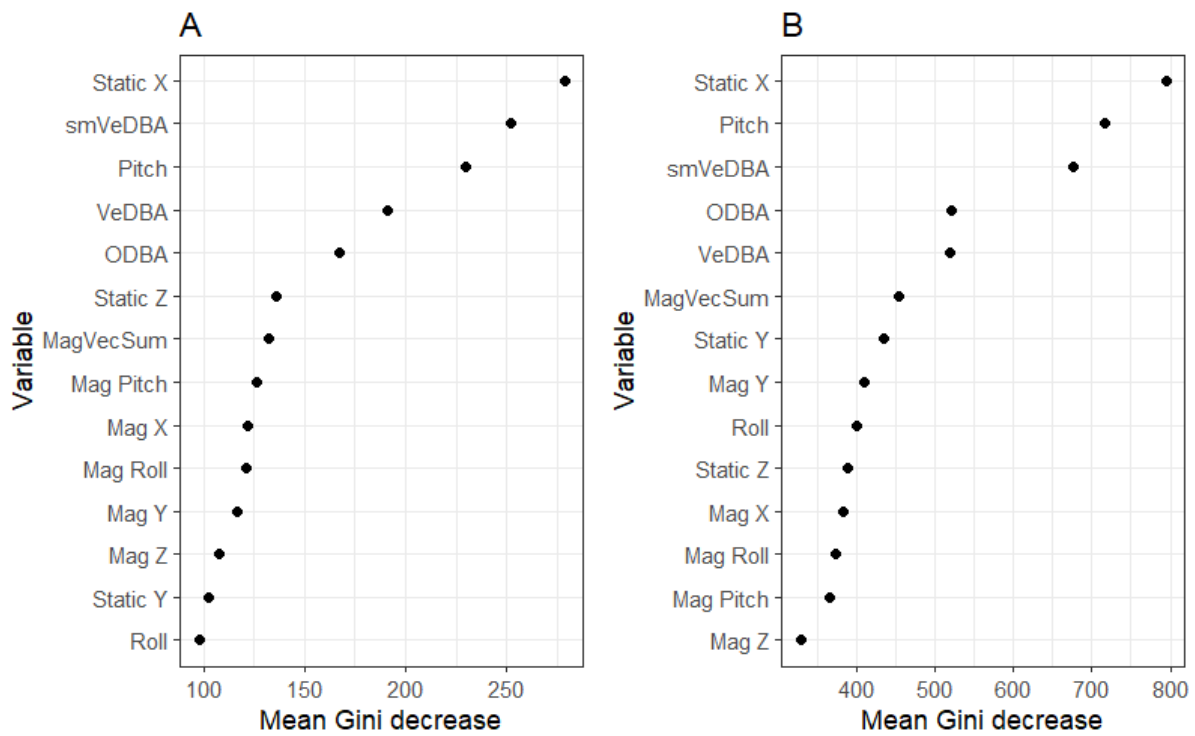


Figure A2: The mean Gini decrease, ranking the variables by their importance for predicting five behaviours (A) and five behaviours including the terrain slope for locomotion behaviours (B) using random forest models.



Figure A3: The precision and recall for each of the five behaviours (A) and five behaviours including the terrain slope for locomotion behaviours (B).

Table A3: Confusion matrix showing the observed and predicted behaviours for predicting five behaviours in a flat environment. Italicised cells are the true positives where the behaviour has been correctly predicted.

Predicted behaviour	Observed behaviour					
	Eating	Other	Resting	Running	Standing	Walking
Eating	<i>630</i>	8	16	0	19	13
Other	0	<i>28</i>	3	0	0	0
Resting	22	4	<i>978</i>	0	12	3
Running	0	0	0	<i>12</i>	0	0
Standing	9	1	1	0	<i>300</i>	2
Walking	2	0	0	3	9	<i>100</i>

Table A4: Confusion matrix showing the observed and predicted behaviours for predicting five behaviours including slope of terrain for locomotion behaviours. Italicised cells are the true positives where the behaviour has been correctly predicted.

Predicted behaviour	Observed behaviour									
	Eating	Other	Resting	Running Downhill	Running Flat	Running Uphill	Standing	Walking Downhill	Walking Flat	Walking Uphill
Eating	<i>2845</i>	11	3	0	9	0	81	33	120	13
Other	1	<i>53</i>	0	0	0	0	4	0	1	0
Resting	1	0	<i>589</i>	0	0	0	3	0	0	0
Running Downhill	0	1	0	<i>25</i>	1	0	0	1	2	0
Running Flat	0	0	0	1	<i>150</i>	0	2	2	2	1
Running Uphill	0	0	0	0	0	<i>8</i>	0	0	0	0
Standing	42	1	5	0	1	0	<i>1411</i>	2	19	2
Walking Downhill	2	0	0	0	1	0	0	<i>111</i>	0	3
Walking Flat	43	8	0	0	8	1	25	26	<i>563</i>	12
Walking Uphill	4	0	0	0	0	<i>3</i>	4	1	9	<i>128</i>