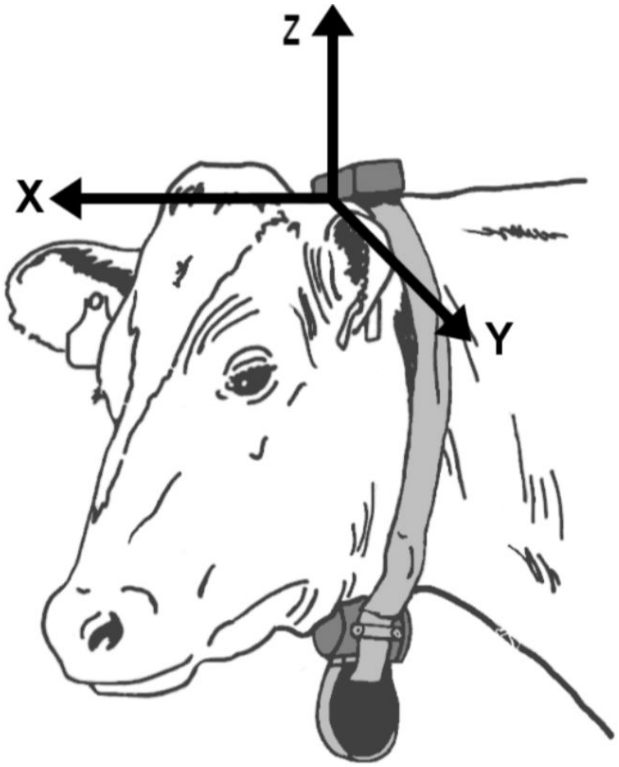
Recent Accelerometer Work

By Davey Seeman



Datalogger with the accelerometer 3D

Counterweight

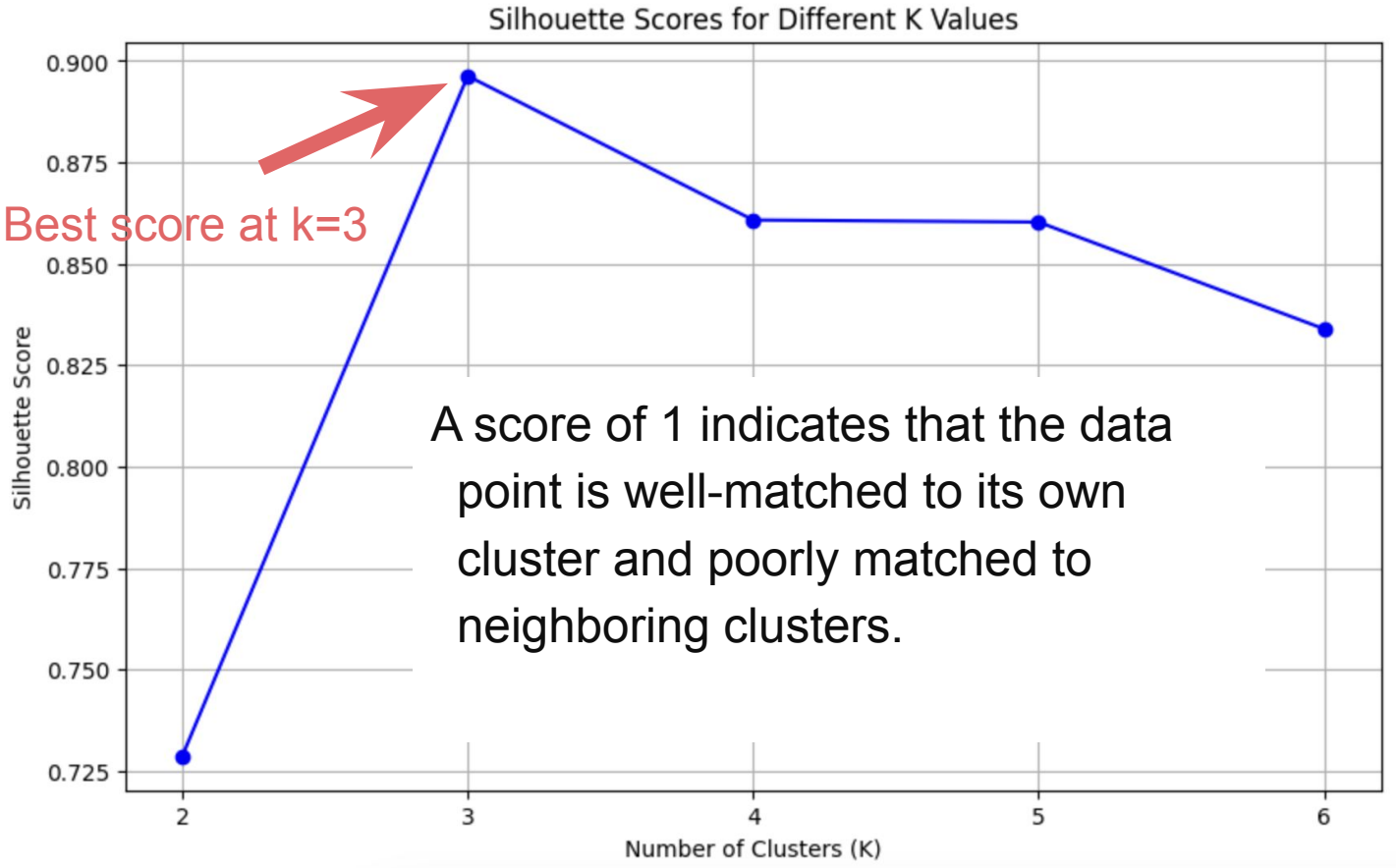
K-Means Clustering

Method: Divide data into distinct groups or “clusters” based on their accelerometer data (their acceleration along x,y, z, coordinates).

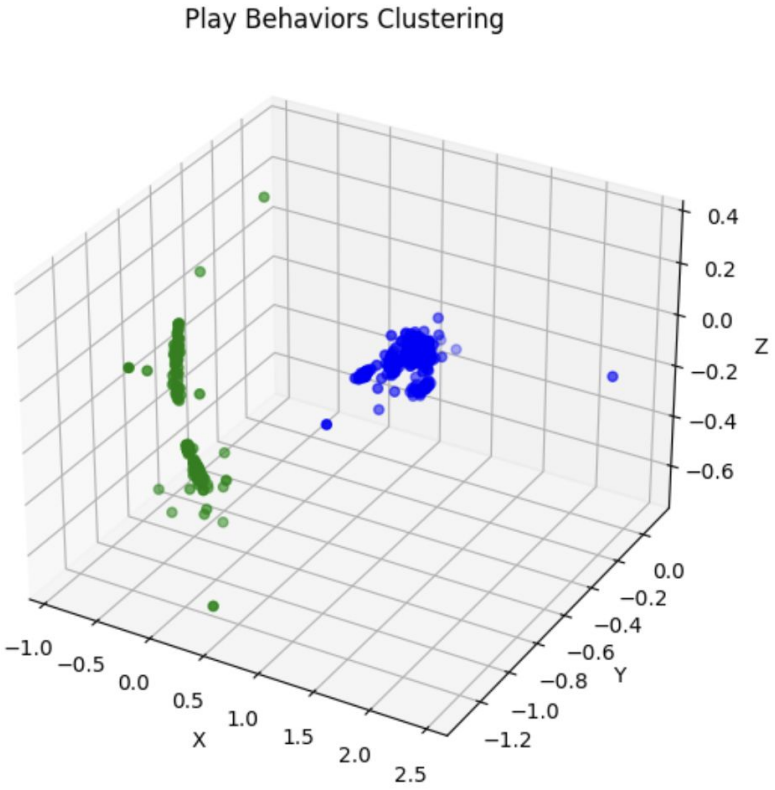
Algorithm: The algorithm works by initializing a number (K) of cluster centres (centroids) randomly, and then iteratively assigning each data point to the nearest centroid and recalculating the centroids as the average of all points in a cluster.

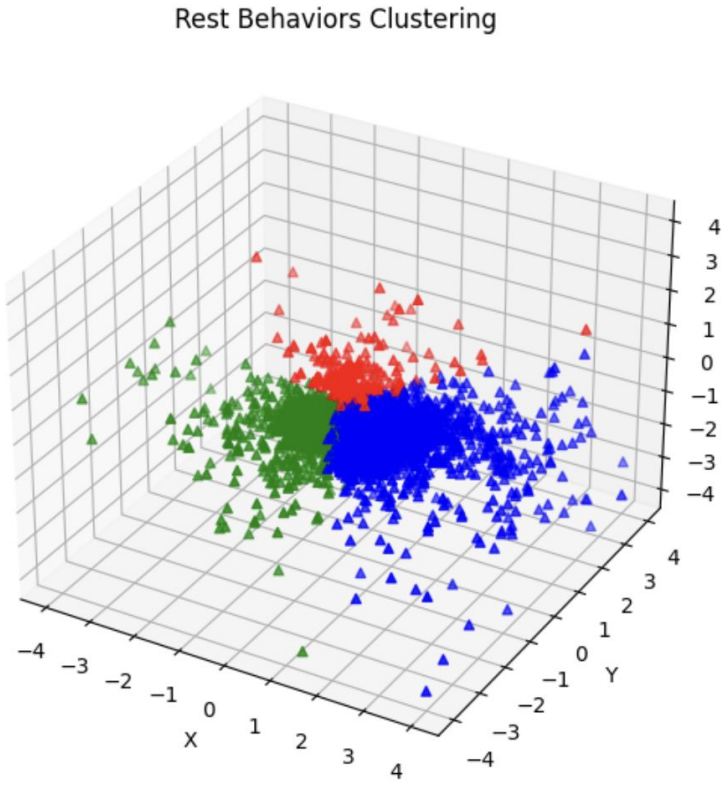
Goal: explore the data, and see if it's possible to predict whether the cows are playing or not just based on their accelerometer data

Silhouette Score



Using Clustering to Predict Behavior: Two Spot 2643





Tabular Results

	BehaviorType	Cluster0	Cluster1	Cluster2
1	other	69842	59	587
2	rest	191712	33824	225774
3	play	1250	1	2327

Divided into all Behavior Types

	Behavior	0	1	2
1	Management (someone in the stall...	3945	null	41
2	Milk Feeding	43520	37	337
3	butting fixtures	null	1	2129
4	frontal pushing	408	null	4
5	head-shake	438	null	194
6	leap	404	null	null
7	out of view	22377	22	209
8	rest	191712	33824	225774

Adding More Features to Improve Accuracy

Including Rolling Average of x, y, and z readings as features

	BehaviorType	Cluster0	Cluster1	Cluster2
1	other	37	70251	200
2	rest	33770	181424	236116
3	play	1	1252	2325

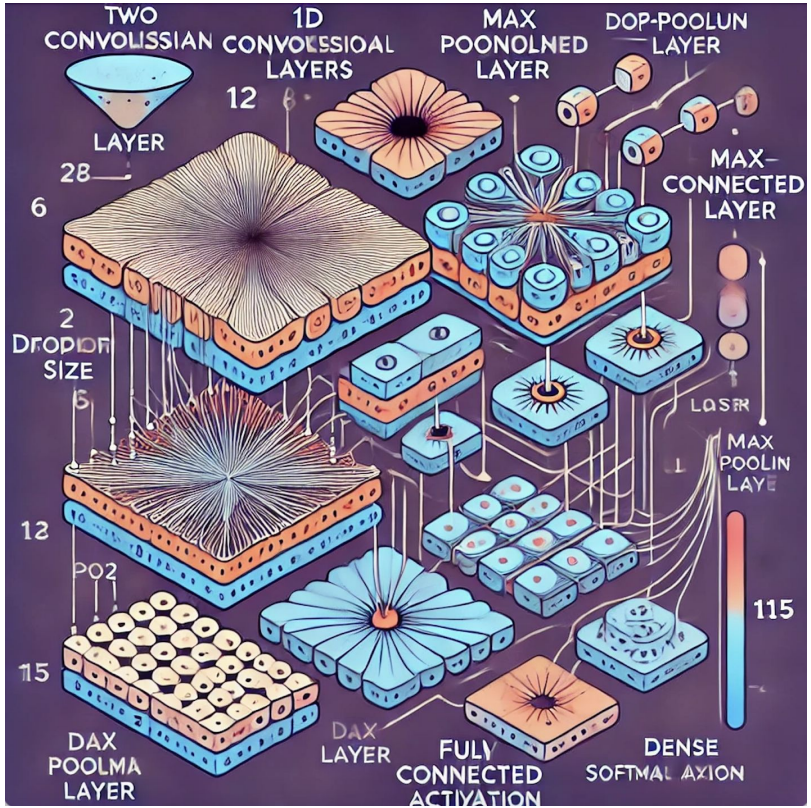
Including Average Change in accelerometer x, y, and z as features

LSTM Model used in Kirk E. Turner et al. — My starting point

Result: Classified Sheep Behaviors with 88% accuracy using an LSTM. F1-Score of 0.84 (compared to 0.65 for random forest regression).

Their Model: First, two 1D convolutional layers with kernel size 6 and a filter size of 128. Then a dropout layer. Then maxpooling layer with pool size 2. Then dense layer selecting 115 features. Then those features are fed into an LSTM layer. Finally, dense layer with softmax activation

Diagram of That Architecture (Created by Dall-E)



Future Ideas for LSTM

1. SMOTE (Synthetic Minority Oversampling Technique):
   - **Goal:** Address class imbalance present in behavior types.
   - **Method:** Generates new samples by interpolating between existing minority class samples.

2. BLSTM (Bidirectional Long Short Term Memory)
   - **Goal:** Improve accuracy by capturing context from both past and future sequences in the data.
   - **Method:** Similar to the LSTM model but it processes the data in both forward and backward directions and then combines the information from each of these passes.

3. More Literature Review
   - Further research to develop more ideas on how to build the LSTM

Thank you