Background
As more American households continue to adopt new pets into their families, the need for pet health comprehension grows. Elanco’s Connected Pet, Connected Vet Project aims to tackle this problem. Elanco uses an accelerometer device to track and record the movement of pets. The Elanco-Purdue team began to clean and analyze the data gathered by these accelerometers. The team then looked to compare the similarities and differences between healthy and unhealthy dogs to draw conclusions from the analysis and potentially recognize early signs of disease not seen by the eye.

Goal
Use accelerometer data sufficiently to understand pet behavior trends and their correlation to health conditions such as mild osteoarthritis.

Our Data
The data we worked with comes from an accelerometer that has been placed on dogs’ collars to track their everyday movements. These dogs have varying status; healthy, mild arthritis, osteoarthritis, and lumbar osteoarthritis.

Table 1: Data table

<table>
<thead>
<tr>
<th>Number</th>
<th>BID</th>
<th>Breed</th>
<th>Gender</th>
<th>Shepherd/Goldendoodle Mix</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15029AAADC</td>
<td>(male)</td>
<td>Healthy</td>
<td>October 21</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>15029AADDF</td>
<td>(male)</td>
<td>Healthy</td>
<td>October 21</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>15029AACDF</td>
<td>(male)</td>
<td>Healthy</td>
<td>November 21</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>15029ABDFC</td>
<td>(male)</td>
<td>Healthy</td>
<td>October 21</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>15029ACDFC</td>
<td>(male)</td>
<td>Healthy</td>
<td>October 21</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>15029ADFFC</td>
<td>(male)</td>
<td>Healthy</td>
<td>October 21</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>15029AEFFC</td>
<td>(male)</td>
<td>Healthy</td>
<td>October 21</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>15029AOGPC</td>
<td>(male)</td>
<td>Healthy</td>
<td>October 21</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>15029AOHPC</td>
<td>(male)</td>
<td>Healthy</td>
<td>October 21</td>
<td></td>
</tr>
</tbody>
</table>

Introduction
Elanco’s Combined role
Distinguish predictors between
Multiple tables
Accelerometer dashboard
Compare dogs’ activity levels on the weekdays vs. weekends
Distribution graphs
Add additional features to the dashboard

Healthy dogs run much more frequently
Itching much more common in healthy dogs

Our Data
The data includes time stamps, 3 axis accelerometer data (x,y,z) and different activity calls throughout the day based on the accelerometer data. Our project aims to analyze this data to:
• Compare dogs’ activity levels on the weekdays vs weekends
• Compare healthy dogs to unhealthy dogs to see where in the data diseases can be spotted

We do this by looking at different statistical analysis such as t-tests, Fourier transform, Anova tests, pivot tables and an interactive R shiny dashboard

Results
From our Dashboard we concluded that the main patterns that separate the healthy dogs from the dogs with arthritis is the number of occurrence of certain high intensity activities (such as itch and run) rather than the time spent doing that activity, the distribution of acceleration on certain high intensity activities (i.e. run), and the percent of time spent active in a day.

Conclusion
Elanco’s Connected Pet, Connected Vet Project has progressed in many ways. The team has created a functioning dashboard to compare and differentiate pet actions. Based upon the similarities and differences of these actions, the team achieved insight into the correlation between pet behaviors and pet conditions. Some limitations to this project were the sample sizes being used, information about the dogs, and manually cleaning the data for abnormalities.

Future Goals
• Incorporate larger datasets for analysis
• Predicting health conditions of datasets (machine learning)
• Add additional features to the dashboard
  - ANOVA testing
  - FFT analysis

Acknowledgements
The team would like to thank our corporate partner mentors: Troy Hawkins, Shrinivas Mane, Kate Sharon, and Madan Krishnamurthy for their guidance throughout the academic year. We would also like to thank Kevin Amstutz from the Data Mine team for his guidance in analyzing our data. The team would also like to acknowledge former members Yu-Hao Chang and Chin Yang who contributed to the project during Fall 2021.

Dashboards
One of the main components of our project is the dashboard. Our dashboard is based on the data from the 10 dogs (5 healthy, 5 with various types of Arthritis) and their corresponding accelerometer data.

Accelerometer Data:
• Collar on dogs
• 8 days read
• X, Y and Z axis
• Large dogs
• 8 activities

Goals:
• Find patterns useful in predicting health of dog
• Distinguish predictors between conditions
• Insight into models

Dashboard:
• Action dashboard
• Accelerometer dashboard

Combined role:
• Data to interactive graphics/tables
• Summary of behaviors and movements
• R Shiny

Growth:
Last semester we also made an R Shiny Dashboard, here is what is different...
• > 3 dog
• More time considered
• Considered health
• Focus on behaviors
• More division/filter options
• Two Dashboards complementing
• Distribution graphs
• More color
• More tables
• More statistic-oriented

What’s Next?
The mean of differences between the healthy and dogs with osteoarthritis along all 3 axes.
• The values along Z axis are high for Walk, Run and Sprint as expected.
• The Z values for Itch and Other are high too but these are not similar distributions, so these can be misleading.
• The values along the Z axis varies over a large range since the movement is larger than up-down movements or left-right lateral movement.
• Most of the p-values were less than 0.001
• With p-values this small, we can conclude that accelerometer values are significantly different for healthy dogs and dogs with osteoarthritis.

Table 2: Example of accelerometer data

<table>
<thead>
<tr>
<th>Index</th>
<th>Timestamp</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Activity</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16230621 12</td>
<td>572</td>
<td>606</td>
<td>486</td>
<td>Shake</td>
<td>14</td>
</tr>
<tr>
<td>2</td>
<td>16230621 12</td>
<td>568</td>
<td>606</td>
<td>486</td>
<td>Shake</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>16230621 12</td>
<td>564</td>
<td>606</td>
<td>486</td>
<td>Shake</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>16230621 12</td>
<td>560</td>
<td>606</td>
<td>486</td>
<td>Shake</td>
<td>14</td>
</tr>
</tbody>
</table>