Implications:

As demonstrated in **Figure 1**, the model was able to make reasonably accurate predictions of the Stress induced by Roll-Ins with the pylo velo green ball, with a mean squared error of 22.97. Once an entire season, or multiple seasons, worth of data is collected, the accuracy of these predictions have a good chance to improve. If this model can be improved and utilized in real time the most obvious implication is improving the decisions around pitch counts and game day lineup decisions. The other side of this, is managing both the scheduling and programming of practices / training. Collecting data from different balls and different throws will illuminate the differential stress induced by specific aspects of a workout, and therefore allow a coach and/or trainer to structure their practices accordingly in order for optimal performance and rest. What this would look like if applied could be as unstructured as the coach/trainers having a better rough estimation of how much physical stress different parts of their practices are causing, all the way to something like a “practice calculator” which could be used to program a specific level of stress for the day, based on known levels from historic data.

As seen in **Figure 2**, there were not any significant correlations between Stress and any single variable on its own. There was an intuitive moderate correlation (0.61) between arm speed and ball speed (MPH). One interesting result is that there was a weak inverse correlation (-0.34) between arm slot and ball speed, meaning that as arm slot angle decreased, ball speed increased. As stated, the correlation is weak, but it may be something worthwhile investigating on an individual player basis, to see how adjusting arm slot affects ball speed for each thrower

Model Explanation: *Coach*

Data was collected from 25 pitchers wearing a MOTUS Sleeve during walking windups, rockers, and roll in throws using a variety of different ball types. The variables collected include MPH, arm speed, arm slot, and shoulder rotation. A model that was created and trained on this small amount of data was able to reasonably predict the induced stress for each throw, based on the previously mentioned variables.

Model Explanation: *Applied Scientist*

Data was collected from 25 pitchers wearing a MOTUS Sleeve during walking windups, rockers, and roll ins, using a variety of different balls. The variables collected include MPH, arm speed, arm slot, and shoulder rotation.

Each combination of throw and ball type included 50 data points, with each of the 25 pitchers performing 2 throws. The data from all the different throws and ball types was combined and used as the training data set, except for the Pylo Velo Green data, which was reserved as the testing set. A random forest of regression trees was used to predict the resulting Stress, this method was chosen because of its accuracy, resource efficiency, and because it does not function as a black box, all the decisions that lead up to each final prediction can be visualized in the form of a tree. The model resulted with a mean squared error of 10 on the training set and 22.97 on the testing. This seems to suggest the model is not overfitting but would benefit from a much a larger training data set, especially more data specially from roll-in throws. The “Stress” variable itself seems somewhat abstract as of now, and will need to be validated, either as a risk factor against season long injury data, or in a laboratory setting against standard measures of musculoskeletal stress.

Figure 1.

Scatter plot to assess the performance of the model's predictions of Stress for the Pylo Velo Green Roll-Ins data. Mean Squared Error of 22.97.

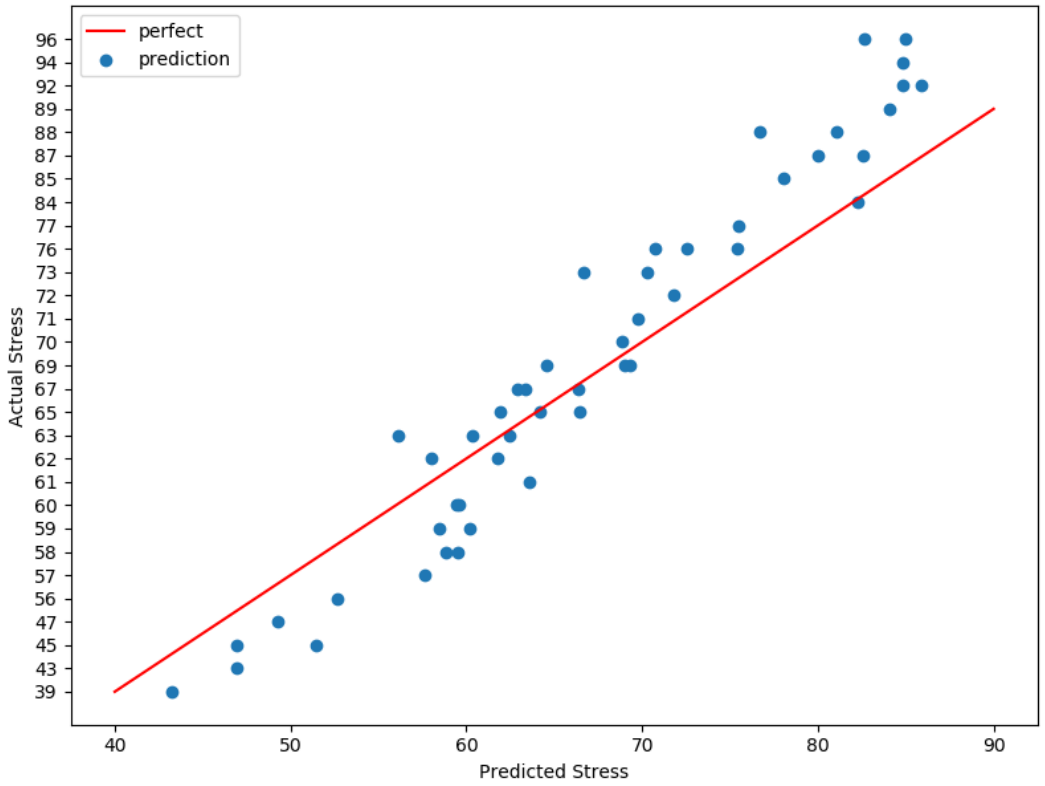

Figure 2.

A heatmap showing the values of correlations between each variable. No noticable correlations between any single variable & Stress. Moderate correlation between ball speed and arm speed. Weak inverse correlation between arm slot and ball speed.