Modeling Robotic Surgery Predictions: Write-Up

Meftah, Morteza M.D,; Waren, Daniel M.D; Bosco, Joseph A. IV;
Di Gangi, Catherine; Watson, Cody Ph.D

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This is a VERY rough draft of the write-up. It is meant to demonstrate the work I have done on the project in a way that you don't need to read any code. Document written by Jack Bosco. Code for the data analysis, modeling, and visualization are also written by Jack Bosco.

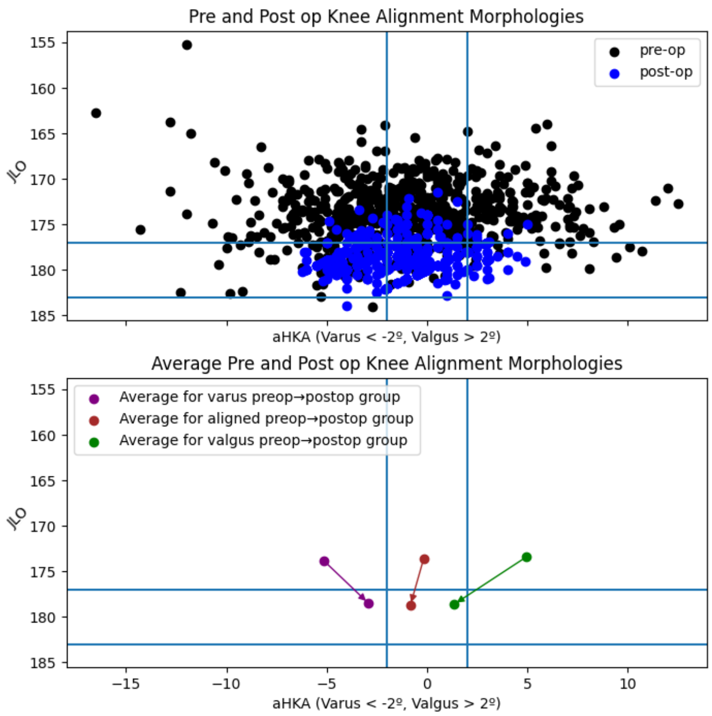

Figure 1: These are the averages of the clusters - See CPAK reference

Top: Pre and post-op data displayed on a scatterchart of Joint Line Obliquity (JLO) and anterior Hip Knee Alignment (aHKA)
Bottom: Average Pre and post-op alignment grouped by pre-operative aHKA values. The average change from pre-op to post-op is shown.

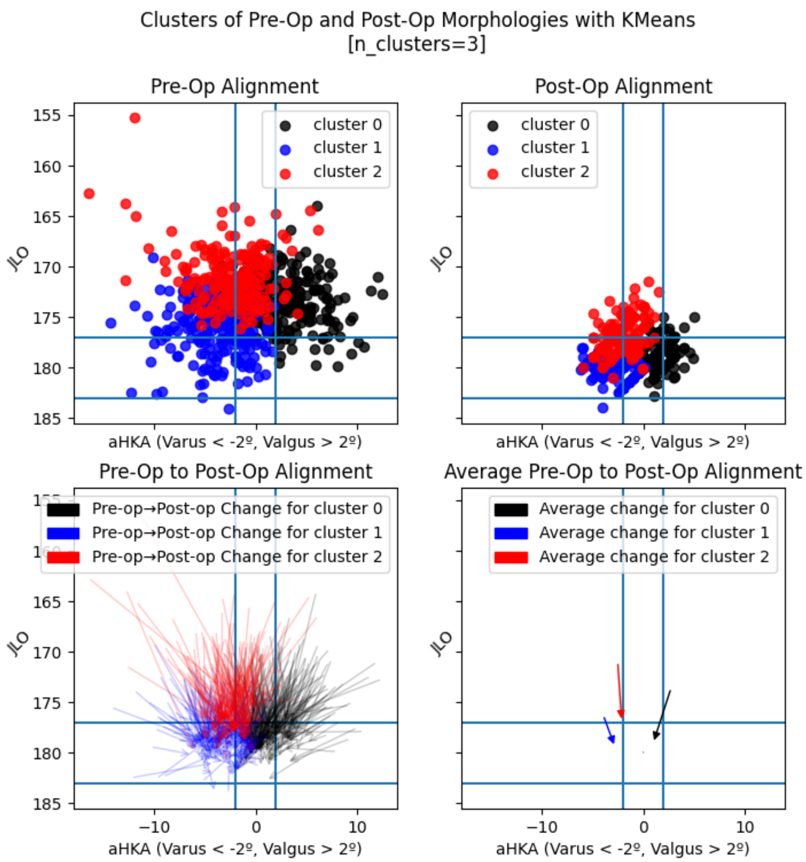

Figure 2: These are the clusered data points.

First, the pre-operative data was standardized using the standard scaler method. Then, the pre-operative alignments were clustered using the K-means clustering algorithm (see Sklearn K-Means Clustering).
Bottom Left: Arrows are drawn for each pre and post-operative pair (one pair per case).
Bottom Right: Averages are taken for each cluser and the change from pre-op to post-op is shown.

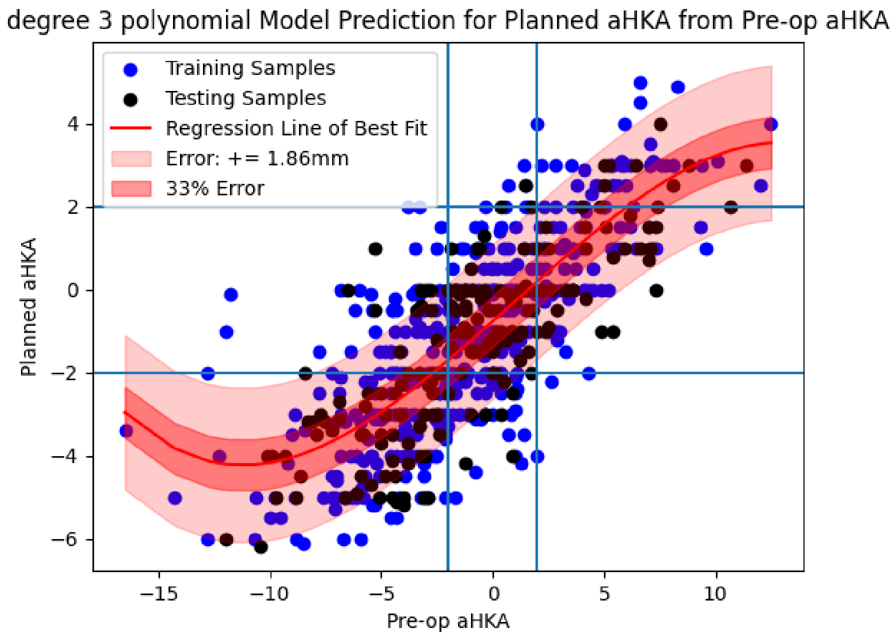

Figure 3: This is a regression trained using a linear regression algorithm. The error is the mean squared distance from the testing set (black). The regression is trained on the training set (blue)

To create this regression, the pre and post-operative aHKA values were standardized using the standard scaler method.
Then, the features are transformed using a polynomial transformation of degree 3 (see Sklearn Polynomial Features).
Finally, the model is trained using a linear regression algorithm (see Sklearn Linear Regression).

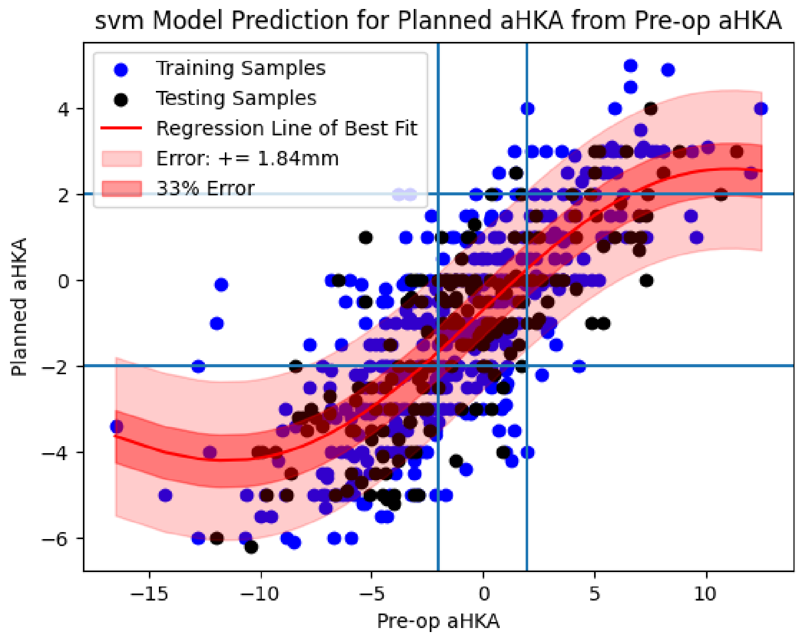

Figure 4: This is a regression trained using a support vector machine algorithm. The error is the mean squared distance from the testing set (black). The regression is trained on the training set (blue)

To create this regression, the pre and post-operative aHKA values were standardized using the standard scaler method.
Then, the model is trained using a nu support vector regression algorithm (see Sklearn Support Vector Machine).

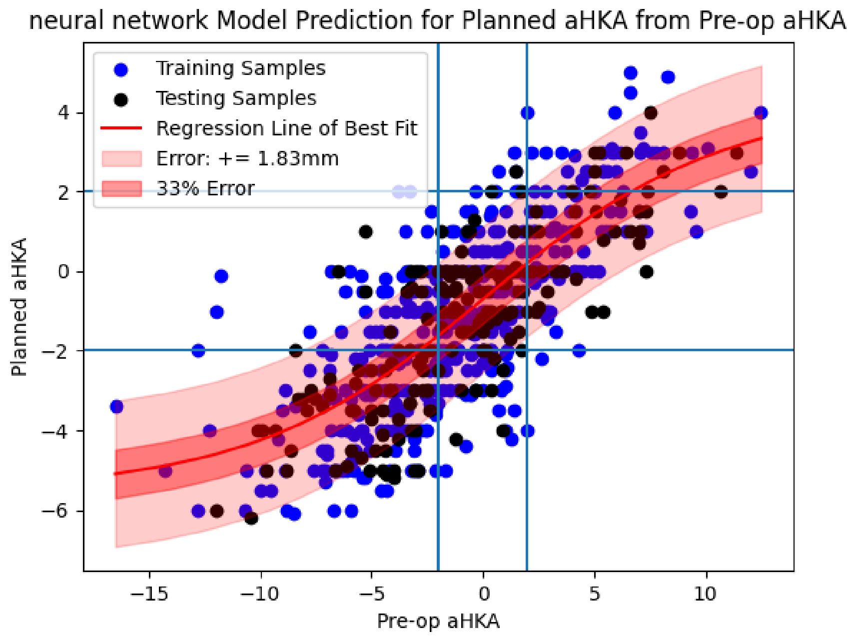

Figure 5: This is a regression trained using a deep learning algorithm on a MLP/neural network model. The error is the mean squared distance from the testing set (black). The regression is trained on the training set (blue)

To create this regression, the pre and post-operative aHKA values were normalized using the min-max scaler method with feature range $(-1, 1)$. Then, the model is trained using a multi-layer perceptron (MLP) algorithm (see Sklearn Multi-layer Perceptrion).