



Quantifying NFL Head Coach Quality by Predicting Contract Renewal

Charlie Williams | Masters Applied Data Science



Introduction

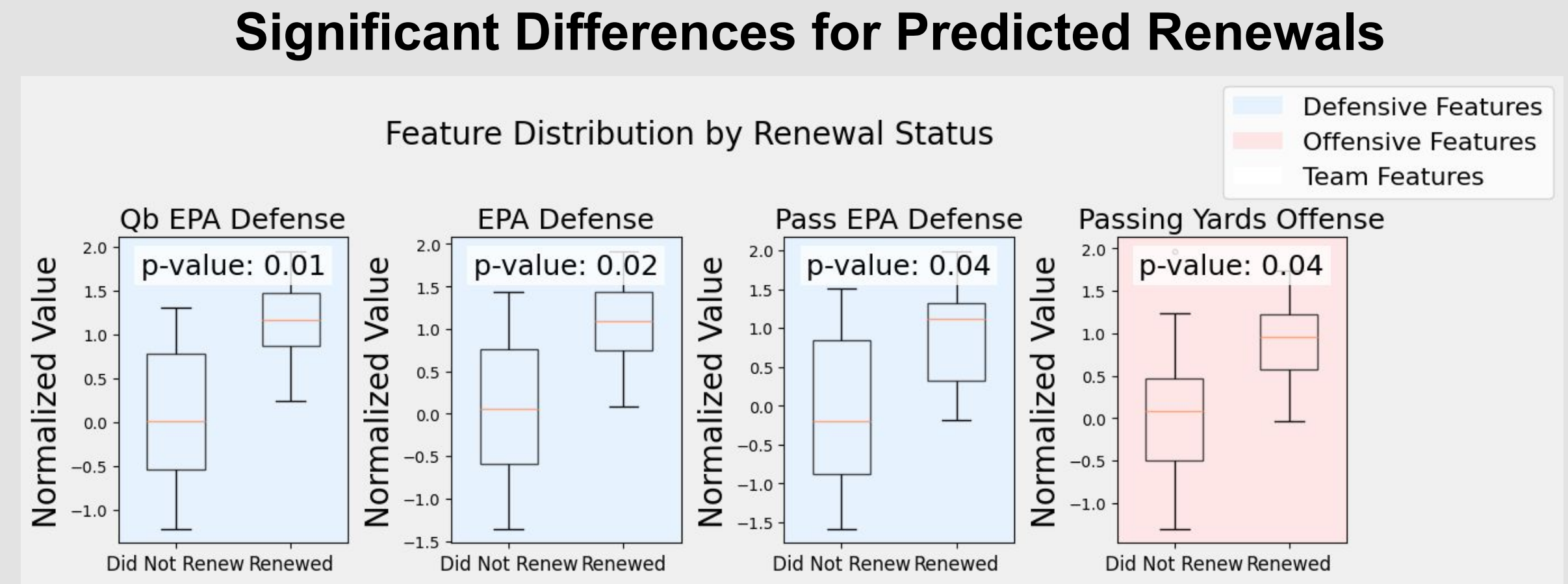
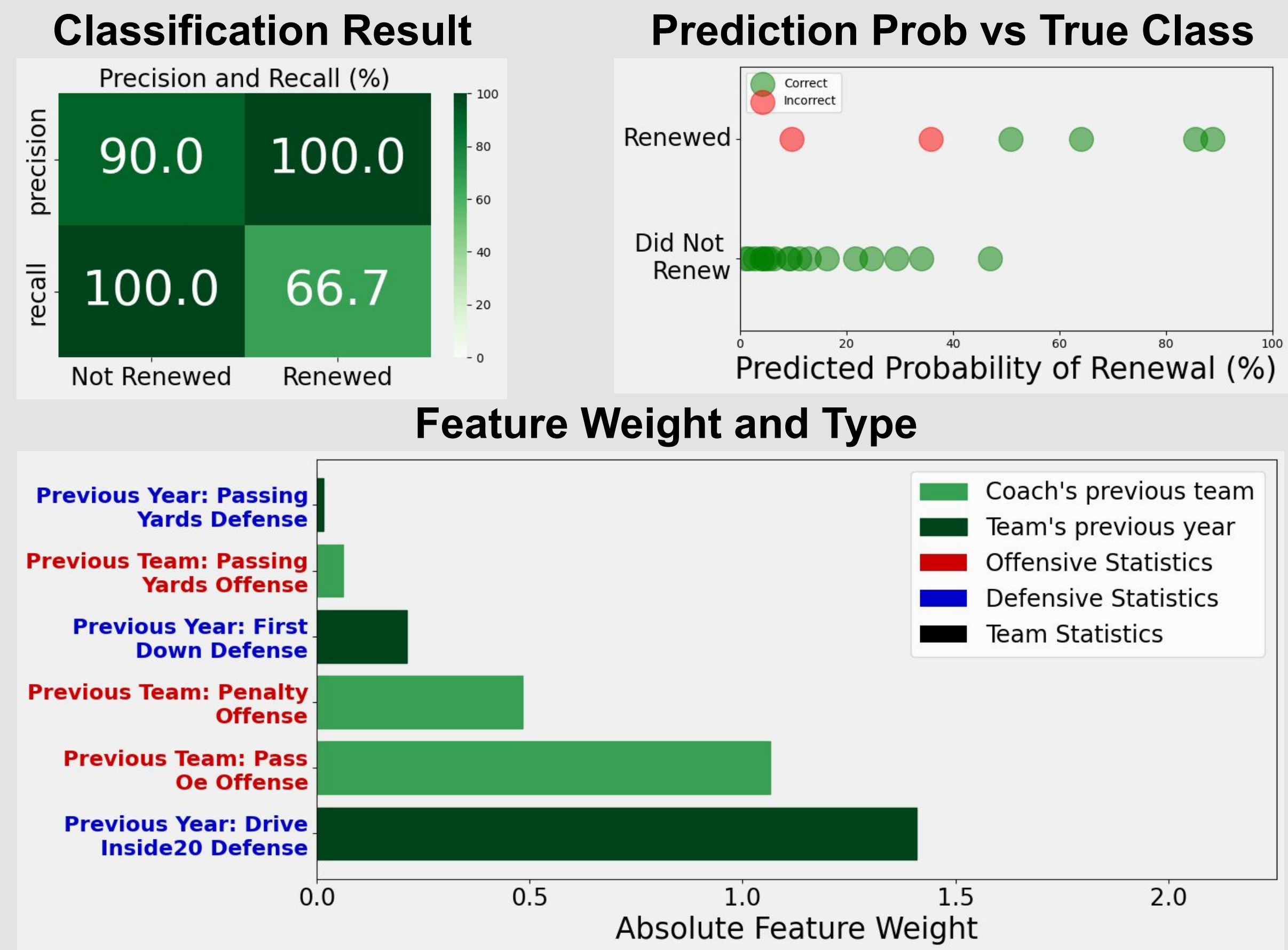
The goal of this investigation is to quantitatively identify “good” head coaches and head coach candidates. To do this we will classify coaches that signed a contract extension with their team as a “good” coach. We then search for performance metrics that can predict if a coach’s contract will be extended.

Methodology

1. Data Collection
 - a. Use nfl_data_py to pull play by play NFL statistics.
 - b. Compile contract information from various news sources.
 - c. Merge contract data with aggregated play-by-play data from coaches previous team.
2. Modeling
 - a. Attempt to create either Classification or Regression model for various contract features to find the most predictable feature.
 - b. For each model find most significant attributes using K best then find the most accurate model from Linear regression, Logistic regression, SVM, KNN, and Random Forest.
 - c. Use best overall model to select final features.
3. Analysis
 - a. Based on model analyze most significant features. Focus on features related to coach rather than team.
 - b. Determine features with significant difference. Between coaches predicted for renewal and not.
 - c. Asses feature useability for determining head coach quality

Offensive Head Coaches

Model: Logistic Regression [C=1, Elastic Net, L1_ratio=0.9, Saga]



Analysis

Classification Results: Very strong classification performance for non-renewing. Even though renewal has lower overall accuracy, it is significantly valuable to achieve 100% precision.

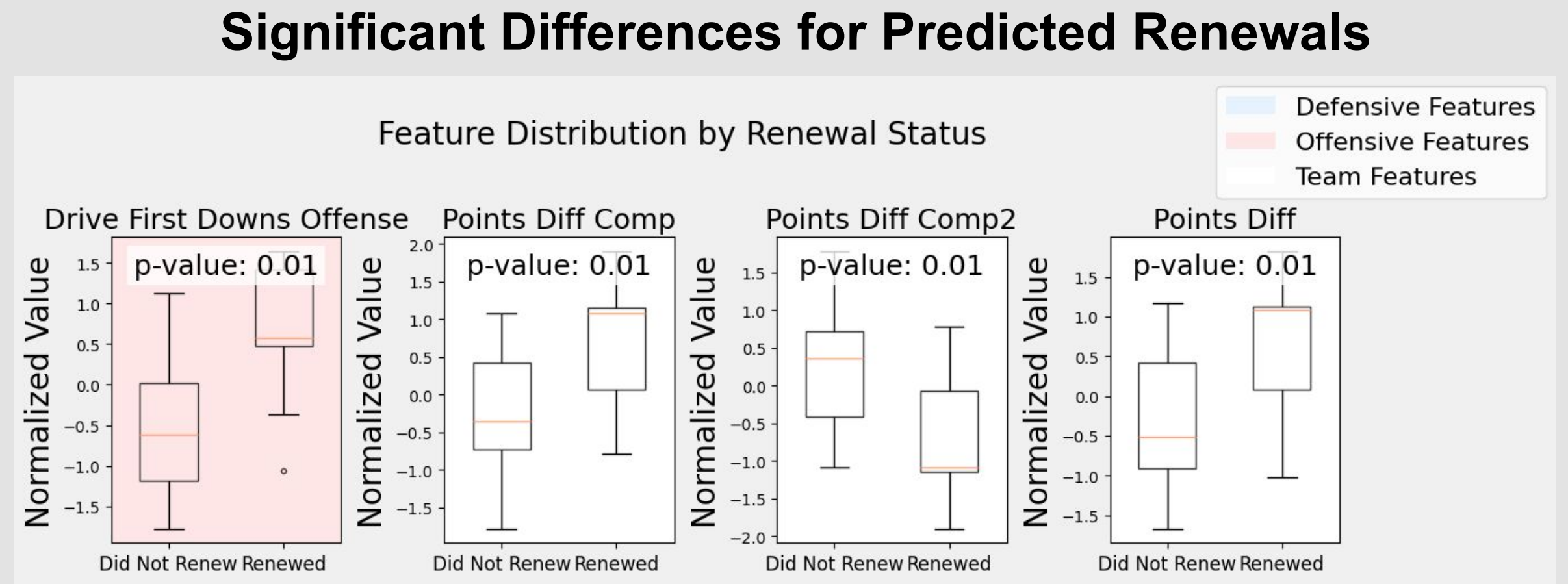
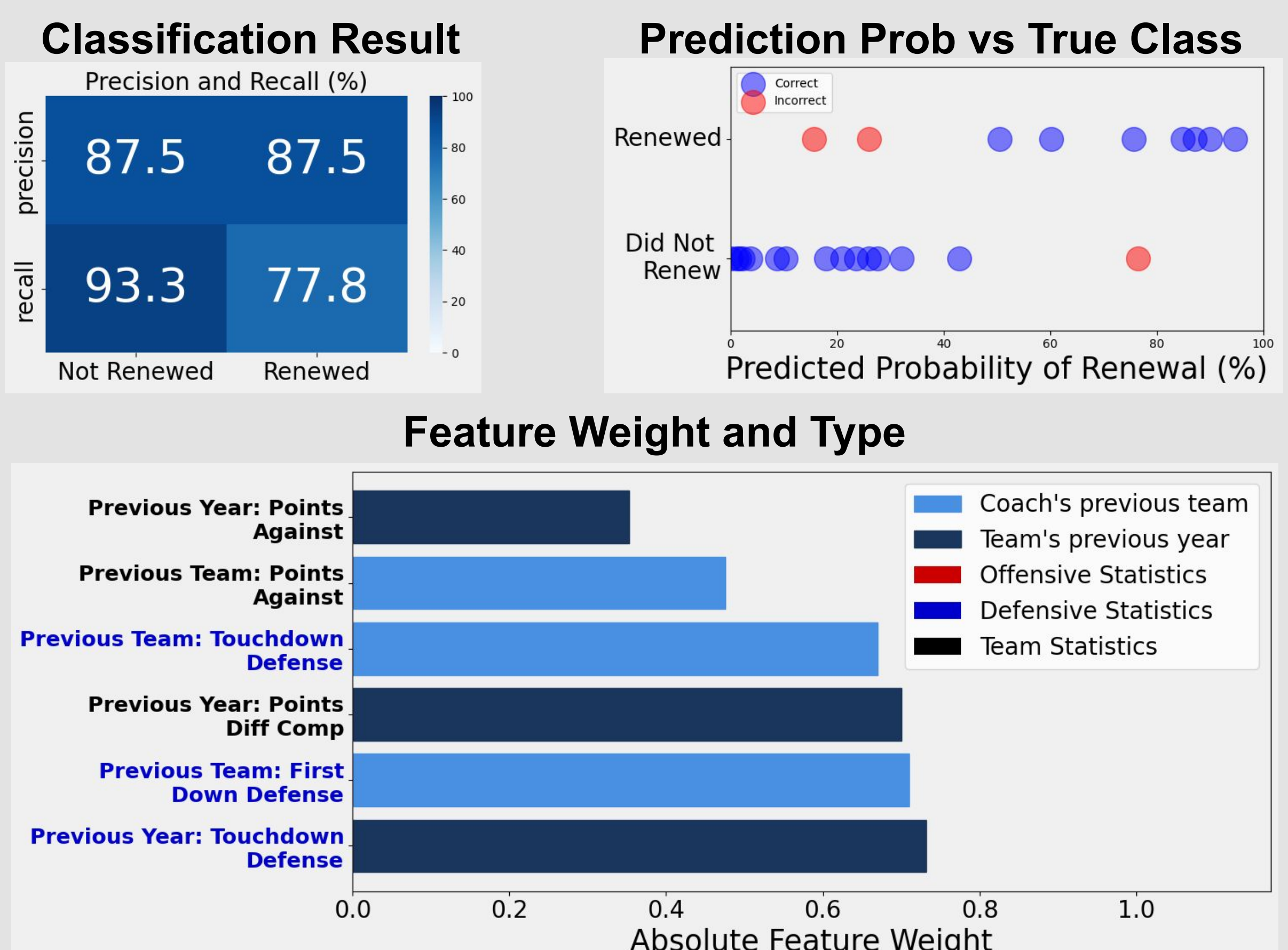
Feature Importance: Two most important coach-related features are number of penalties their offense committed and the number of passes over expected they offense attempted. Qualitatively these seem to be reasonable predictors. Fewer penalties indicate good coaching through higher discipline. More passes than expected indicates a pass heavy offense. While this doesn’t inherently improve an offense it could indicate that strong passing stats are considered better signs of a good offensive coach than equivalent rushing stats.

Feature Difference: It is reasonable to see significant increase to passing yards since passing frequency was a primary feature of the prediction. The other three features are on the defensive side. This could indicate that these coaches have high performing offenses that are forcing opposing offenses into riskier passing situations.

Model Usefulness: Usefulness appears to be high. The model is highly successful for classification and relies on features that can be reasonably explained.

Defensive Head Coaches

Model: Logistic Regression [C=1, Elastic Net, L1_ratio=0.1, Saga]



Analysis

Classification Results: Overall accuracy is lower than offensive classification, however we can see that predicted values are more significantly clustered on their respective side of the spectrum. This shows the model is highly confident in its predictions.

Feature Importance: Features are much more evenly weighted. All three coach-related features are very sensible for assessing defense quality. Points against, Touchdowns and First downs all represent the defense’s core objectives. Prevent points, prevent advancing down the field, hold teams to field goals rather than touchdowns.

Feature Difference: Improved Points Differential is a clear benefit and is clearly related to having a strong defense. The team's offense getting more first downs is less clear, but could indicate that the team is winning more often and the offense is burning the clock. Points Diff Comp/2 are computed features based off of the z-score of points for and against. A lower value of Comp2 indicates a stronger defense and a higher value of Comp indicates a stronger offense. Since both are directly related to points diff it is reasonable that they all vary together.

Model Usefulness: Usefulness also appears to be high. This is a strong, confident predictor that clearly identifies coaches that lead good defenses

Discussion

Summary: This investigation yielded compelling initial results. It is clear that contract renewal serves as a workable indicator of coach quality.

Next Steps: The learnings from this project should be applied to further analysis of coaching quality and its impact. With the ability to quantify coach quality other questions can be asked about the coaches such as: impact on the team, contract ROI, testing if prestigious ‘coaching trees’ consistently make good coaches, and many others.

Acknowledgements

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