QB VIZ: A Modern Framework for Evaluating NFL Quarterback Decision-Making

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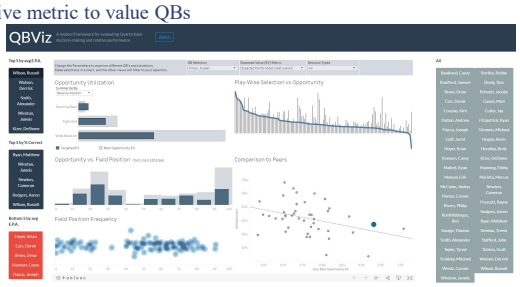
SUMMARY

The quarterback is far and away the most important position in football; Russell Wilson recently signed a **$160M contract**; so this position is vital to team success.

We have taken an opportunity-cost approach to measuring quarterback decision-making applying machine learning techniques to NFL player-tracking data. Our model has produced catch probabilities for over 20,000 eligible receivers and translated them into and objective metric to value QBs



DATA

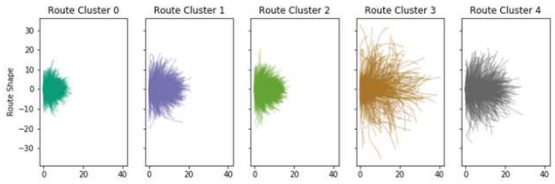
NFL player-tracking data was used with permission from the NFL. The data was loaded into an AWS hosted postgres database. The tracking data provides player location information (x,y,z coordinates, as well as meta-data) at 10 frames per second.

10.9	24.7	91	7,489	24K
GB	MM Rows	NFL Games	Plays	Eligible Receivers

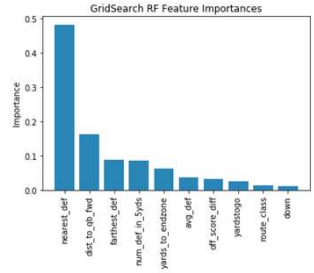
WAS IT A CATCH?

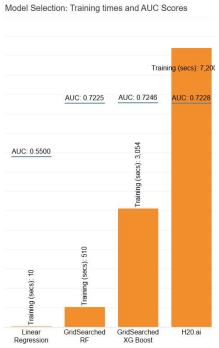
Modeling

We developed several features which were fed into a series of models to determine the optimal model to produce catch probabilities. Including a *route class* feature which was created using K-means to cluster the routes based on the player tracking data.



Four models were tested: logistic regression, random forest, XGBoost and H2o.ai's AutoML. The below visual shows the trade-off between training time and AUC score for each of these models.





Given the tradeoffs between the time and accuracy we selected the grid-searched Random Forest model to produce catch probabilities. The importance of each feature in the model can be seen above.

Data Visualization

Our accompanying web application, QBViz, was developed with html, css, and javascript serving Tableau dashboards. Ours is the first research in this field to provide an interactive tool for users to interact with research in real-time.

NOT ALL YARDS ARE CREATED EQUAL

Approach

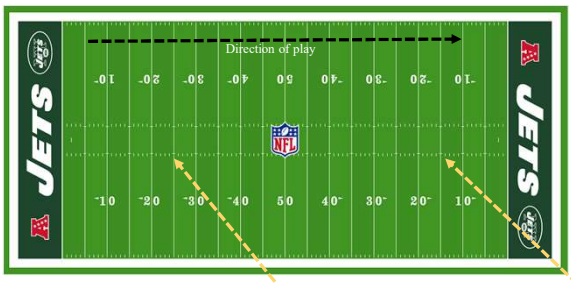
First, we created an expected yards added metric for each eligible receiver.

$$\text{EYA} = \{x \in ER \mid \pi * LOS_{yards} + nd_{yards}\}$$

Where:

π = catch probability, ER = eligible receivers, LOS_{yards} = yards from line of scrimmage

nd_{yards} = yards to nearest defender



However, we know that 10 yards gained here, are different than 10 yards gained here

So, we must translate this into Expected Points Added (EPA – created by *Yurko, et al.*) based on the above EYA

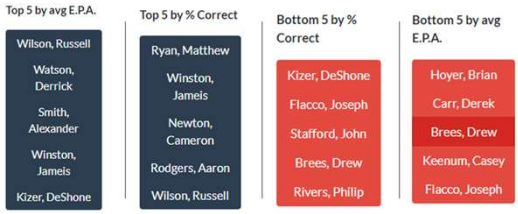
$$EPA = EP(LoS+EYA) - EP(LoS)$$

Where:

EP(LoS) = Exp. Points given LoS as outlined in *Yurko, et al.*

EP(LoS + EYA) = Exp. Points given LoS + EYA for each receiver from above EYA

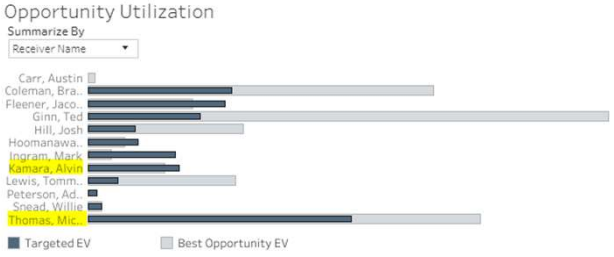
Now we are able to examine the top and bottom 5 QBs for both EPA, as well as Decision Making



While most of these pass the NFL's "sniff test", one stands out – Jameis Winston, ranked 20/33 in NFL's QB Index. However similar work from *Burke*, also listed Winston as a top-5 performer, further validating our process.

Case Study: Drew Brees

Drew Brees, widely considered to be a top QB ranks bottom 5 in both metrics. In examining Brees in QBViz, we see an over-reliance on WRs. He also boasts Michel Thomas and Alvin Kamara as teammates, regarding as two of the best pass-catchers in the league. It is possible that the talent of these pass-catchers outweighs Brees' risky decision making.



CONTACT

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