Overview of Big Data Bowl 2023 Open Metric and Undergrad Finalists

Ron Yurko

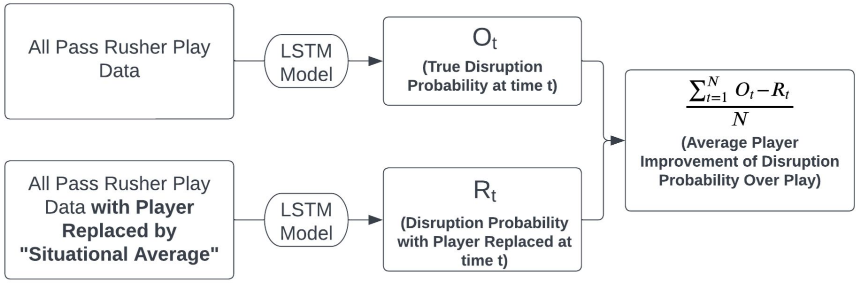
Honorable Mention I found interesting:
https://www.kaggle.com/code/benjenkins96/causal-impact-of-offensive-linemen-on-pass-plays

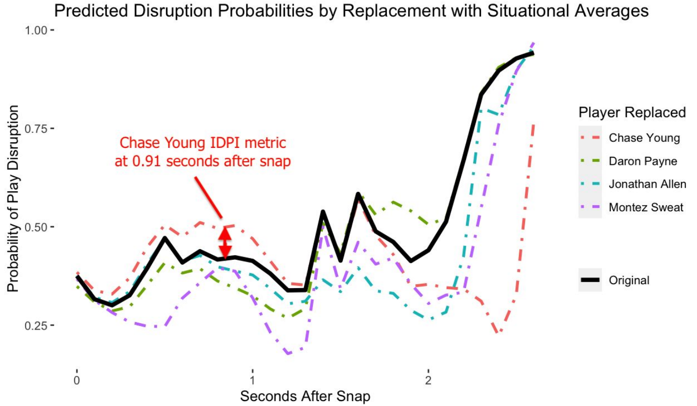
IDPI: A Situational Metric for Pass Rushers

Nick Bachelder

- Instantaneous Disruption Probability Increase (IDPI) metric
  - Model team's probability of pass disruption (i.e., sack, hit, hurry) with LSTM
- LSTM model is trained on equally weighted sum of SoftMax outputs in the hidden layers of the model - trains the probabilities of a play disruption at all points in time during a play
- Replace individual level features with average values across plays in same start-of-play groups
- Compare observed prediction with player's observed features to prediction with averages

Rusher IDPI Metric



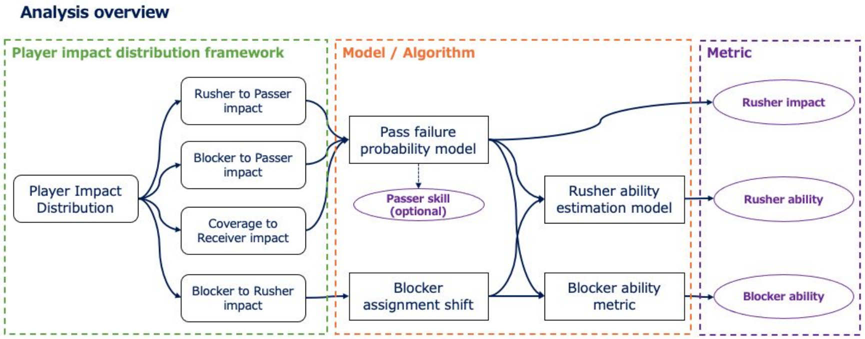


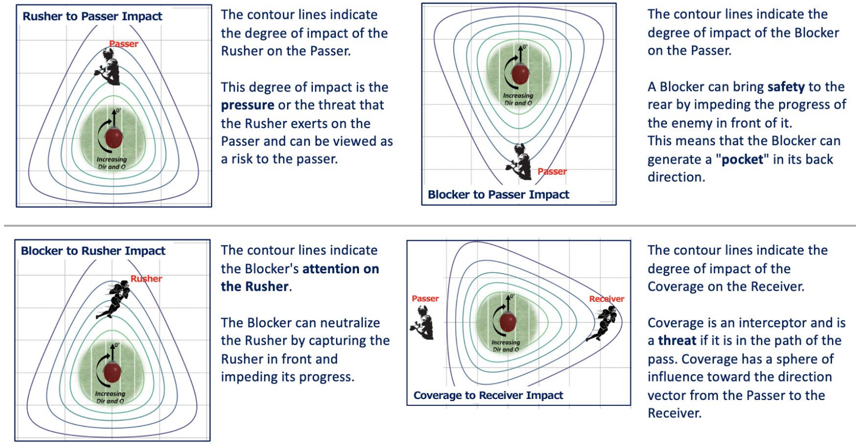
(1:37) J.Herbert sacked at WAS 9 for -3 yards (J.Allen).

Evaluate linemen using Player Impact Distribution

Sho Sekine, Nao Sekine

- Use Gaussian-Gamma mixture distribution to model players’ impact on each other
  - Greater in the direction they are moving or facing, and NOT on their backs or in the direction they cannot see
  - Combines 1-way directionality provided by the Gamma with the spherically decaying characteristics provided by the Gaussian
- Then used Bayesian models from item-response theory to get player ratings?
- Extremely light on details and hard to follow…





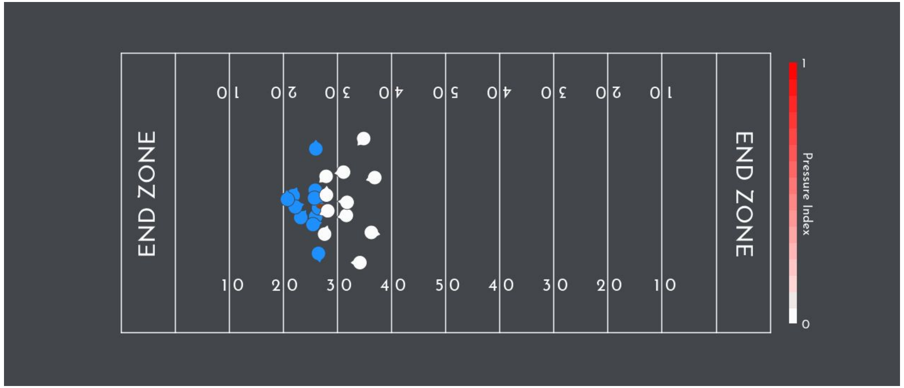
Completions Added Through Suppression of Pressure

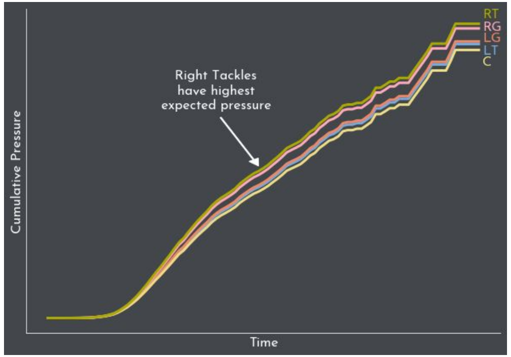
Vincent Karpick

Evaluates offensive linemen based on how many pass completions they created through preventing their opponents from pressuring the quarterback

1. Determining when opposition created pressure via a convolutional neural network (CNN)
2. Find expected pressure rates at each time for different positions with a penalized Cox model
3. Model expected completion rate on plays with and without pressure at various times
4. Combining Cox and completion model to find each player's completions over expected

Hungarian algorithm to assign blockers to pass rushers

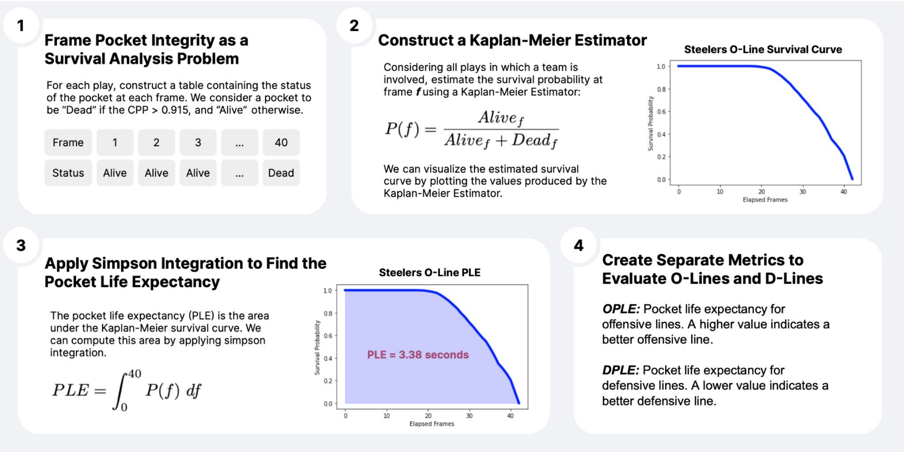


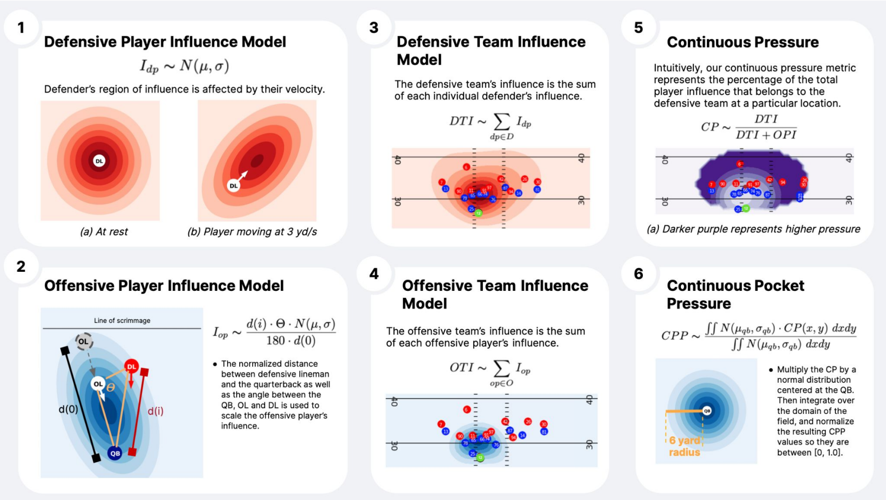


Between the Lines: How Do We Measure Pressure?

Hassaan Inayatali, Aaron White, Daniel Hocevar, University of Toronto

1. Continuous Pocket Pressure (CPP) - model continuous time QB pressure probability
    - Using Fernandez and Bornn approach
2. Survival analysis of CPP exceeding threshold





3. Measure Surplus Pressure:
    - Subtract DPLE when the player is off the field from the DPLE when on the field

Open SPACE: Spatial Survival Probabilities

Jay Sagrolikar, Paul Ibrahim, University of Chicago

SPACE: Survival Probability Above Contextual Expectation

- Response variable: indicator for whether a pressure occurs on the following frame of a play
- Model with random forests, NOT survival models…
- Construct features with Voronoi tessellations: partition the field into sections based on proximity to a player
- Model pressure at the start(?) then within play…

To compare the two, we calculate the final survival probability for an n-frame play via

$$P_s = \prod_{i=1}^{n} P_{s_i},$$

the cumulative product of survival probabilities for each frame. Since we train the model on *frames*, not plays (where probabilities would certainly affect each other), this is a well-defined metric. To define SPACE, we use the expression

$$\text{SPACE} = \frac{1}{n} \sum_{i=1}^{n} (P_{s_i} - C_p),$$

which gives us the survival probability for a team/player over expected.