



SportsInfoSolutions

Analytics Challenge 2020

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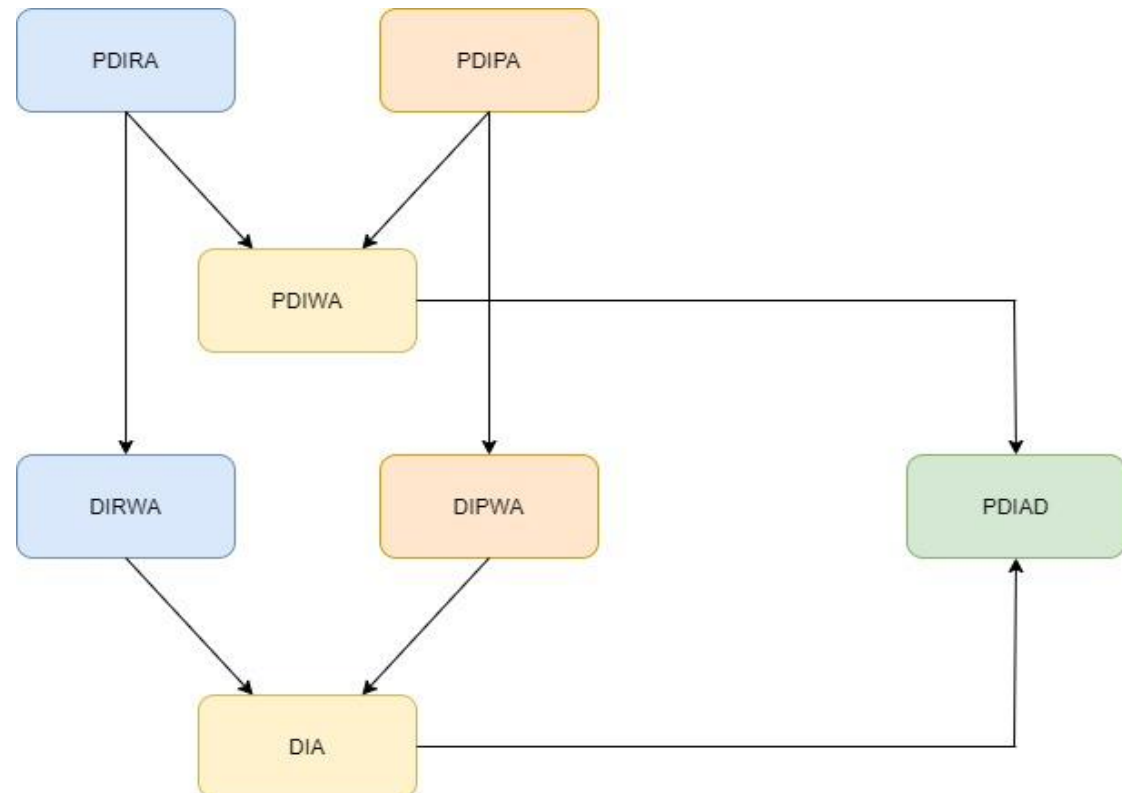
Evaluation Metrics

To determine the most valuable defensive line position, the following metrics were developed to measure the impact of each defensive alignment through key gameplay events:

- DIA – Defensive Impact Average
 - DIRWA – Defensive Impact Rush Weighted Average
 - DIPWA – Defensive Impact Pass Weighted Average
 - PDIWA – Positional Defensive Impact Weighted Average
 - PDIRA – Positional Defensive Impact Rush Average
 - PDIPA – Positional Defensive Impact Pass Average
 - PDIAD – Positional Defensive Impact Average Differential
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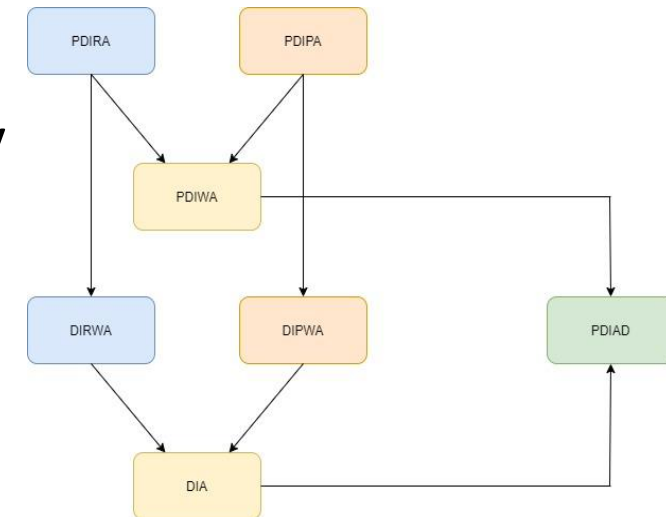
Evaluation Metrics

- Metric Breakdown:
 - DIA – Defensive Impact Average
 - Average of DIRA & DIPWA
 - DIRWA – Defensive Impact Rush Weighted Average
 - Weighted Average of PDIRA
 - DIPWA – Defensive Impact Pass Weighted Average
 - Weighted Average of PDIPA
 - PDIWA – Positional Defensive Impact Weighted Average
 - Average of PDIRA & PDIPA
 - PDIRA – Positional Defensive Impact Rush Average
 - Average score of impact on rushing plays
 - PDIPA – Positional Defensive Impact Pass Average
 - Average score of impact on passing plays
 - PDIAD – Positional Defensive Impact Average Differential
 - Difference between PDIWA & DIA



Evaluation Metrics - PDIRA

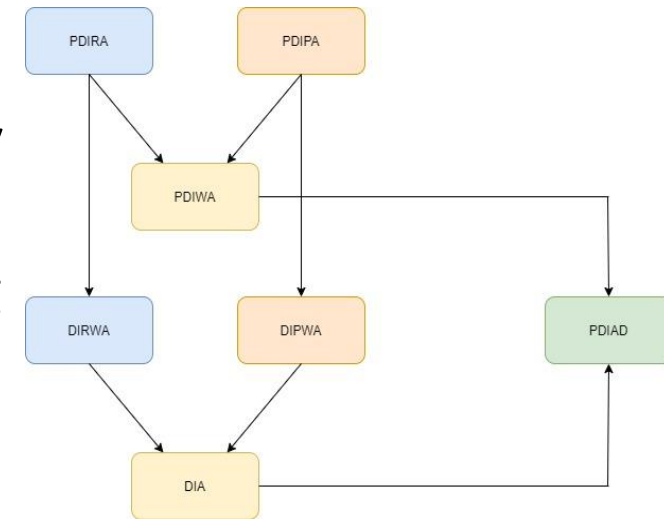
- PDIRA (*Positional* Defensive Impact Rush Average) is a measurement of the average impact of a specific position on the defensive line against rushing plays.
- Calculated by:
 - Each rushing play is evaluated for key gameplay events. These events add or subtract points.
 - PDIRA is the average of this score for all rushing plays per position



Evaluation Metrics - PDIPA

- PDIPA (*Positional* Defensive Impact Pass Average) is a measurement of the average impact of a specific position on the defensive line against passing plays.

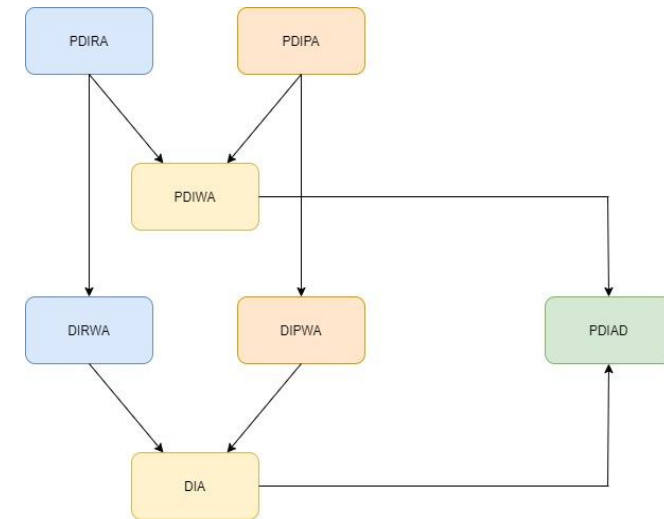
- Calculated by:
 - Each passing play is evaluated for key gameplay events. These events add or subtract points.
 - PDIPA is the average of this score for all passing plays per position



Evaluation Metrics - PDIWA

- PDIWA (*Positional* Defensive Impact Weighted Average) is a measurement of the average impact of a specific position on the defensive line cumulative of rushing and passing plays.
- Calculated by:
 - Weighted average of PDIRA & PDIPA

```
df['pdia_w_avg'] = (df['pdira_sum'] + df['pdipa_sum'])  
/ (df['pdira_count'] + df['pdipa_count'])
```

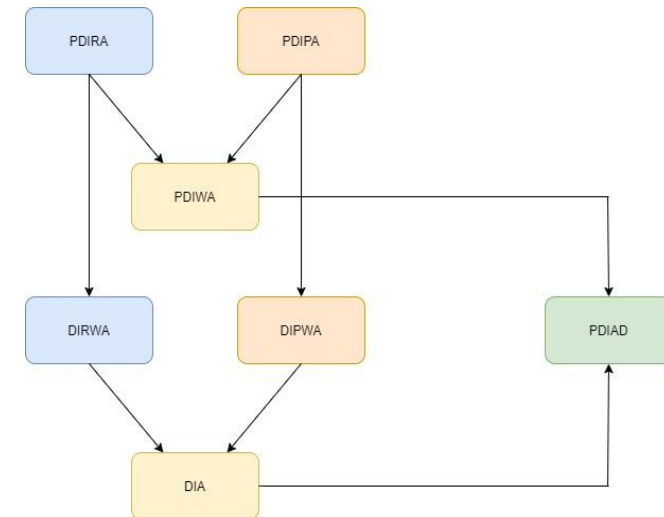


Evaluation Metrics - DIRWA

- DIRWA (Defensive Impact Rush Weighted Average) is the weighted average score for the entire defensive line against rushing plays.

- Calculated by:
 - Weighted average of PDIRA

```
pdira_sum = df['pdira_sum'].sum()
pdira_count = df['pdira_count'].sum()
dira_w_avg = pdira_sum / pdira_count
```

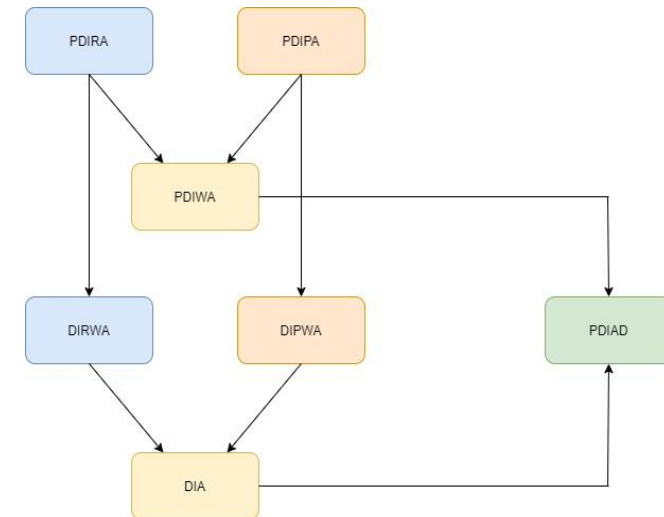


Evaluation Metrics - DIPWA

- DIPWA (Defensive Impact Pass Weighted Average) is the weighted average score for the entire defensive line against passing plays.

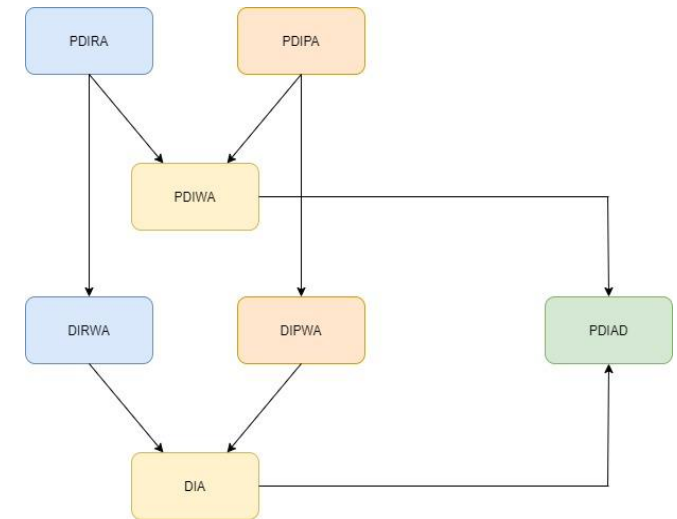
- Calculated by:
 - Weighted average of PDIPA

```
pdipa_sum = df['pdipa_sum'].sum()
pdipa_count = df['pdipa_count'].sum()
dipa_w_avg = pdipa_sum / pdipa_count
```



Evaluation Metrics - DIA

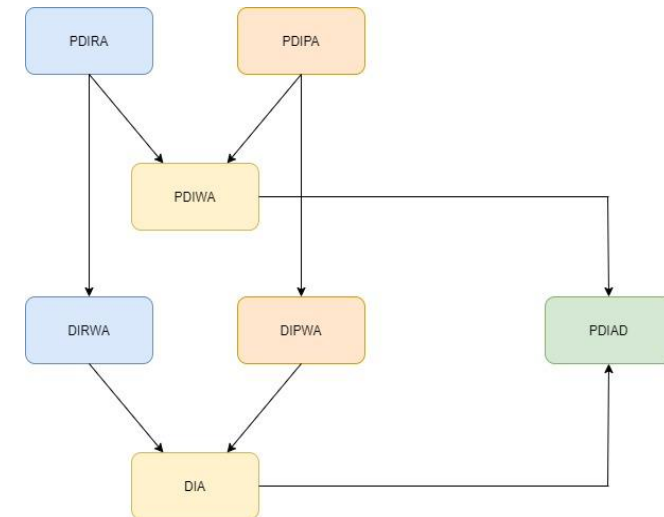
- DIA (Defensive Impact Average) is a measurement of the average impact of the entire defensive line. This metric is used as a baseline for which to compare against all the possible defensive line positions.
- Calculated by:
 - Average of DIRWA & DIPWA



Evaluation Metrics - PDIAD

- PDIAD (Positional Defensive Impact Average Differential) is the difference between each position's impact and the overall defensive line impact. This metric is used to compare relative performance (above or below average) of each position on the defensive line.

- Calculated by:
 - Difference between PDIWA and DIA





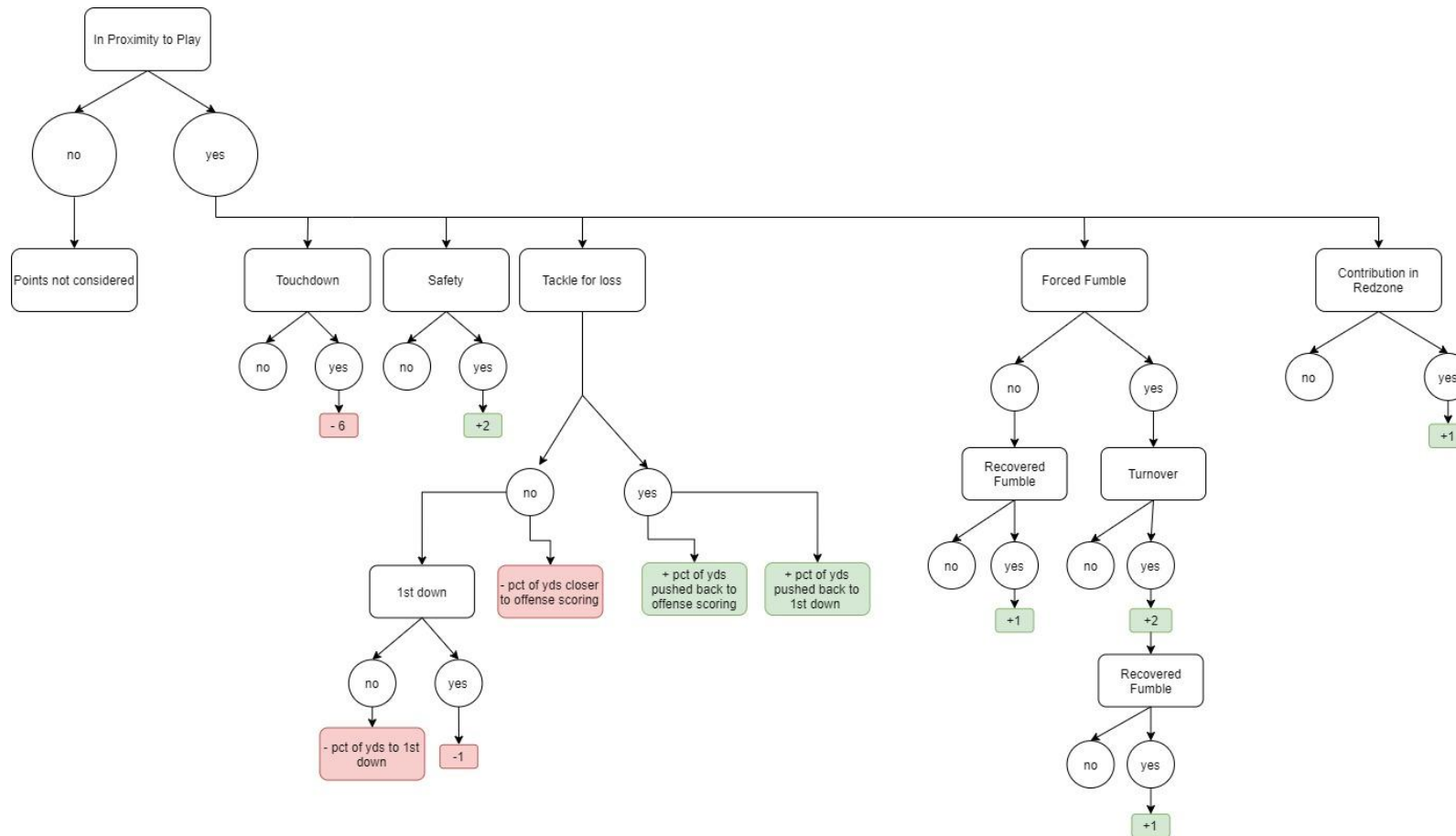
Gameplay Events Breakdown

To calculate the scores for PDIRA and PDIPA, certain gameplay events were evaluated as having impact.

- Rushing
 - Solo Tackle, Assisted Tackle, Tackle for Loss, Forced Fumble, Recovered Fumble, Safety
 - Passing
 - Solo Tackle, Assisted Tackle, Tackle for Loss, Solo Sack, Assisted Sack, Pressure, Forced Fumble, Recovered Fumble, Pass Breakup, Interception, Safety
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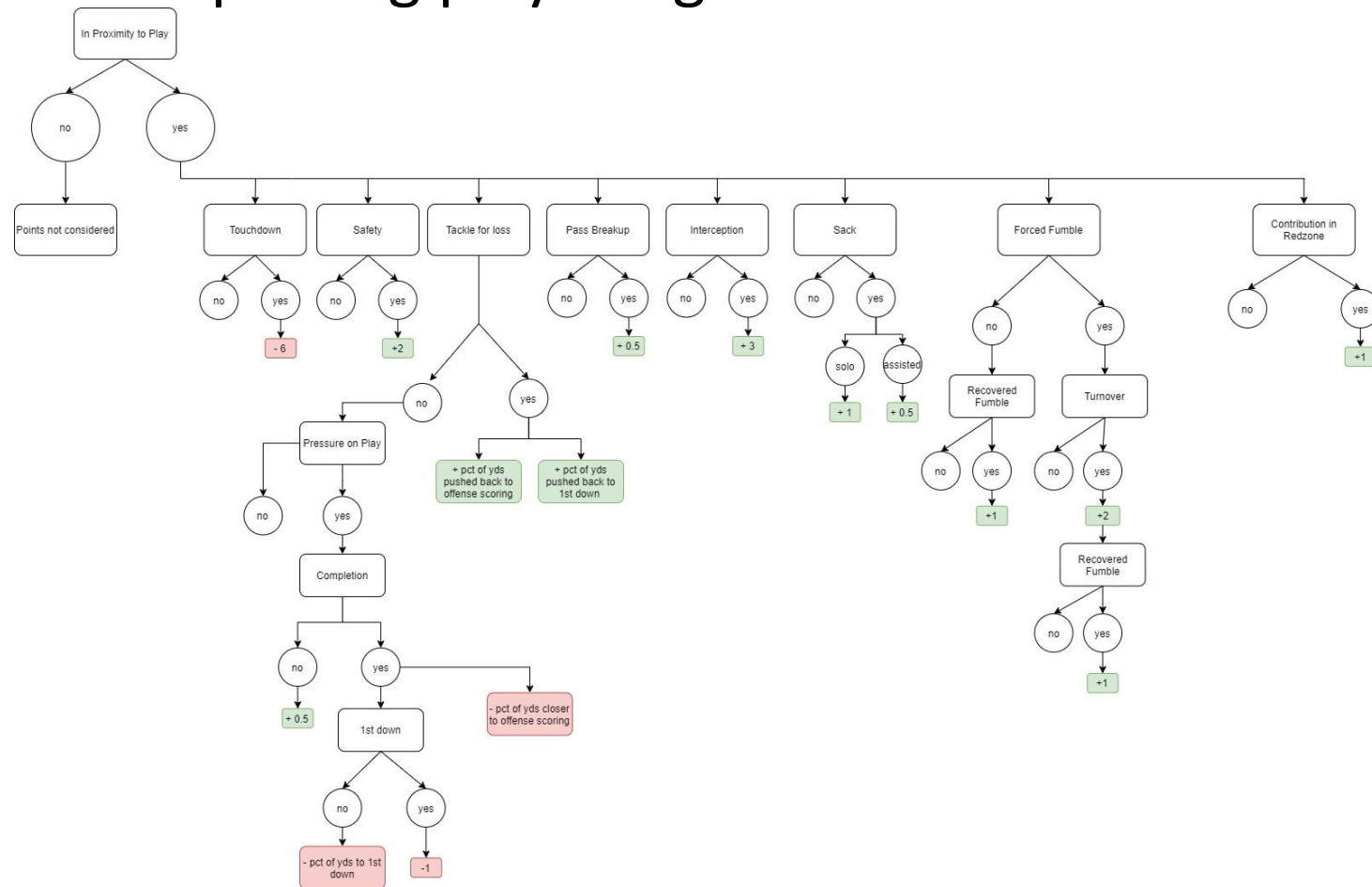
Gameplay Events Breakdown - Rushing

- Breakdown for rushing plays to generate scores for PDIRA



Gameplay Events Breakdown - Passing

- Breakdown for passing plays to generate scores for PDIPA



Gameplay Events Breakdown

- While most of the gameplay events are self explanatory, there are a few clarifications for some more involved scoring decisions.
 - Proximity to play
 - Tackle for loss
 - Redzone contribution



Gameplay Events Breakdown - Proximity

- Proximity to play is used to determine if a player could be in the region to affect the play.
 - For **rushing**:
 - Did the player make a tackle: solo or assisted
 - Was the player near the gap that the RB used
 - Did the player have any other impact contributions
 - Forced fumble, fumble recovery
-



Gameplay Events Breakdown - Proximity

- Proximity to play is used to determine if a player could be in the region to affect the play.
 - For **passing**:
 - Did the player make a tackle: solo or assisted, sack: solo or assisted
 - Was the player rushing, did they get pressure on the QB
 - Did the player have any other impact contributions
 - Forced fumble, fumble recovery, pass breakup, interception
-

Gameplay Events Breakdown – Tackle for Loss

- Tackle for loss is used to determine if the offense made progress down the field.
- If progress was made, the defense position is penalized in two regards:
 - 1) Percentage of progress made compared to remaining yards for the offense to score
 - 2) Percentage of progress made compared to remaining yards for the offense to achieve a first down
- If progress was not made, the defense position is awarded points in two regards:
 - 1) Percentage of yards the offense was pushed back compared to their original yards remaining to score
 - 2) Percentage of yards the offense was pushed back compared to their original yards remaining to achieve a first down

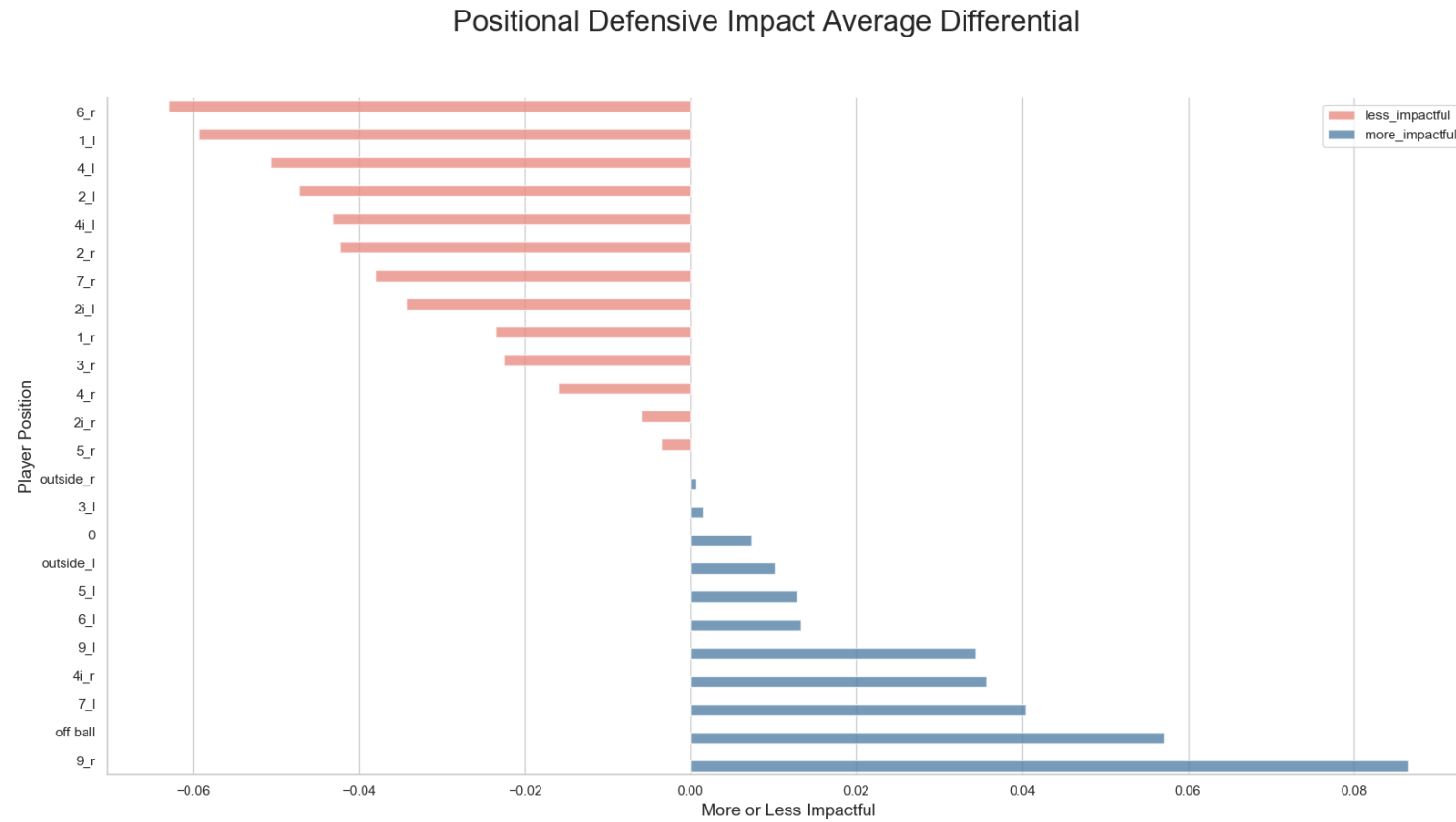
Gameplay Events Breakdown – Redzone Contribution

- Redzone contribution is used to award the defensive position additional points for performing an impactful gameplay event within 20 yards of either endzone.
- This is to indicate extra importance on the gameplay event where that defensive position either contributed to preventing offensive progress towards scoring on the defense side of the field, or contributed towards increasing the chance of a defensive score on the offense side of the field ie. safety.

Conclusion

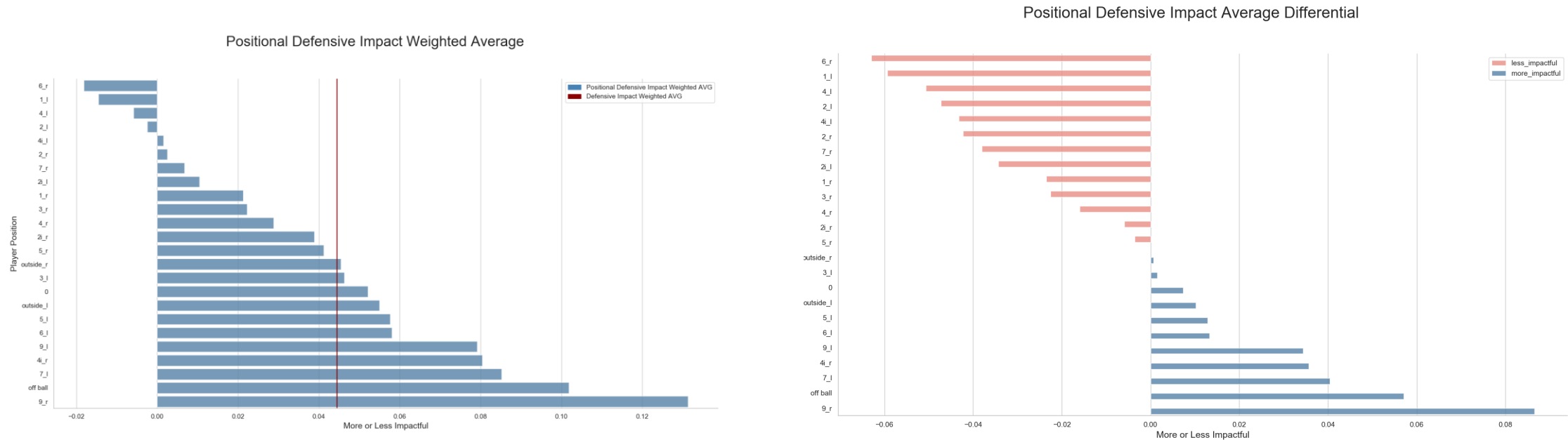
- After calculating the scores, based on the PDIAD (Positional Defensive Impact Average Differential), the most valuable overall defensive line position is:
- 9 Tech, right side of field
 - PDIAD value of 0.0865

Conclusion



Conclusion

- When compared against the PDIAD of all the other possible defensive alignments, players in 9 Tech on the right side of the field had the greatest overall impact.



Left: PDIWA, Right: PDIAD

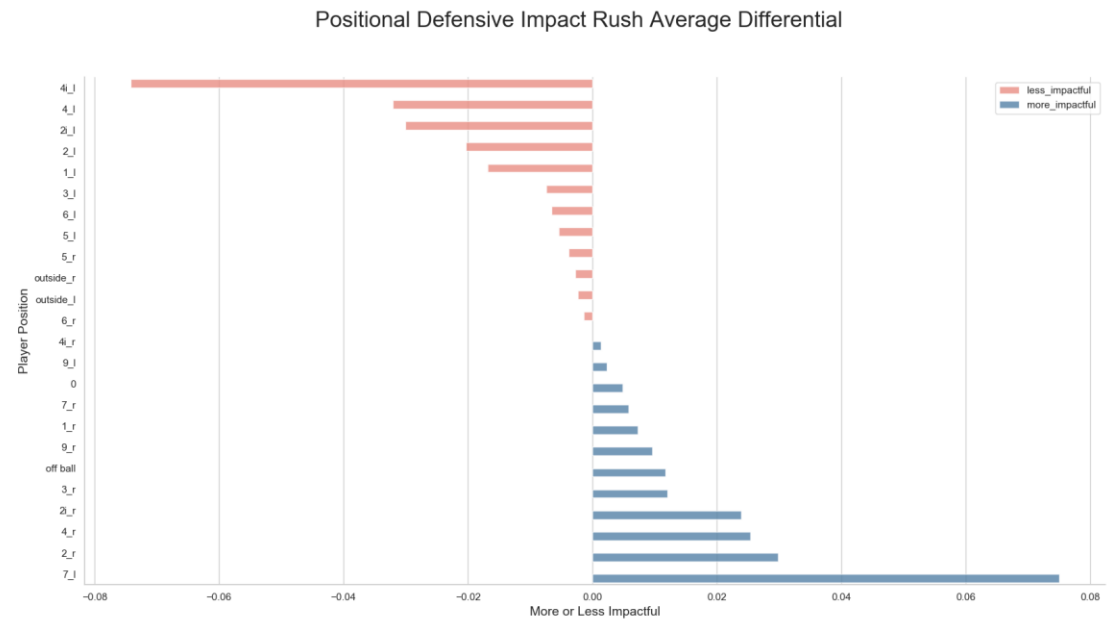
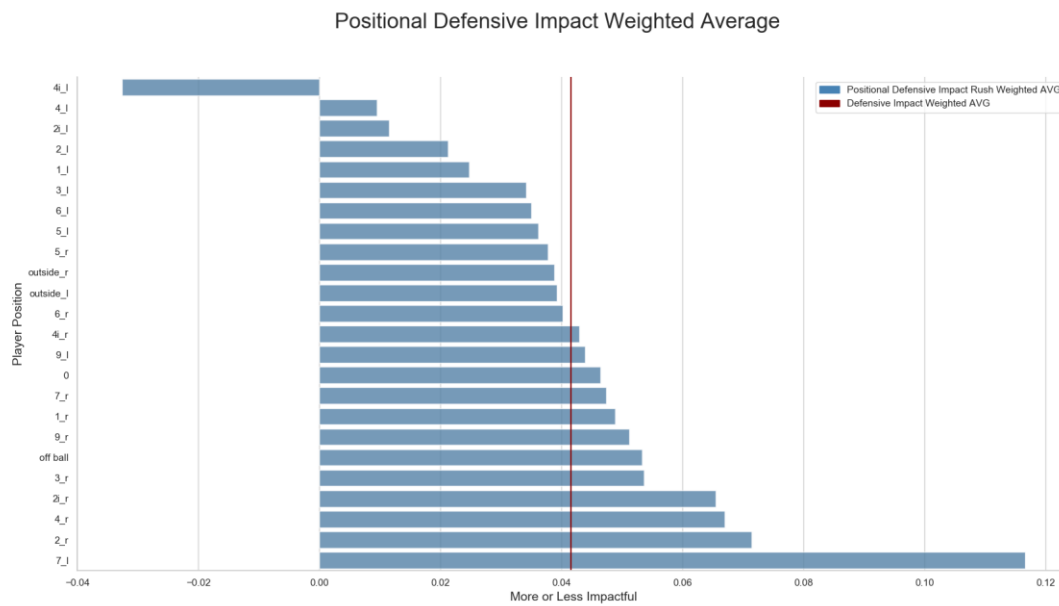


Different Context – Pass vs Rush

- While PDIAD gives us the overall most impactful defensive alignment, it does not consider rush vs pass plays.
 - We find that the most valuable defensive position changes when isolating only rushing plays or only passing plays.
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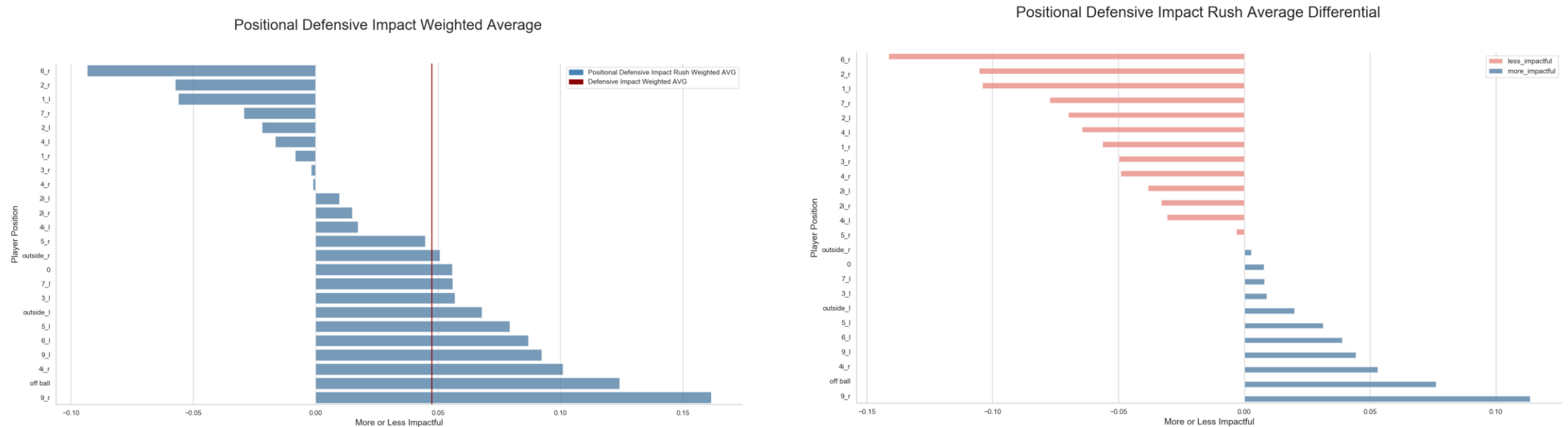
Different Context – Pass vs Rush

- If we consider only PDIRA (Positional Defensive Impact Rush Average) the most valuable position becomes 7 Tech, left side.



Different Context – Pass vs Rush

- If we consider only PDIPA (Positional Defensive Impact Pass Average) the most valuable position is still the same, as well as the 2nd most valuable position. However, the 3rd most valuable position changes to 4 Tech, left side from 7 Tech, left side





Assumptions

- In performing the scoring calculations, some assumptions were made.
 - For proximity to play, there is no definitive way to determine from the data provided whether a specific position was actually involved in the play, or close enough to the play to be considered involved. As such, points could be awarded or not awarded on plays where this assumption was made incorrectly.
 - This analysis does not consider game score, time remaining, or progress into the NFL season. This is specifically an isolated look at the overall impact per defensive position on an average play. However there is the possibility that there are elements that contribute to better or worse performance.
-



Assumptions

- Defensive positions were set as their Tech positions for the plays. This does mean that the same player can, and likely will, have multiple defensive positions. However this analysis is not of individual players, but the average impact of each alignment across all plays recorded in that alignment. There is possibility that specific players could have an affect on the overall impact of a defensive alignment.
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Limitations & Future Analysis

- In regards to the PDIAD metrics used in this analysis, the following additional data would supplement the scoring process:
- Rushing:
 - If designed gap was not used, what would it have been?
 - X,Y Coordinates of each player
- Passing:
 - Time to throw
 - Angle of pass release to determine which defensive positions are nearby
 - Did the QB leave the pocket? Was it schematic?