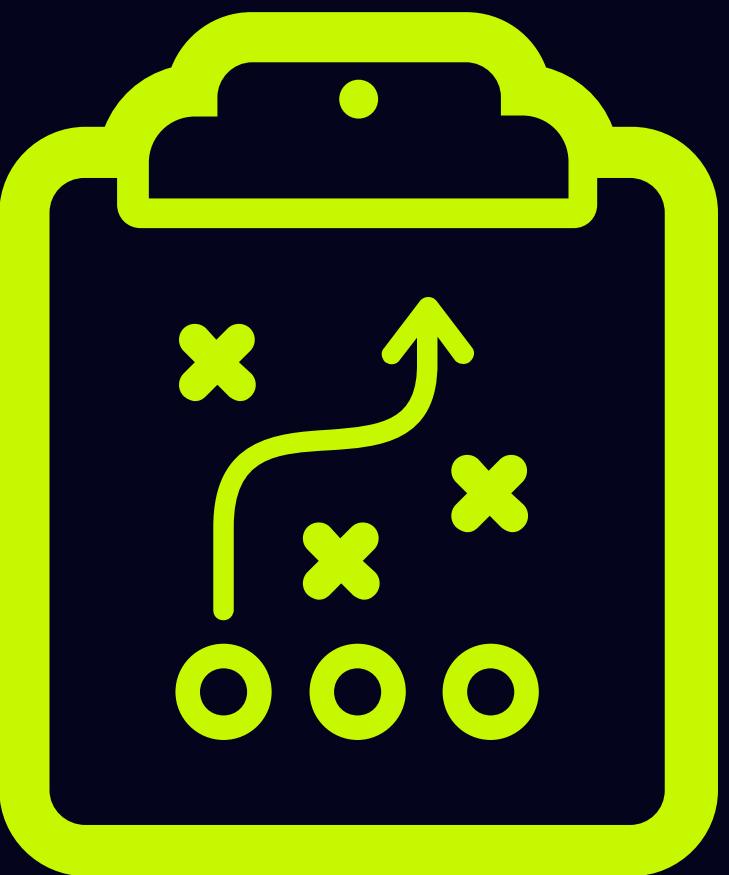
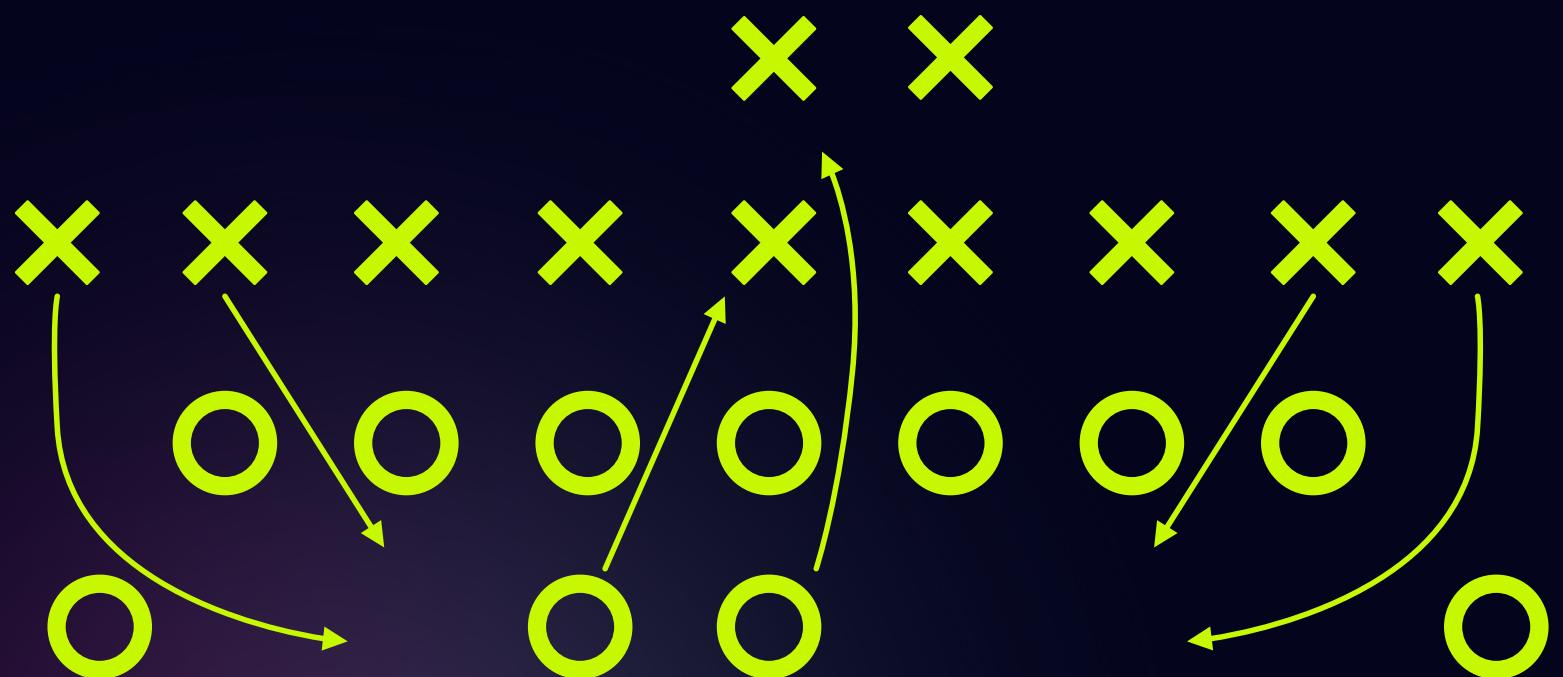


NFL PLAYCALLING



OUR TEAM



Camdin

Reese

Jordan

Micah

OUR GOALS

01

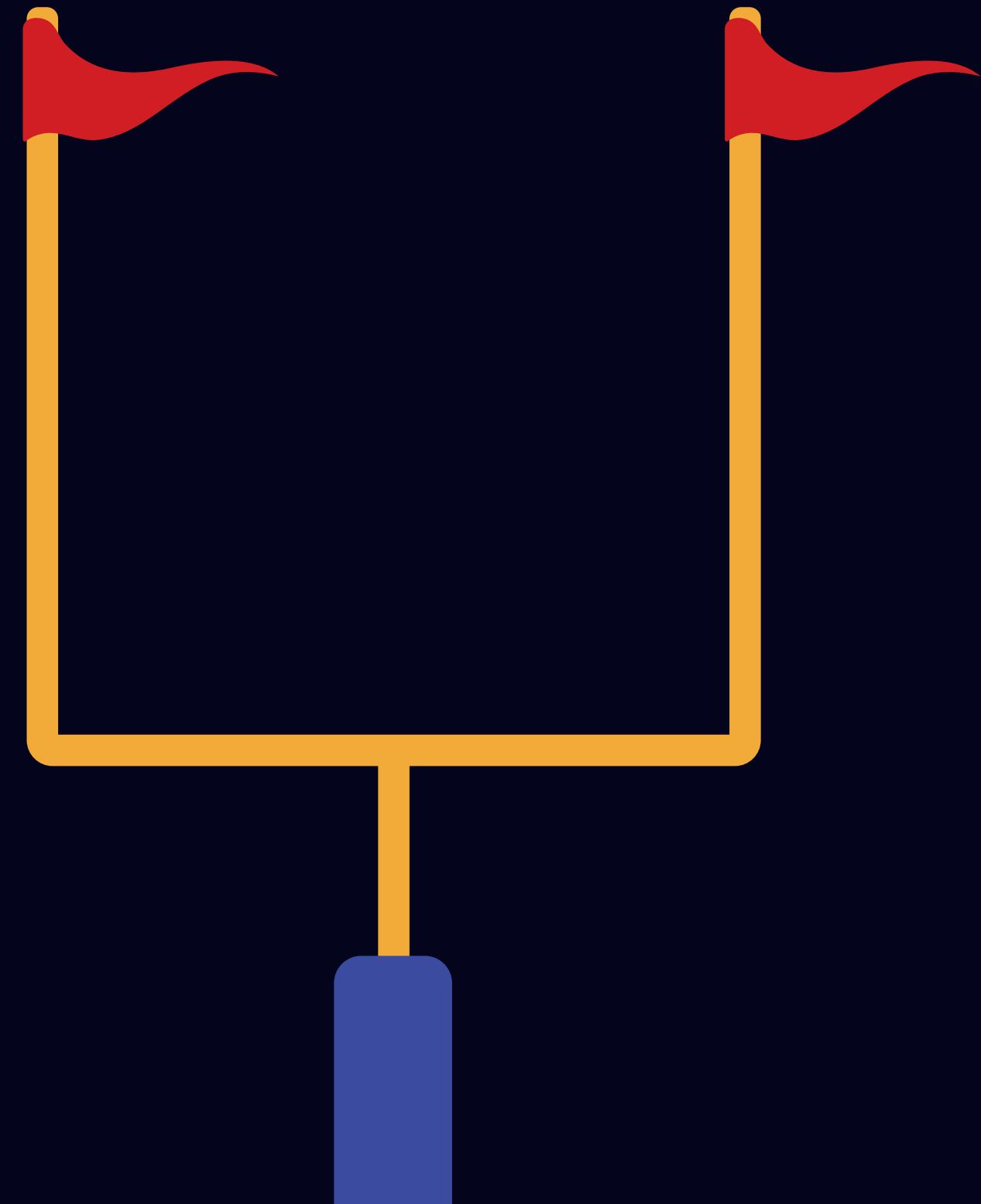
Build a model that predicts the style of play an NFL coach would run in a given situation. The situation consists of yardline, time remaining in the half, down, yards to gain, quarter, etc.

02

Define the model using various techniques to improve the accuracy as well as create more refined predictions based upon which team is calling the play.

03

Conclude how consistent playcalling is across the league for every given situation.



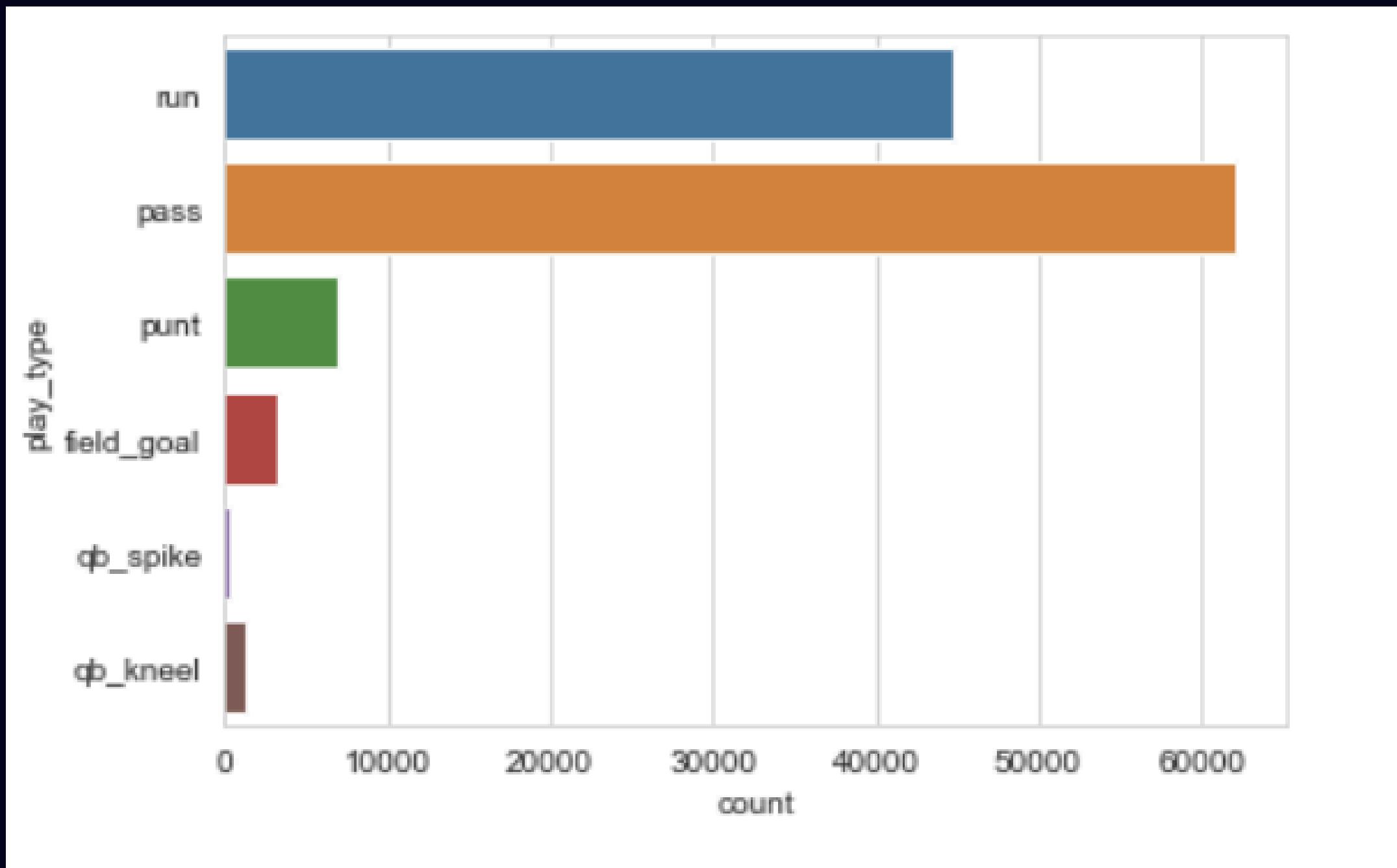
```
##pip install nfl_data_py
import nfl_data_py as nfl
```

DATA SOURCE



- **Nfl_data_py is a Python library for interacting with NFL data sourced from nflfastR, nfldata, dynastyprocess, and Draft Scout.**
- This data includes play-by-play, combine, injury, roster, next-gen, and many other forms of data. It goes back as far as 1999.

PLAY TYPE DISTRIBUTIONS (2021 - 2023)



Run - Lower risk, lower average yards, keeps the clock running

Pass - Higher risk, higher average yards, stops clock on incompletion

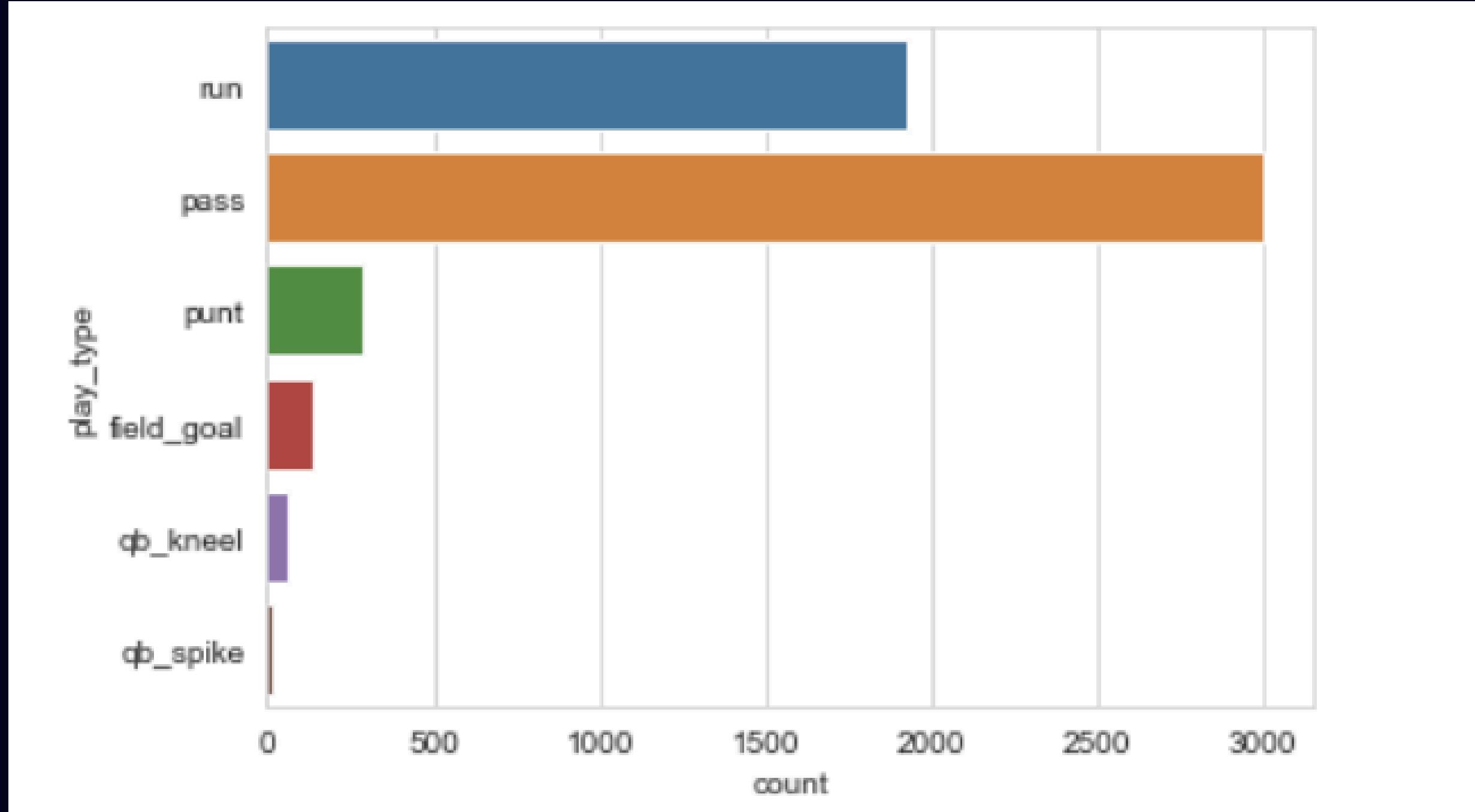
Punt - Conservative play to give other team ball on 4th down with minimal disadvantage

Field Goal - Conservative play that gives a team a higher chance to score but rewards less points

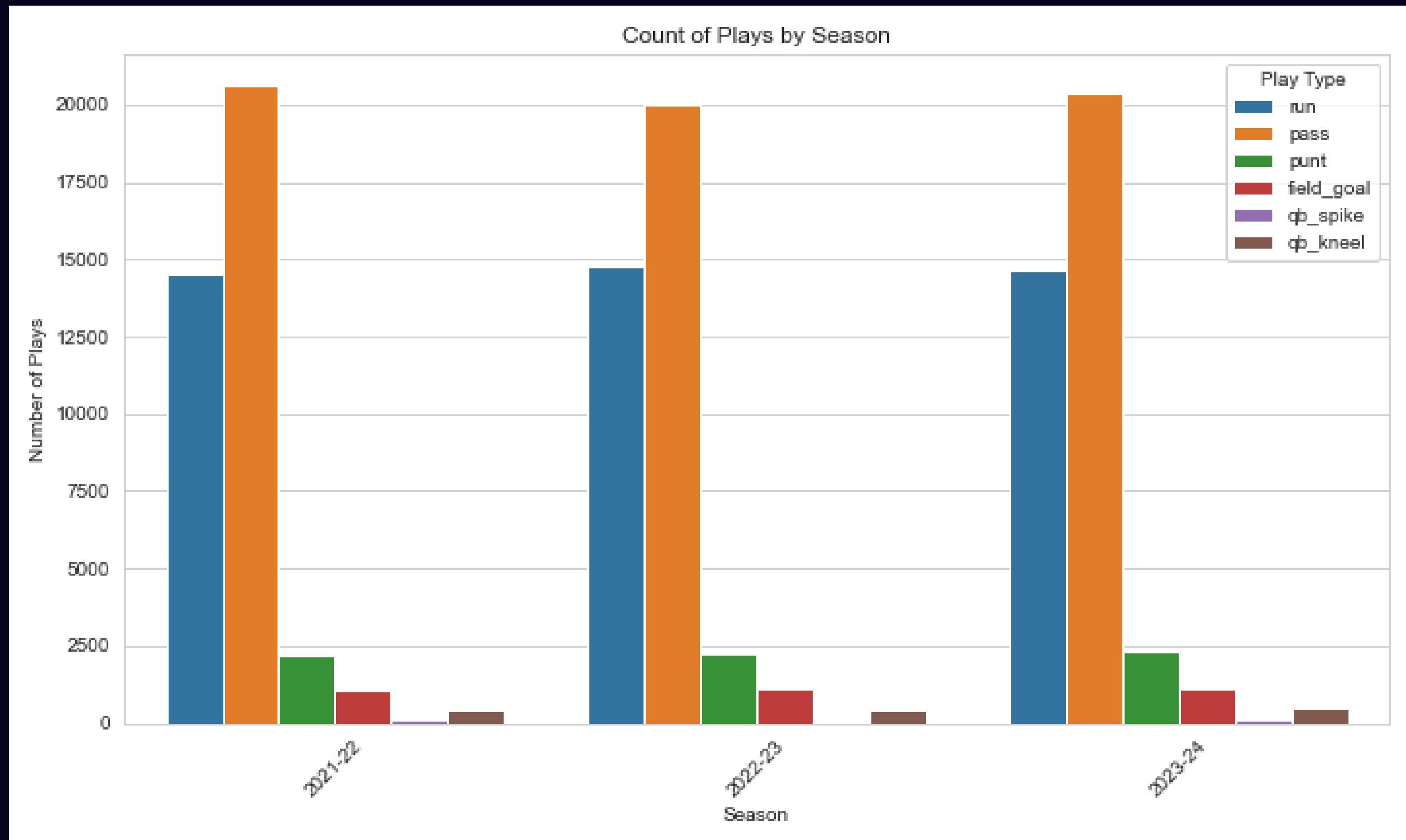
QB Spike - Gimmick play that is only intended to stop the clock when there are no timeouts

QB Kneel - No risk play that will keep the clock running

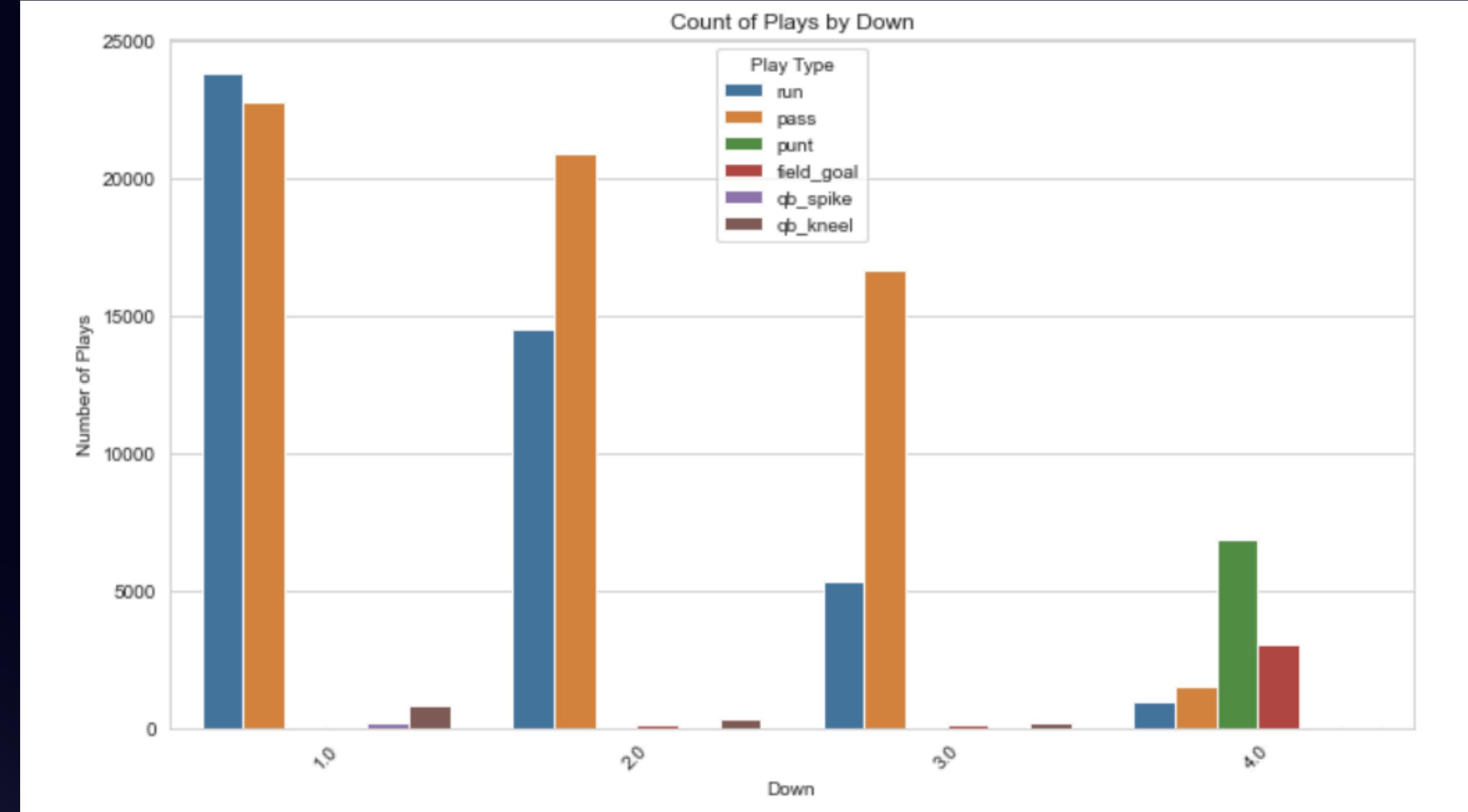
PLAY TYPE DISTRIBUTIONS POST-SEASON (2021-2023)



PLAY TYPE DISTRIBUTIONS BY SEASON



PLAY TYPE DISTRIBUTIONS BY DOWN (2021 - 2023)



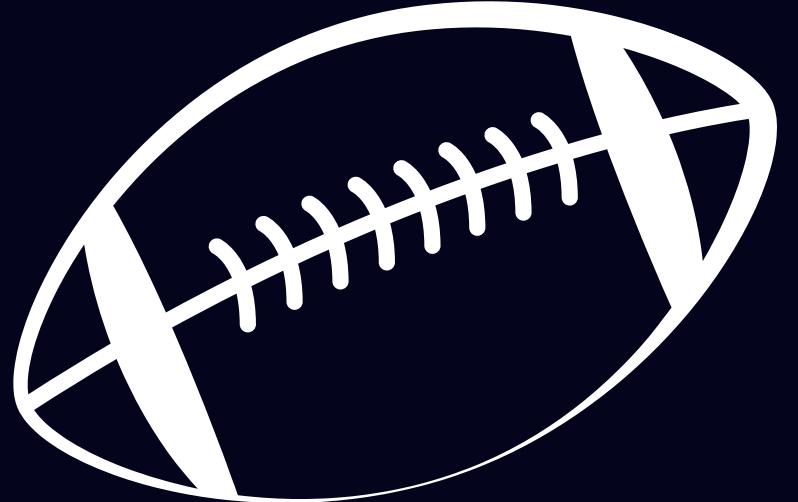
Expectations / Predictions

- SPIKES & QB KNEELS WILL BE TRICKY
- FIRST AND SECOND DOWN ARE FAIRLY RANDOM
 - RUN OR PASS
- IN GAME PRE SNAP PREDICTORS ARE IDEAL
- SOME TEAMS MAY NOT CONFORM TO TRADITIONAL WISDOM

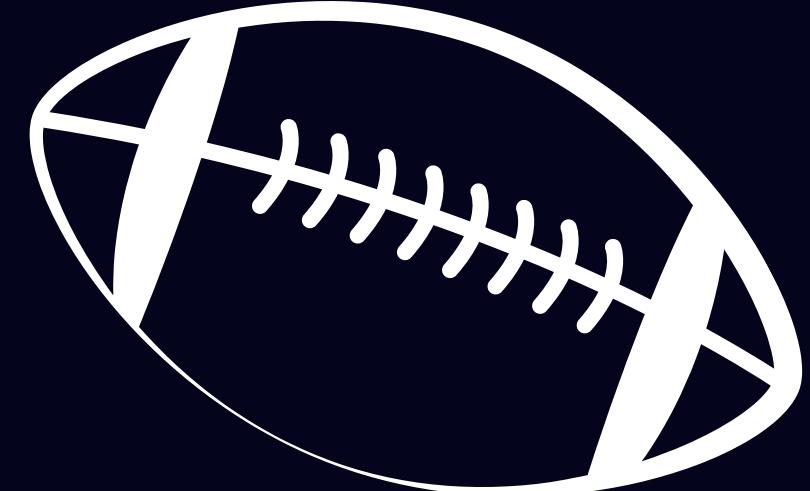


Your Turn to be a Categorization Algorithm!





Cheat Sheet



Run - Lower risk, lower average yards, keeps the clock running

Pass - Higher risk, higher average yards, stops clock on incompletion

Punt - Conservative play to give other team ball on 4th down with minimal disadvantage

Field Goal - Conservative play that gives a team a higher chance to score but rewards less points

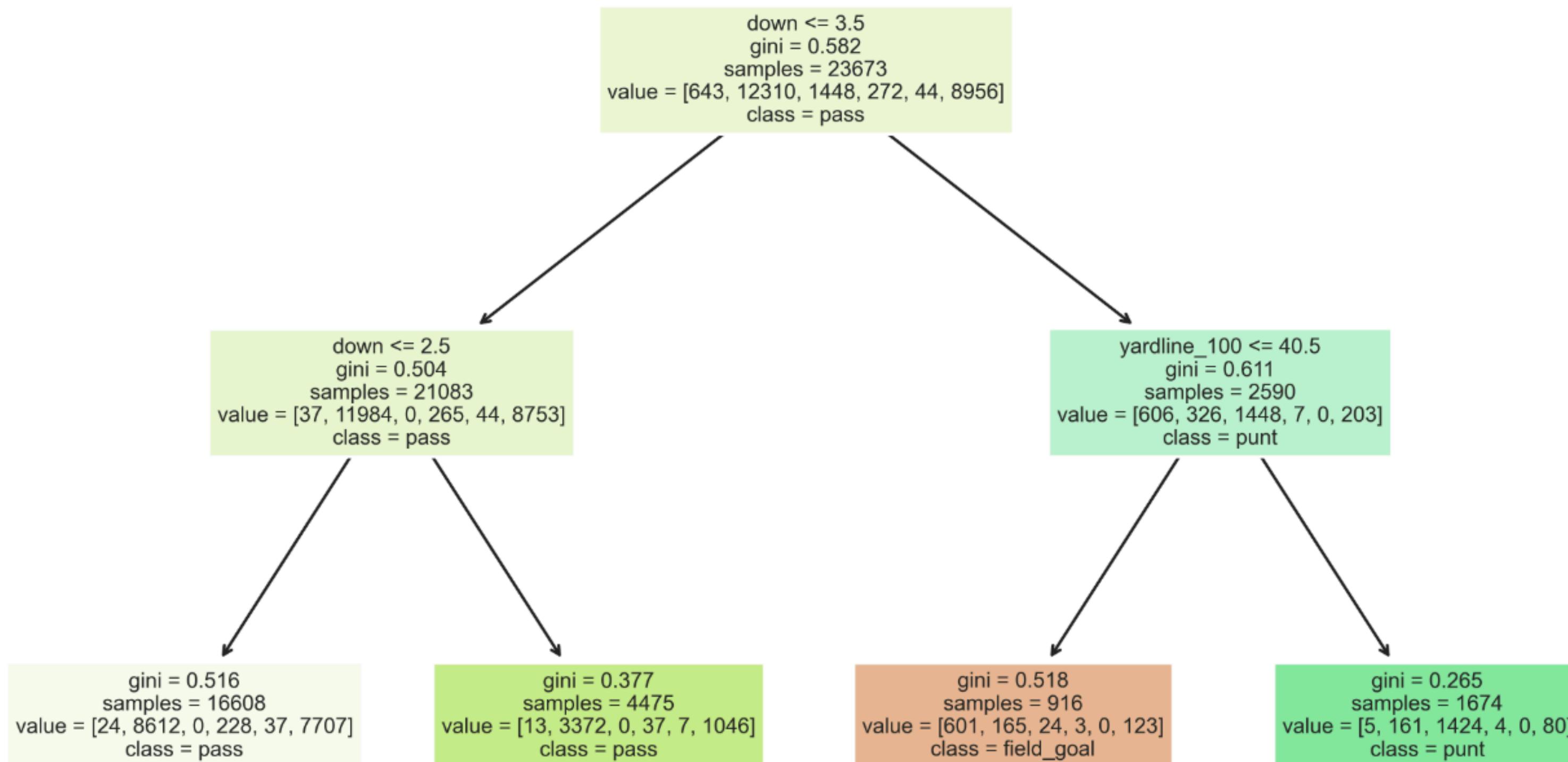
QB Spike - Gimmick play that is only intended to stop the clock when there are no timeouts

QB Kneel - No risk play that will keep the clock running

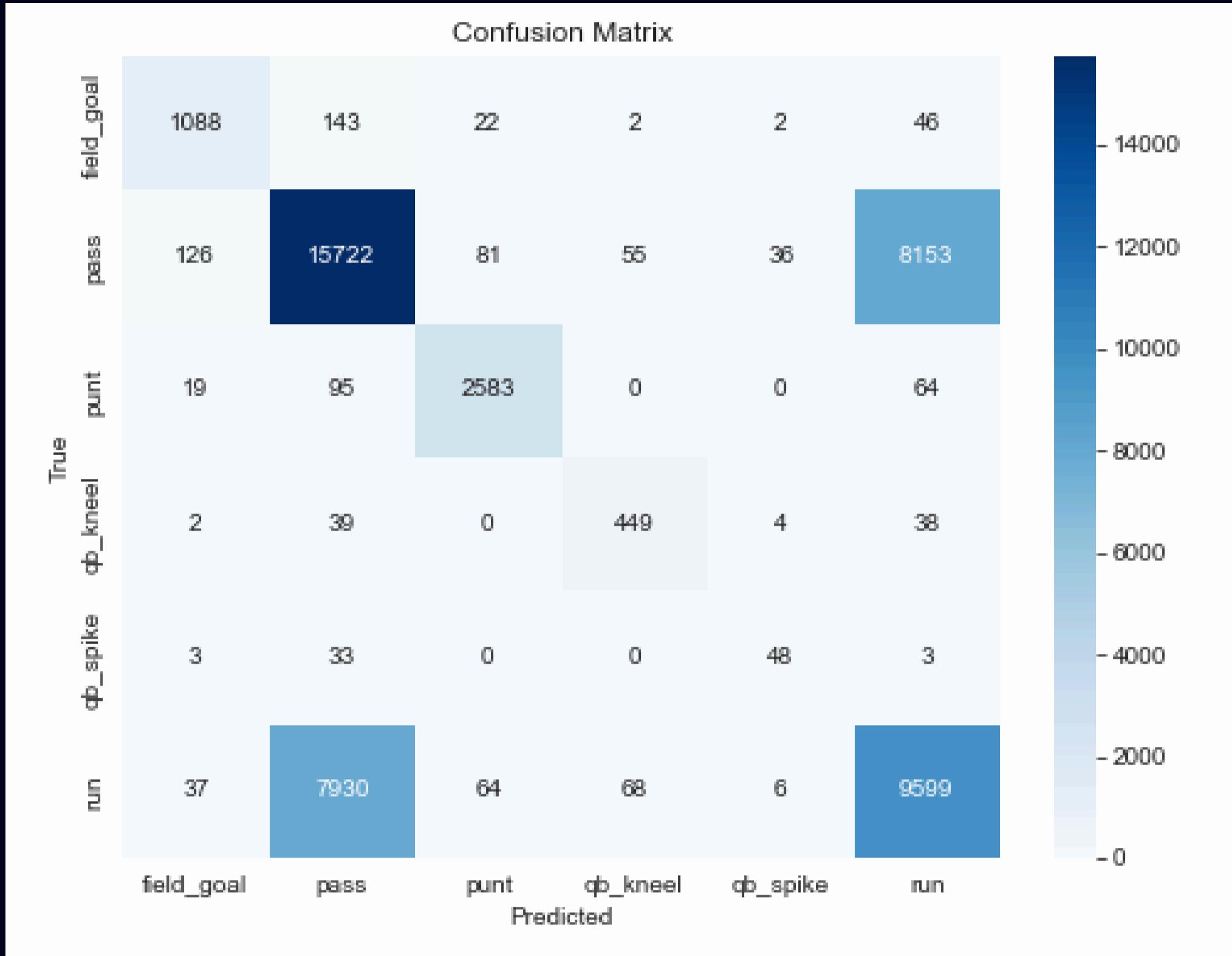
How We Did

Camdin	Micah	Reese	Jordan
1	1	1	1
0	1	1	1
1	1	1	0
1	1	0	0
1	1	0	1
0	1	0	0
0	1	0	1
1	1	1	0
1	1	0	1
0	0	1	0
60%	90%	50%	50%

Decision Tree



Second Regression Tree



Team Based Regression Tree

BAL Overall Accuracy: 62.72%

BUF Overall Accuracy: 64.36%

CAR Overall Accuracy: 66.79%

CHI Overall Accuracy: 59.90%

CIN Overall Accuracy: 66.43%

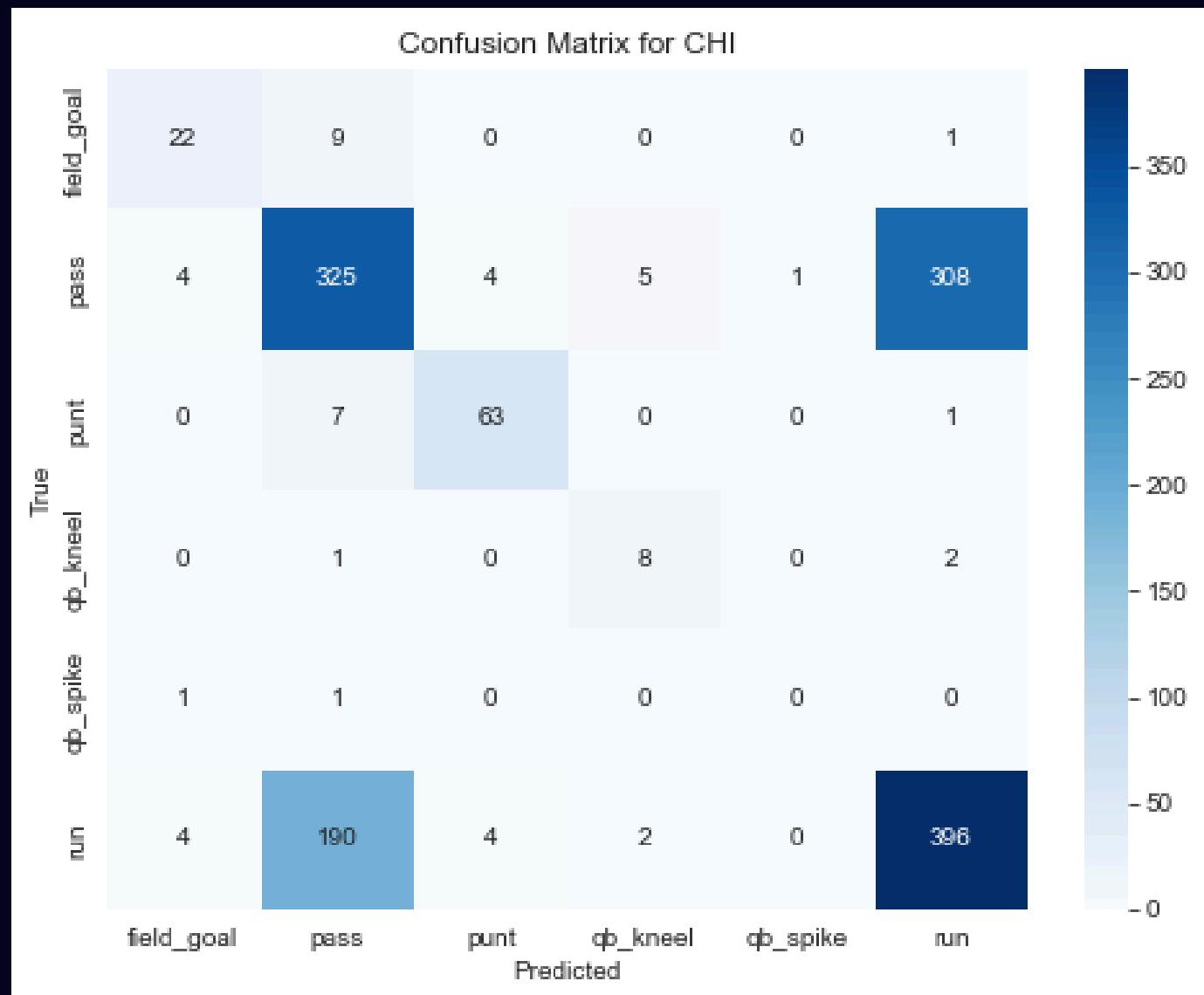
CLE Overall Accuracy: 63.89%

DAL Overall Accuracy: 65.06%

DEN Overall Accuracy: 63.99%

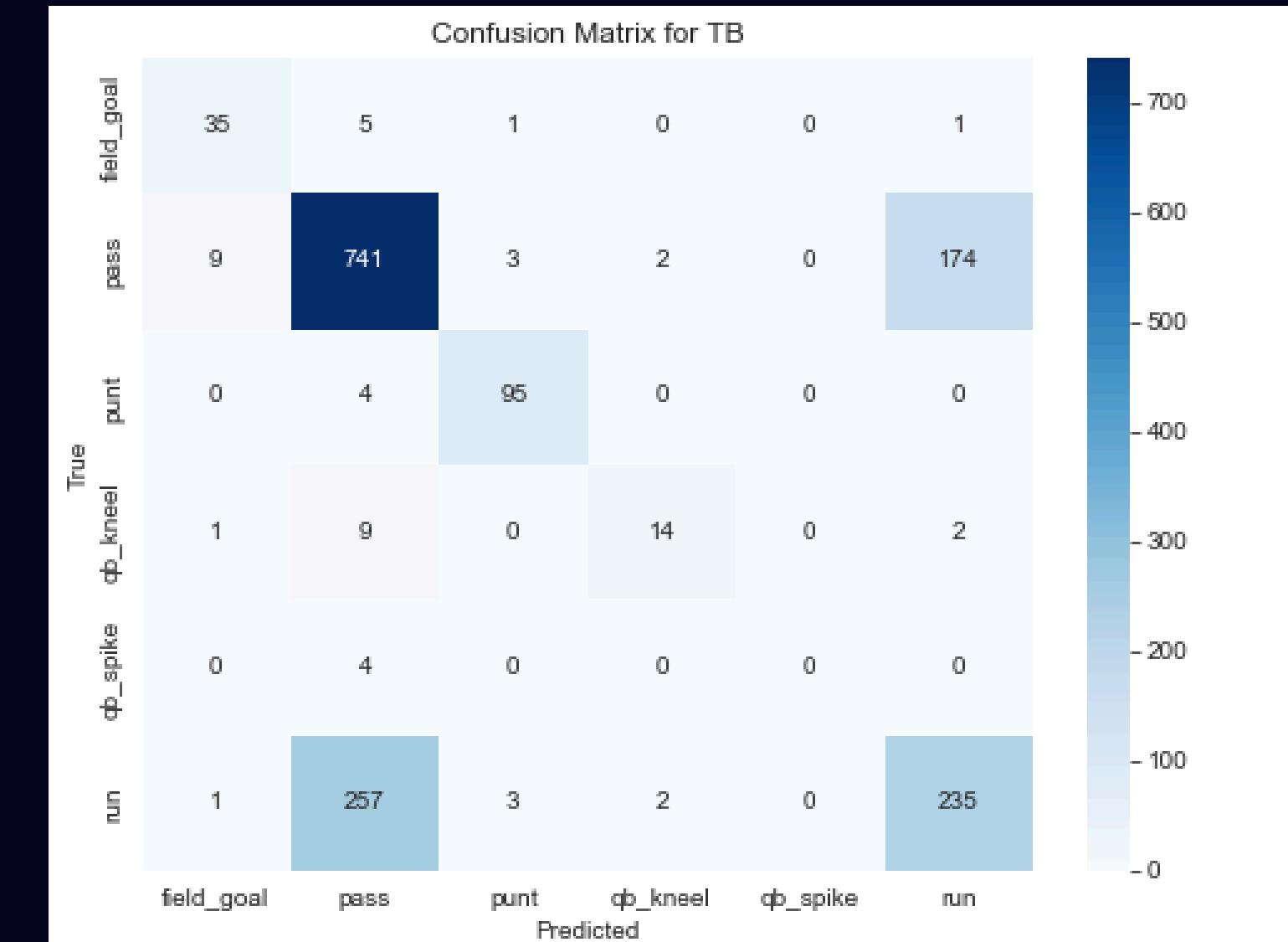
DET Overall Accuracy: 64.10%

Deeper Dive



Accuracy Data for: CHI
 Class field_goal: 68.75%
 Class pass: 50.23%
 Class punt: 88.73%
 Class qb_kneel: 72.73%
 Class qb_spike: 0.00%
 Class run: 66.44%

Overall Accuracy: 59.90%



Accuracy Data for: TB
 Class field_goal: 83.33%
 Class pass: 79.76%
 Class punt: 95.96%
 Class qb_kneel: 53.85%
 Class qb_spike: 0.00%
 Class run: 47.19%

Overall Accuracy: 70.09%

Random Forest All Teams



Class field_goal: 91.25%

Class pass: 73.90%

Class punt: 97.50%

Class qb_kneel: 87.41%

Class qb_spike: 56.32%

Class run: 56.02%

Overall Accuracy: 69.11%

Team-Based Random Forest

BAL Overall Accuracy: 69.21%

BUF Overall Accuracy: 67.63%

CAR Overall Accuracy: 69.02%

CHI Overall Accuracy: 62.77%

CIN Overall Accuracy: 70.43%

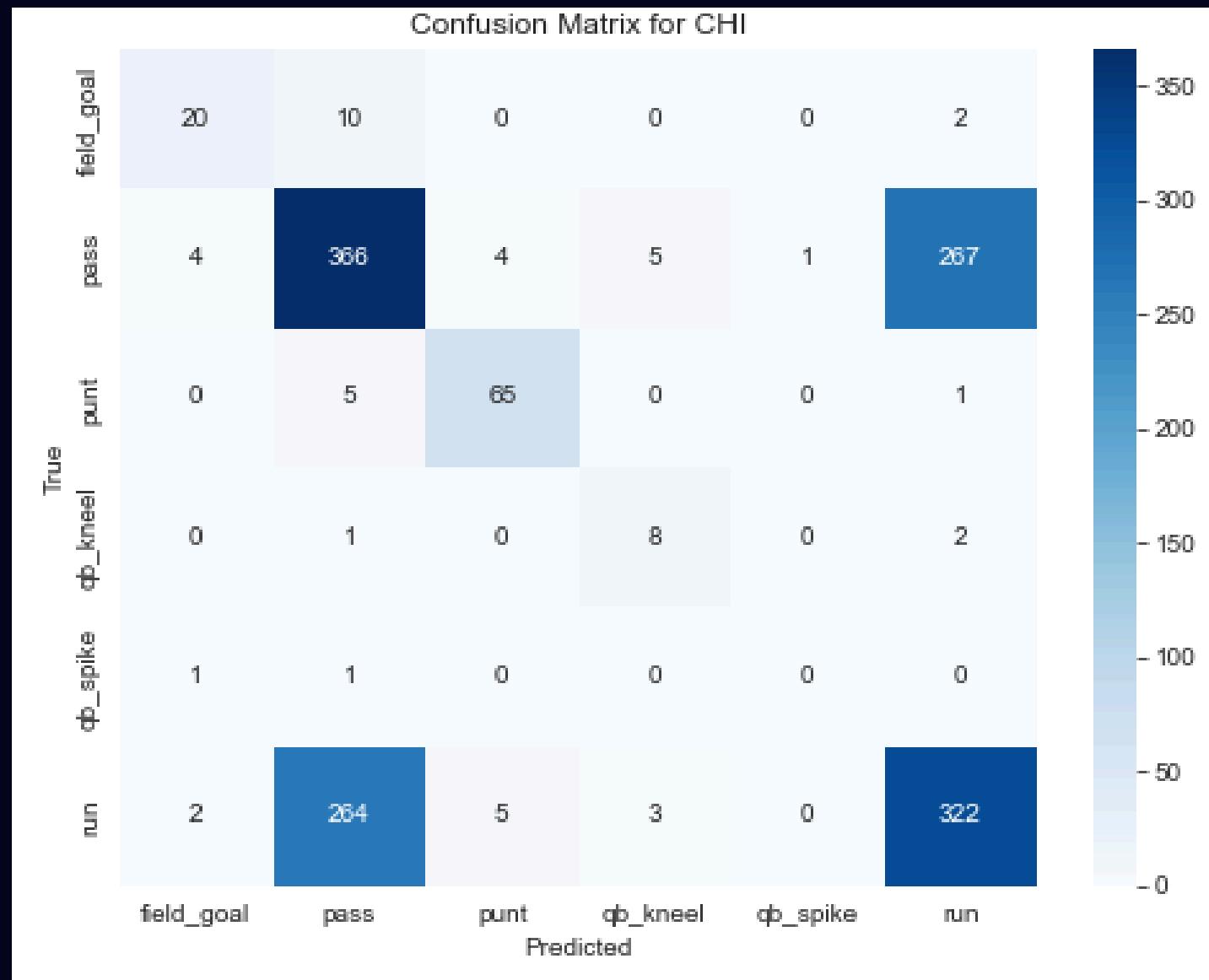
CLE Overall Accuracy: 67.68%

DAL Overall Accuracy: 67.15%

DEN Overall Accuracy: 66.98%

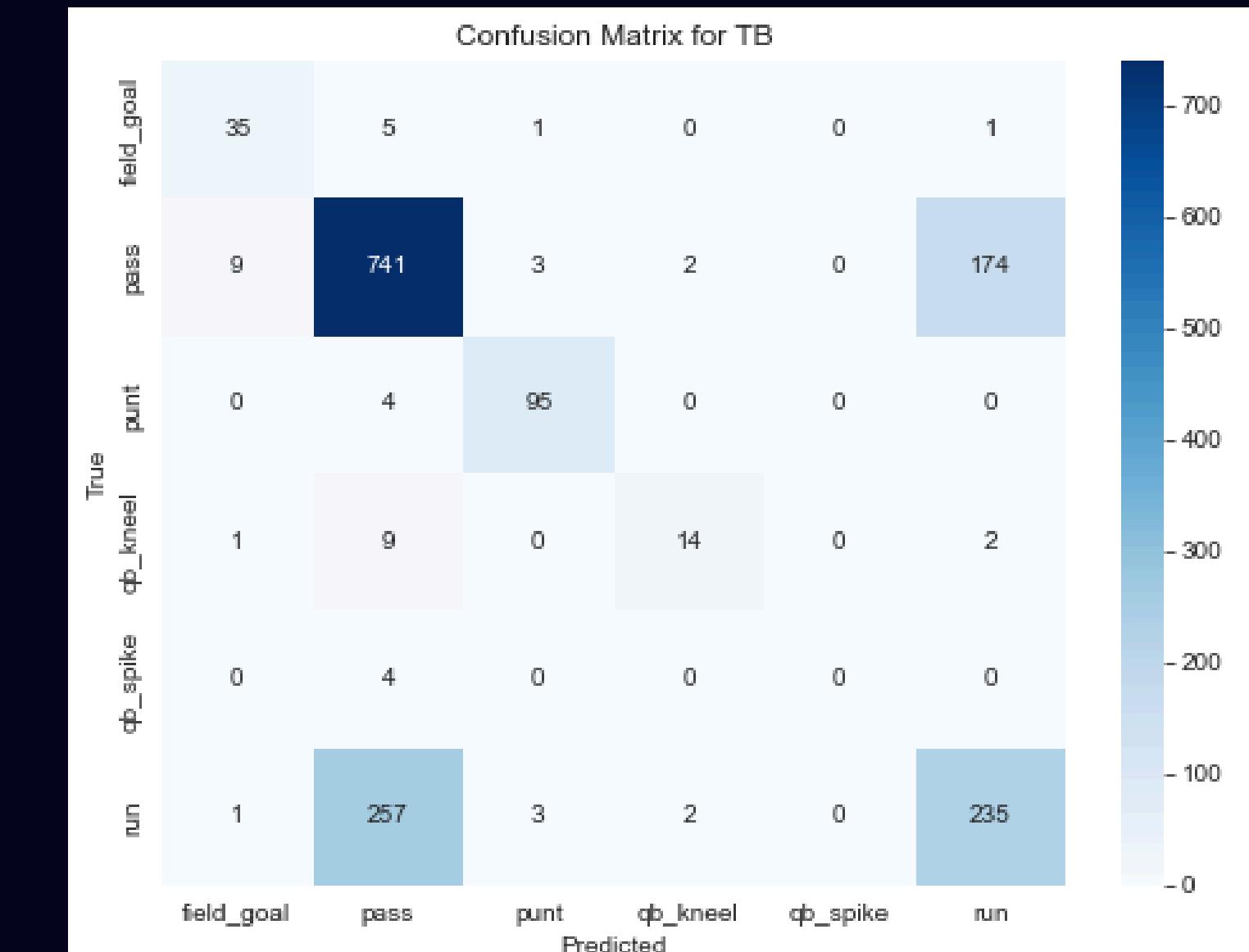
DET Overall Accuracy: 64.10%

Deeper Dive PT. 2



Accuracy Data for: CHI
Class field_goal: 78.12%
Class pass: 57.81%
Class punt: 97.18%
Class qb_kneel: 54.55%
Class qb_spike: 0.00%
Class run: 63.59%

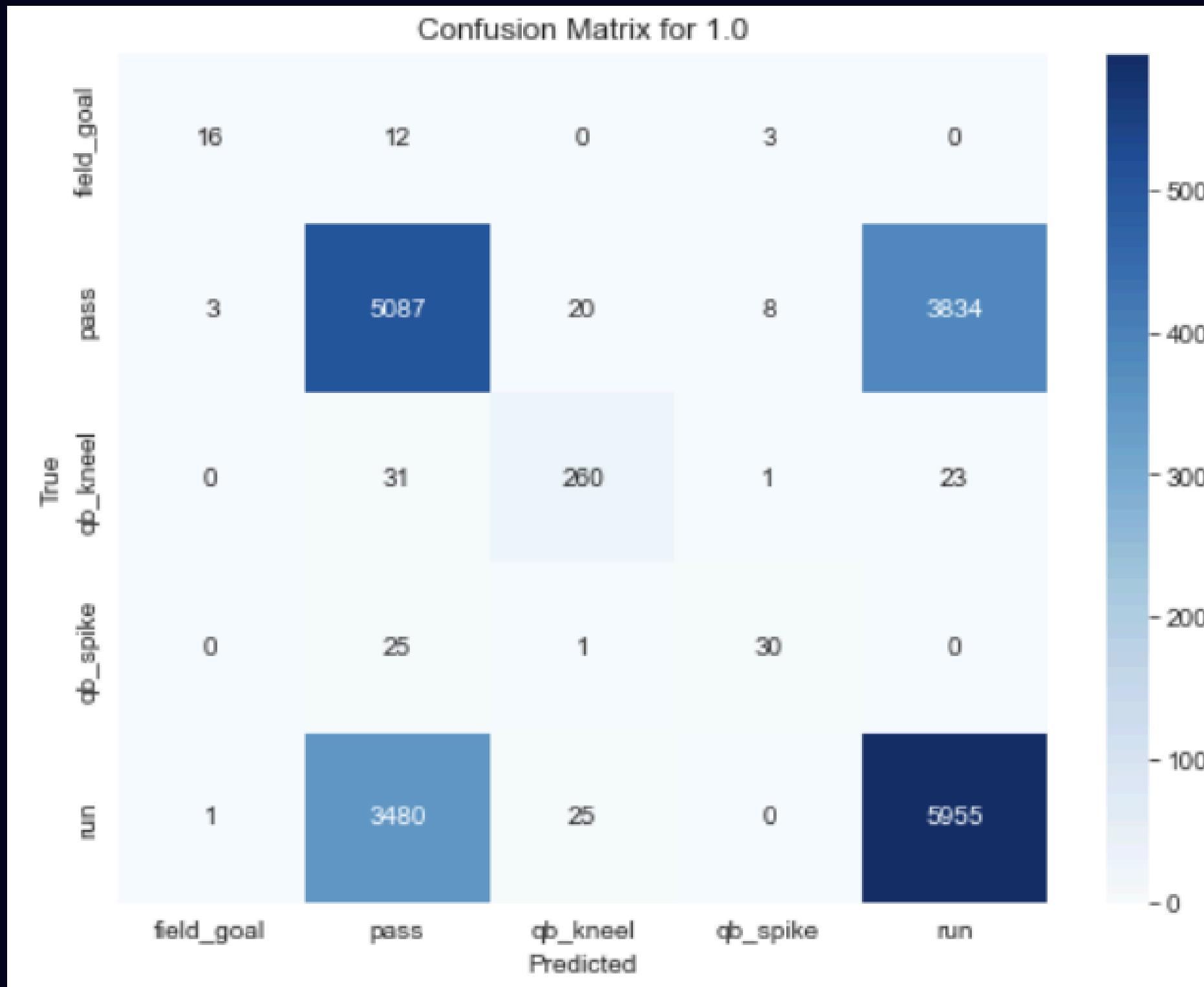
Overall Accuracy: 62.77%



Accuracy Data for: TB
Class field_goal: 83.33%
Class pass: 82.13%
Class punt: 100.00%
Class qb_kneel: 73.08%
Class qb_spike: 0.00%
Class run: 49.80%

Overall Accuracy: 72.84%

Down Based Random Forest : First Down

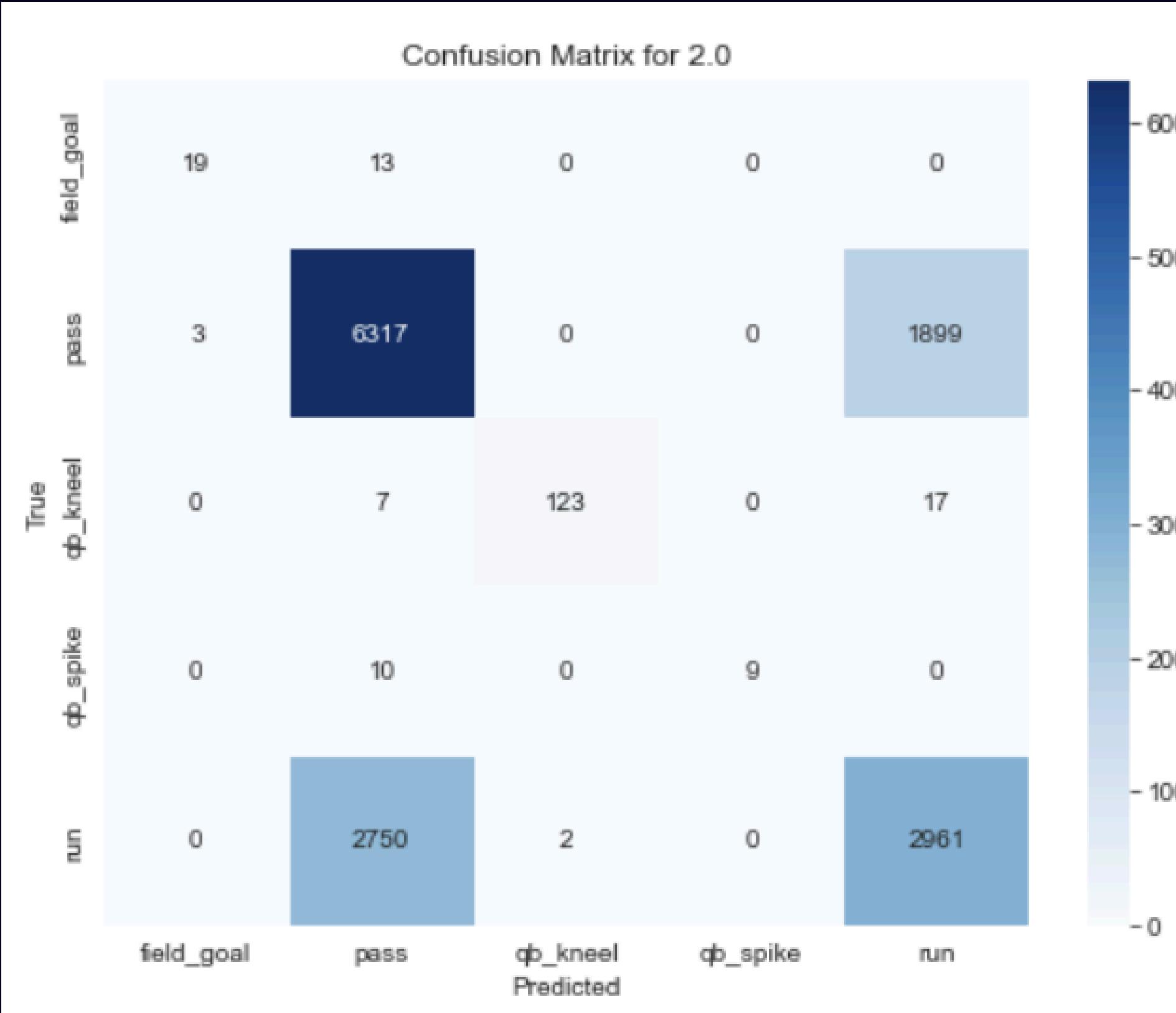


Accuracy Data for: 1.0
Class field_goal: 51.61%
Class pass: 56.83%
Class qb_kneel: 82.54%
Class qb_spike: 53.57%
Class run: 62.94%

Overall Accuracy: 60.31%

Feature yardline_100: 0.23413676772553346
Feature half_seconds_remaining: 0.4030161383626239
Feature qtr: 0.04308598264160737
Feature ydstogo: 0.021246393827250475
Feature score_differential: 0.1751166516852297
Feature posteam_timeouts_remaining: 0.03327324821045644
Feature defteam_timeouts_remaining: 0.0338708546554403
Feature running_clock: 0.015103832629931816
Feature previous: 0.04115013026192659

Down Based Random Forest: Second Down

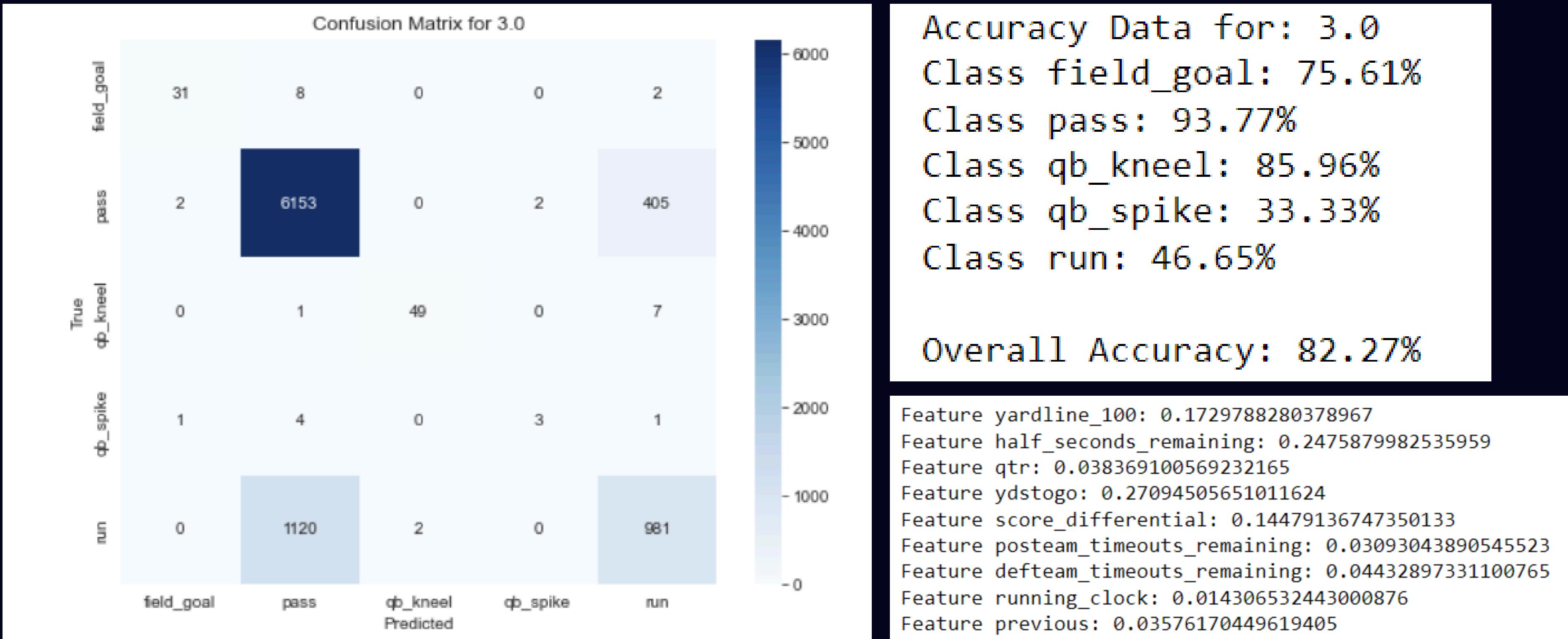


Accuracy Data for: 2.0
Class field_goal: 59.38%
Class pass: 76.86%
Class qb_kneel: 83.67%
Class qb_spike: 47.37%
Class run: 51.83%

Overall Accuracy: 66.73%

Feature yardline_100: 0.22334170677512916
Feature half_seconds_remaining: 0.31456779154718395
Feature qtr: 0.04508022060185386
Feature ydstogo: 0.13918704946979304
Feature score_differential: 0.1661616237494182
Feature posteam_timeouts_remaining: 0.0320521071310622
Feature defteam_timeouts_remaining: 0.03571792287484388
Feature running_clock: 0.011959654052207886
Feature previous: 0.031931923798507816

Down Based Random Forest : Third Down



Down Based Random Forest Fourth Down



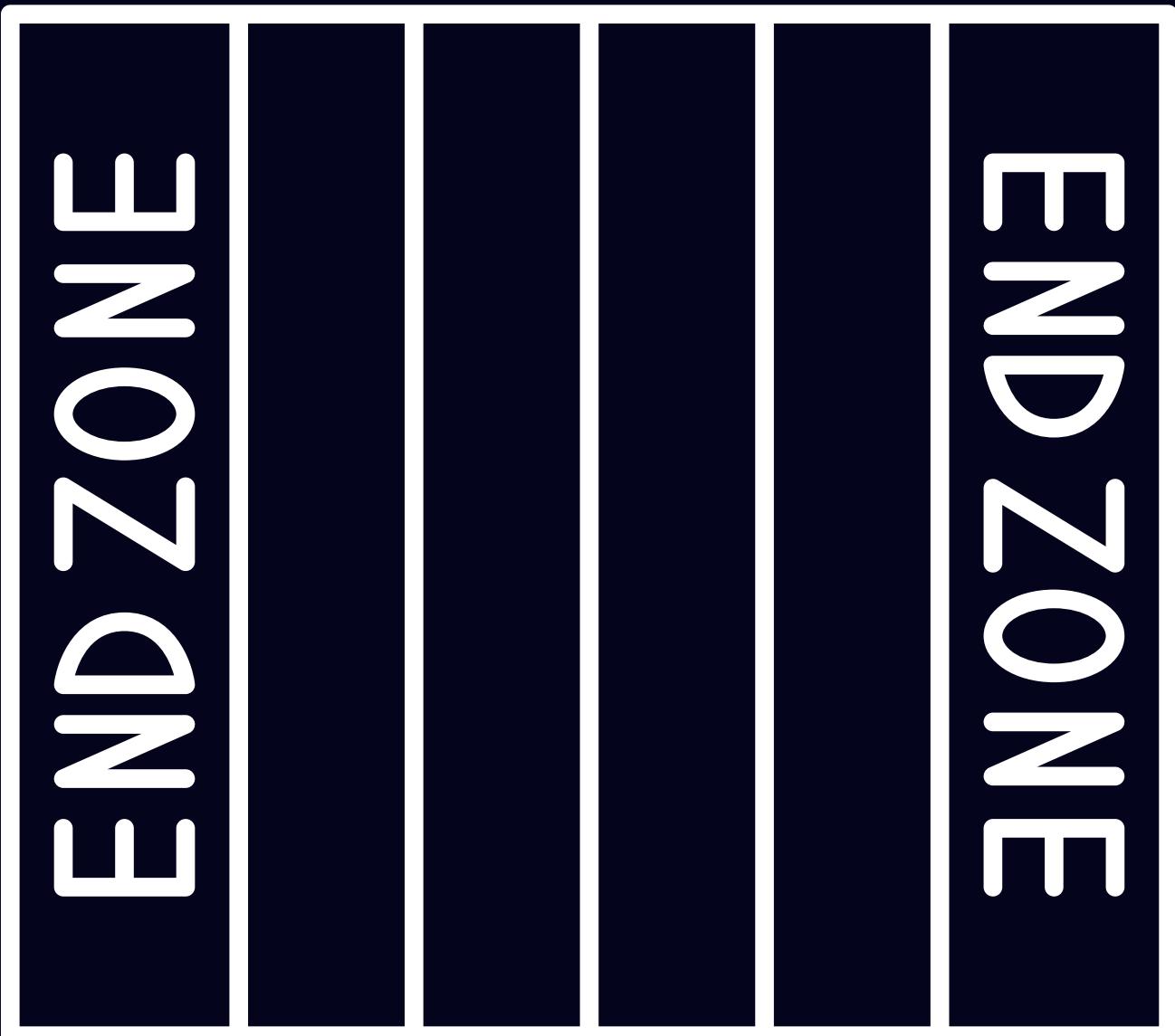
Accuracy Data for: 4.0
Class field_goal: 93.13%
Class pass: 54.37%
Class punt: 96.68%
Class qb_kneel: 0.00%
Class run: 51.34%

Overall Accuracy: 87.06%

Feature yardline_100: 0.5467970395374326
Feature half_seconds_remaining: 0.10698763733531494
Feature qtr: 0.04152055524587322
Feature ydstogo: 0.12171802599451077
Feature score_differential: 0.10711120267043958
Feature posteam_timeouts_remaining: 0.02562284487011486
Feature defteam_timeouts_remaining: 0.017777721748619135
Feature running_clock: 0.01254622421789665
Feature previous: 0.019918748379798044

Is Play-Calling Conventional?

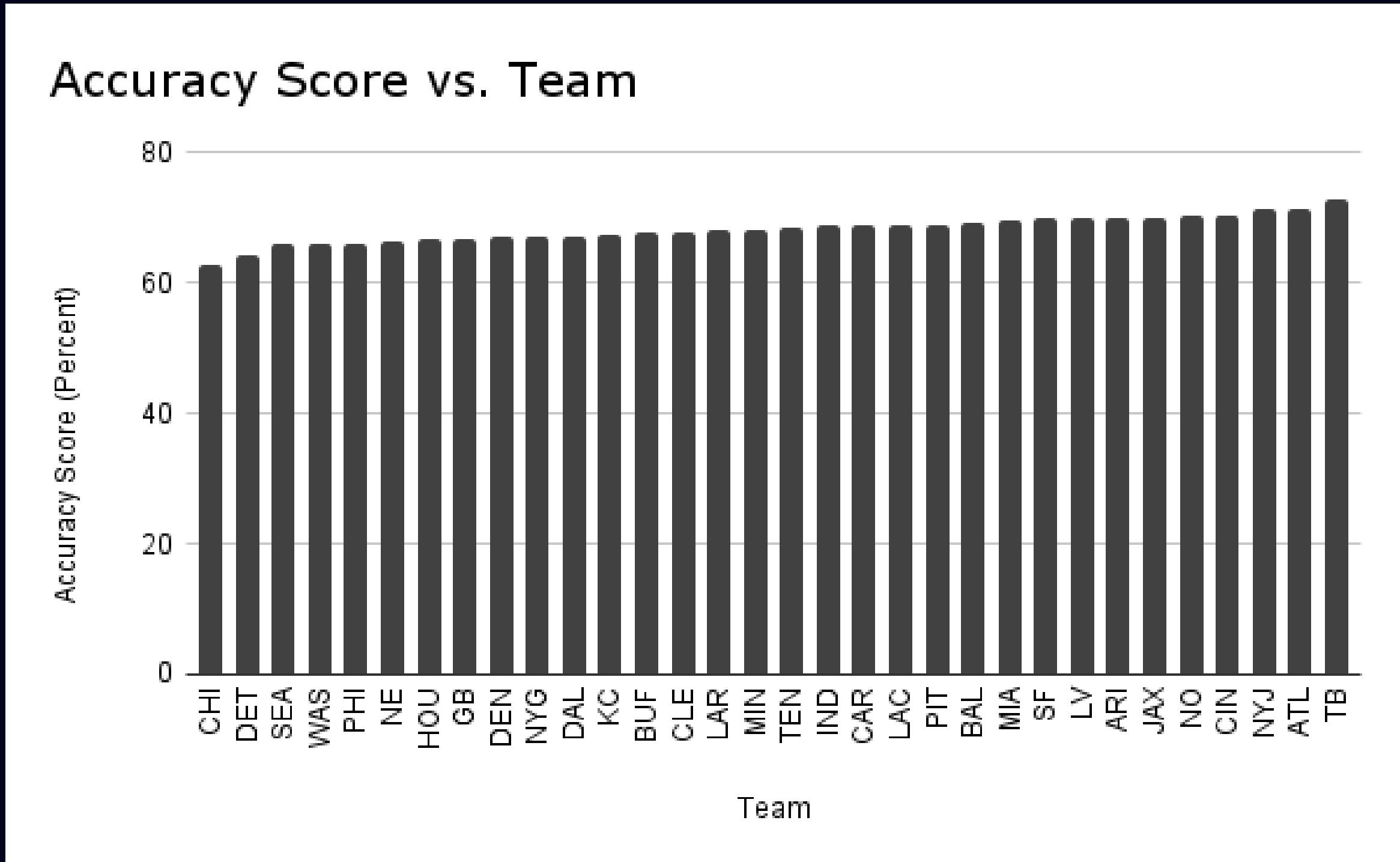
- Punts, Field Goals, and QB Kneels are called very consistently based on simple situational factors
- Passes and Runs are more dynamic play calls that depend less on simple situational factors
- QB Spikes are in fact not called based on our conventional wisdom of situational factors



Are There Unconventional Teams?

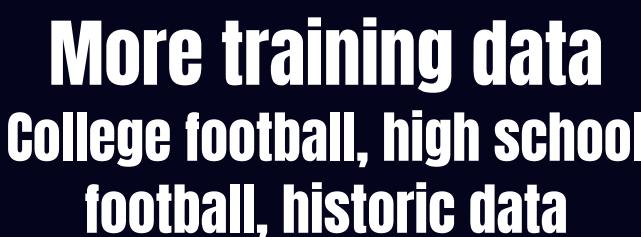
- The Tampa Bay Buccaneers win the award for most predictable play calling at 72.84%

The Chicago Bears win the award for least predictable play calling at 62.77%



Future Research

1



More training data
College football, high school
football, historic data

2



More subtlety in play types
Long and short passes, different
personnel, more niche play calls

3



Serving Options
Share the models on a public
platform

THANK YOU

