

The impact of quarterly scores on NFL outcomes

QUARTER MARKS

HOME

7

DOWN

1

2:34

TO GO

10

VISITOR

3

BALL ON

20

QTR

1

by Chris Martin

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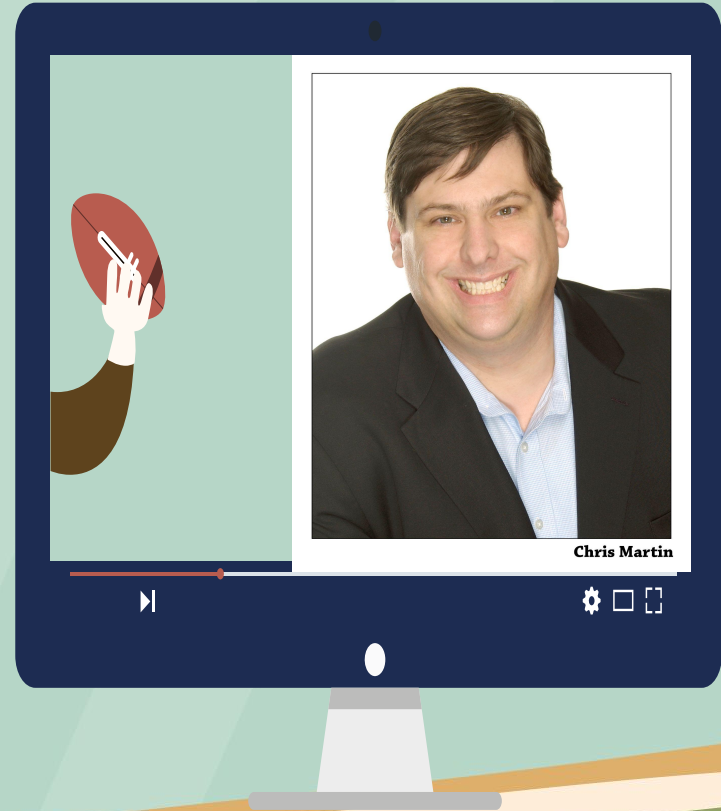
June 14, 2021

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INTRODUCTION

Chris Martin

- Data scientist
- Sports broadcaster
- Sports announcer
- NFL fan



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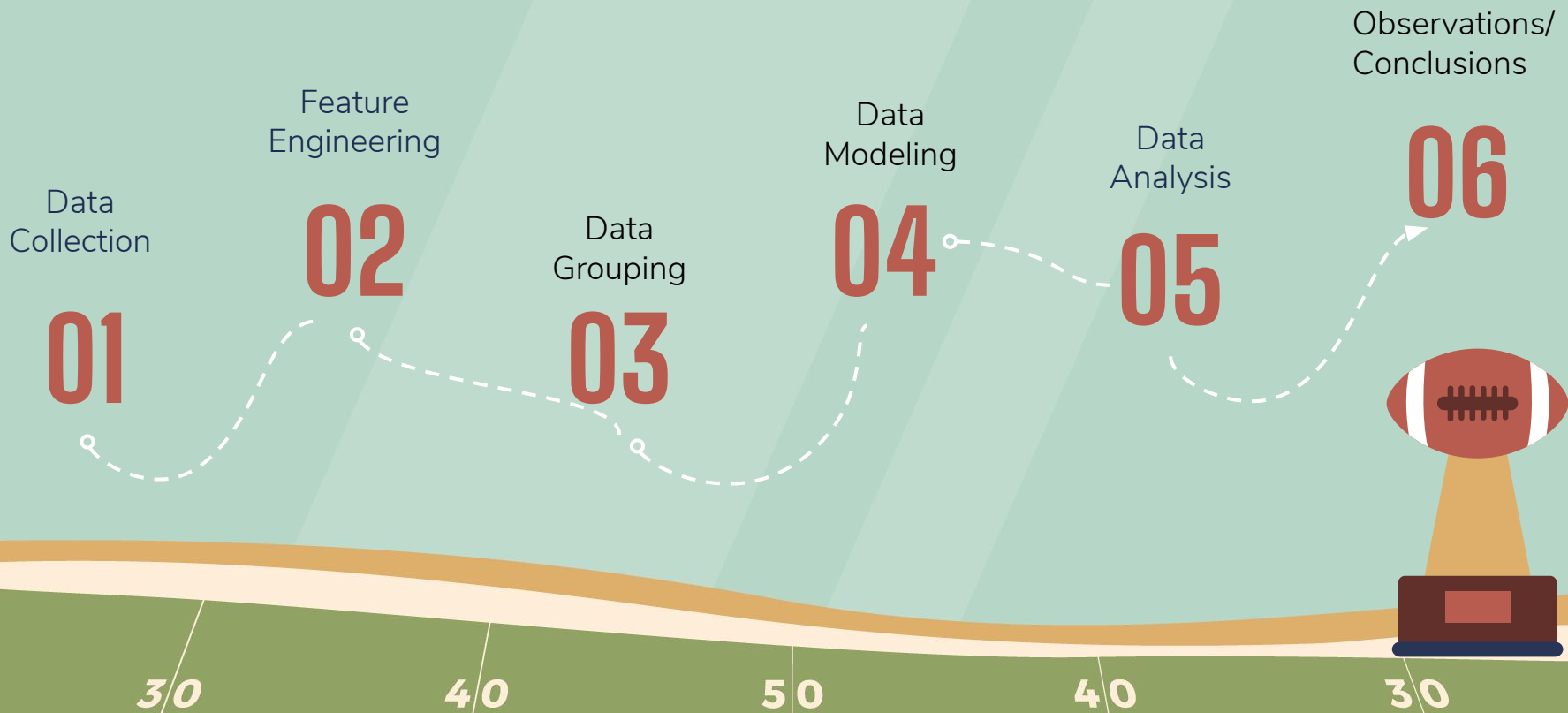
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Problem Statement:

How accurately can we predict outcomes of NFL games by focusing on quarterly outcomes?

PROCESS STEPS



ASSUMPTIONS

1. Focused solely on which NFL team scored more points in a particular quarter - no specific point totals were considered.
2. No overtime periods were studied. A deadlock after four quarters was scored as a tie.
3. Other factors were also examined:
 - Teams involved
 - Year of football season
 - Week of football season

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DATA COLLECTION

- Wrote web scraping program in R
- Focused on 2000 through 2019 seasons
- Obtained data from CBSsportsline.com & Pro-Football-Reference.com
- Stored in master database

| Week | Day | DateStamp | Vteam | VQ1 | VQ2 | VQ3 | VQ4 | Year | Hteam | HQ1 | HQ2 | HQ3 | HQ4 |
|------|-----|-----------|-----------|-----|-----|-----|-----|------|----------|-----|-----|-----|-----|
| 1 | Sun | 9/3/2000 | Bears | 7 | 6 | 7 | 7 | 2000 | Vikings | 6 | 3 | 7 | 14 |
| 1 | Sun | 9/3/2000 | Colts | 0 | 7 | 7 | 13 | 2000 | Chiefs | 0 | 7 | 7 | 0 |
| 1 | Sun | 9/3/2000 | Panthers | 10 | 0 | 0 | 7 | 2000 | Redskins | 7 | 0 | 3 | 10 |
| 1 | Sun | 9/3/2000 | 49ers | 7 | 7 | 7 | 7 | 2000 | Falcons | 6 | 16 | 14 | 0 |
| 1 | Sun | 9/3/2000 | Ravens | 10 | 3 | 3 | 0 | 2000 | Steelers | 0 | 0 | 0 | 0 |
| 1 | Sun | 9/3/2000 | Jaguars | 0 | 10 | 10 | 7 | 2000 | Browns | 0 | 7 | 0 | 0 |
| 1 | Sun | 9/3/2000 | Buccaneer | 0 | 14 | 7 | 0 | 2000 | Patriots | 3 | 7 | 0 | 6 |
| 1 | Sun | 9/3/2000 | Lions | 0 | 6 | 8 | 0 | 2000 | Saints | 7 | 0 | 0 | 3 |
| 1 | Sun | 9/3/2000 | Cardinals | 0 | 0 | 3 | 13 | 2000 | Giants | 7 | 7 | 0 | 7 |
| 1 | Sun | 9/3/2000 | Eagles | 14 | 10 | 3 | 14 | 2000 | Cowboys | 0 | 6 | 0 | 8 |
| 1 | Sun | 9/3/2000 | Chargers | 0 | 0 | 0 | 6 | 2000 | Raiders | 0 | 0 | 2 | 7 |
| 1 | Sun | 9/3/2000 | Seahawks | 0 | 0 | 0 | 0 | 2000 | Dolphins | 10 | 13 | 0 | 0 |
| 1 | Sun | 9/3/2000 | Jets | 7 | 3 | 0 | 10 | 2000 | Packers | 7 | 3 | 3 | 3 |
| 1 | Sun | 9/3/2000 | Titans | 0 | 6 | 0 | 7 | 2000 | Bills | 0 | 7 | 3 | 6 |
| 1 | Mon | 9/4/2000 | Broncos | 7 | 10 | 10 | 9 | 2000 | Rams | 7 | 14 | 14 | 6 |
| 2 | Sun | 9/10/2000 | Dolphins | 0 | 0 | 0 | 7 | 2000 | Vikings | 3 | 0 | 0 | 10 |
| 2 | Sun | 9/10/2000 | Browns | 7 | 7 | 3 | 7 | 2000 | Bengals | 0 | 7 | 0 | 0 |

NFL Week 1 Scores

| | | |
|----------|-------------|--------|
| Pre Wk 4 | Week 1 | Week 2 |
| Week 1 | 2018 Season | |

| | |
|-----------|--------------|
| FINAL | 1 2 3 4 T |
| Jets 1-0 | 7 10 31 0 48 |
| Lions 0-1 | 7 3 7 0 17 |

| | |
|---|---|
| JETS | LIONS |
| PASS S. Darnold 198 YDS, 2 TDS, 1 INT | PASS M. Stafford 286 YDS, 1 TD, 4 INTS |
| RUSH I. Crowell 10 ATT, 102 YDS, 2 TDS | RUSH T. Riddick 4 ATT, 20 YDS |
| REC Q. Enunwa 6 REC, 63 YDS, 1 TD | REC K. Golladay 7 REC, 114 YDS |

| | |
|-----------|-------|
| BOX SCORE | RECAP |
|-----------|-------|

| | |
|-------------|-------------|
| FINAL | 1 2 3 4 T |
| Bengals 1-0 | 3 7 7 17 34 |
| Colts 0-1 | 3 13 7 0 23 |

| | |
|---|---------------------------------------|
| BENGALS | COLTS |
| PASS A. Dalton 243 YDS, 2 TDS, 1 INT | PASS A. Luck 219 YDS, 2 TDS, 1 INT |
| RUSH J. Mixon 17 ATT, 95 YDS, 1 TD | RUSH J. Wilkins 14 ATT, 40 YDS |
| REC A. Green 6 REC, 92 YDS, 1 TD | REC J. Doyle 7 REC, 60 YDS |

| | |
|-----------|-------|
| BOX SCORE | RECAP |
|-----------|-------|

| | |
|-------------|--------------|
| FINAL | 1 2 3 4 T |
| Rams 1-0 | 7 3 10 13 33 |
| Raiders 0-1 | 7 6 0 0 13 |

| | |
|-----------------------------------|---------------------------------------|
| RAMS | RAIDERS |
| PASS J. Goff 233 YDS, 2 TDS | PASS D. Carr 303 YDS, 3 INTS |
| RUSH T. Gurley 20 ATT, 108 YDS | RUSH M. Lynch 11 ATT, 41 YDS, 1 TD |
| REC B. Cooks 5 REC, 87 YDS | REC J. Cook 9 REC, 180 YDS |

| | |
|-----------|-------|
| BOX SCORE | RECAP |
|-----------|-------|

| | |
|--------------|-------------|
| FINAL | 1 2 3 4 T |
| Texans 0-1 | 3 3 7 7 20 |
| Patriots 1-0 | 7 14 3 3 27 |

| | |
|--|---|
| TEXANS | PATRIOTS |
| PASS D. Watson 176 YDS, 1 TD, 1 INT | PASS T. Brady 277 YDS, 3 TDS, 1 INT |
| RUSH L. Miller 20 ATT, 98 YDS | R. Burkhead 18 ATT, 64 YDS |
| REC D. Hopkins 8 REC, 78 YDS | REC R. Gronkowski 7 REC, 123 YDS, 1 TD |

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| BOX SCORE | RECAP |
|-----------|-------|

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FEATURE ENGINEERING

Added winner columns



| | |
|-----|--------------------------------|
| HHH | Home team wins by 15+ pts |
| HH | Home team wins by 8-14 pts |
| H | Home team wins by 1-7 pts |
| T | Tie |
| V | Visiting team wins by 1-7 pts |
| VV | Visiting team wins by 8-14 pts |
| VVV | Visiting team wins by 15+ pts |

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DATA GROUPING

BOX SCORE

| | Q1 | Q2 | Q3 | Q4 |
|---------|----|----|----|----|
| Visitor | | | | |
| Home | | | | |

GAME QUARTERS

QUARTER CLUMPS

| | |
|-------------|----------|
| Q1 | Q2 |
| Q3 | Q4 |
| Q1/Q2 | Q2/Q3 |
| Q3/Q4 | Q1/Q4 |
| Q1/Q3 | Q2/Q3 |
| Q1/Q2/Q3 | Q1/Q2/Q4 |
| Q1/Q3/Q4 | Q2/Q3/Q4 |
| Q1/Q2/Q3/Q4 | |

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MODELING!



FEATURE GROUPS



Quarter
clumps



Weeks



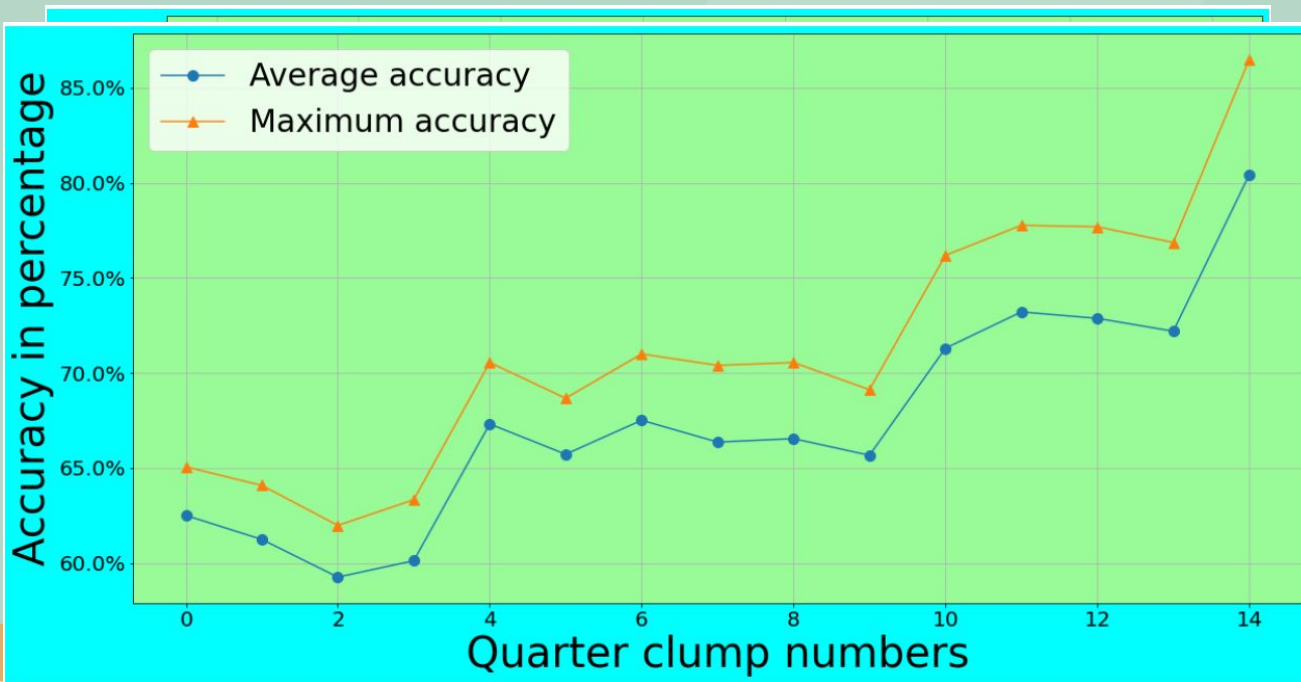
Years



Teams

BASIC ACCURACY

CLUMPS



| | | | |
|-------------|----|----------|----|
| Q1 | 0 | Q2 | 1 |
| Q3 | 2 | Q4 | 3 |
| Q1/Q2 | 4 | Q2/Q3 | 5 |
| Q3/Q4 | 6 | Q1/Q4 | 7 |
| Q1/Q3 | 8 | Q2/Q3 | 9 |
| Q1/Q2/Q3 | 10 | Q1/Q2/Q4 | 11 |
| Q1/Q3/Q4 | 12 | Q2/Q3/Q4 | 13 |
| Q1/Q2/Q3/Q4 | | 14 | |

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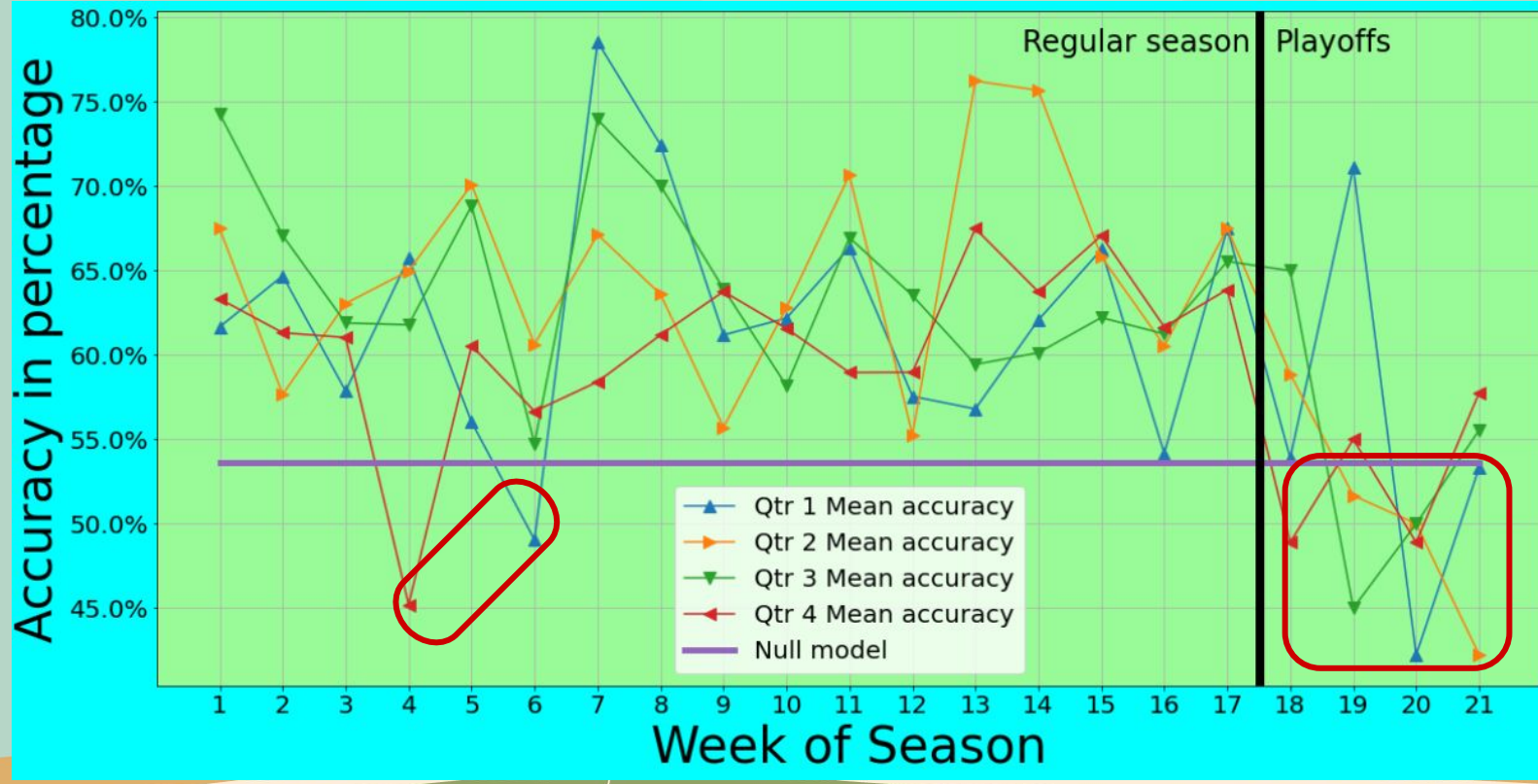
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WEEKLY INSIGHTS



Individual quarterly mean accuracy scores below the null model:

Regular season: 2 (2.9%)

Playoffs: 9 (56.3%)

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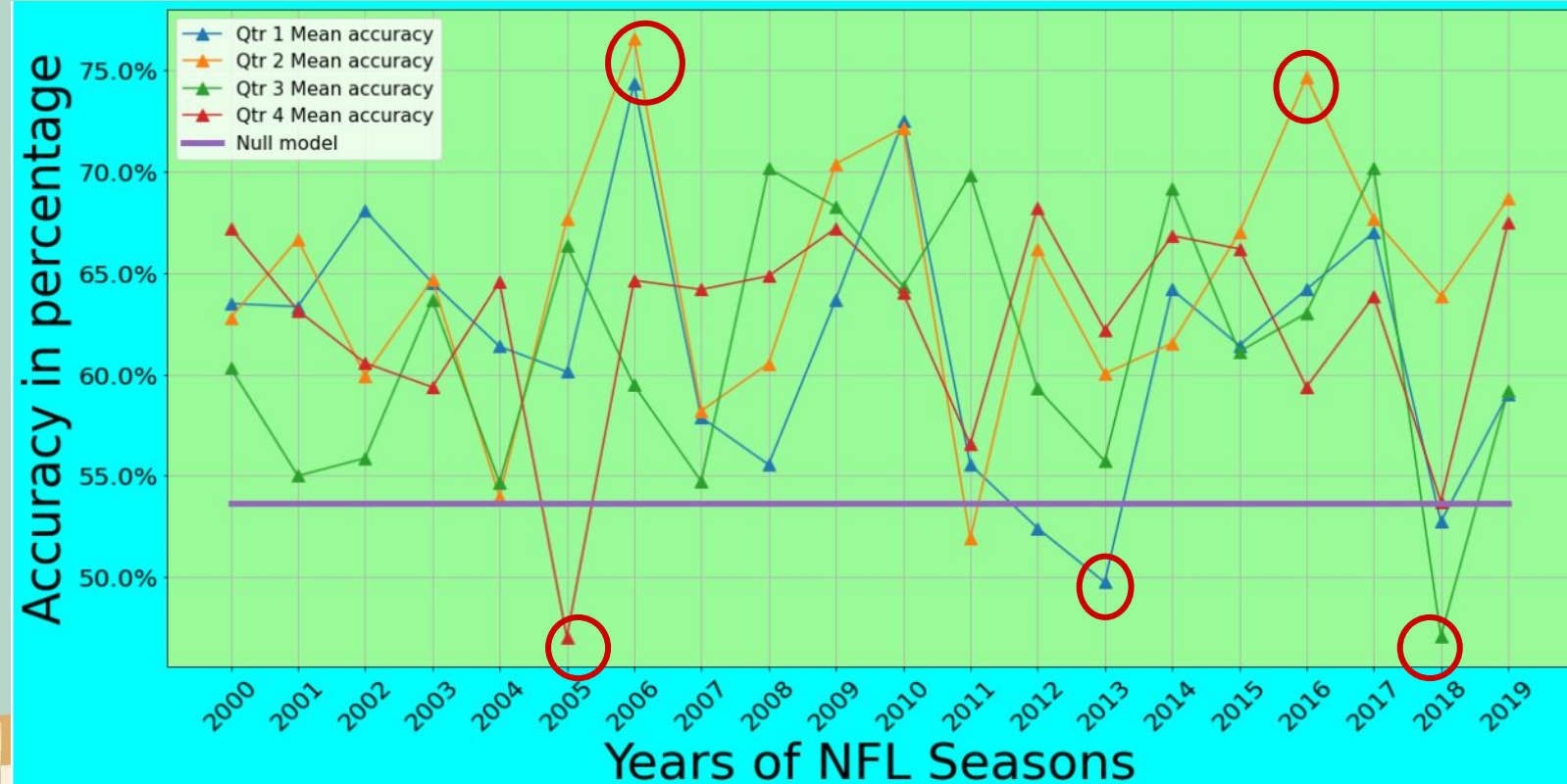
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YEARLY INSIGHTS



Best individual
quarterly mean
accuracy scores:

Q2 2006: 77.5%

Q2 2016: 74.9%

Q1 2006: 74.1%

Worst individual
quarterly mean
accuracy scores:

Q4 2005: 46.1%

Q3 2018: 46.2%

Q1 2013: 49.8%

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TEAMS RESULTS

Team models with highest/lowest overall accuracy scores (by quarter)

QTR
1

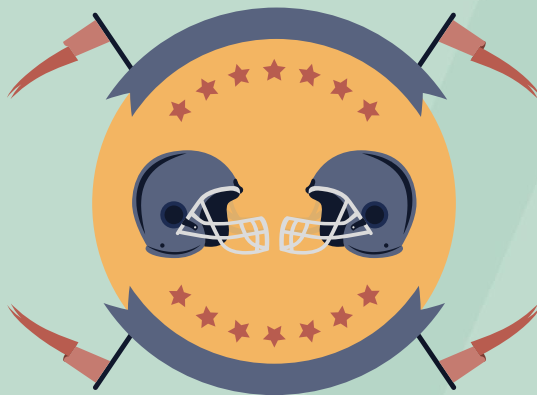
Highest:
Browns 80.49%_v

Lowest:
Seahawks 55.81%_h

QTR
2

Highest:
Saints 83.72%_h

Lowest:
Titans 53.49%_v



QTR
3

Highest:
Browns 80.49%_v

Lowest:
Chiefs 51.22%_v

QTR
4

Highest:
Ravens 78.57%_h

Lowest:
Eagles 54.55%_h

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TEAMS RESULTS

Team models with highest/lowest overall accuracy scores...

First Half

Highest:

Eagles 84.09%^h

Lowest:

Titans 62.79%^v

Second Half

Highest:

Texans 81.08%^v

Lowest:

Cardinals 63.41%^v



Among all clumps

Highest:

Jaguars 92.68%^h

Lowest:

Chiefs 74.42%^h

Average of all quarter combinations

Highest:

Lions 81.21%

Lowest:

Titans 66.99%

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Scoreboard

HOME

7

DOWN

1

2:34

TO GO

10

BALL ON

20

VISITOR

3

QTR

4

STREAMLIT APP

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CONCLUSIONS

1. More difficult than expected to predict outcomes of NFL games.
2. Models don't account for real-world factors and variables
3. Model results may change with lengthened 2021 schedule

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FUTURE RECOMMENDATIONS

More variables

Time, date,
opponent

Different feature combinations

Years, weeks,
conditional
probabilities

Change scoring levels

Make smaller/larger
spreads of points

Use score differences

Utilize numbers
instead of levels

Tune model hyperparameters

Tweak individual
models to enhance
performance

Predict quarterly scores

Try to predict whole box
score, not just final score

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SPECIAL THANKS to General Assembly

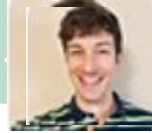
Jeff Hale

Lead Instructor



Eric Bayless

Instructional
Assistant



Jacob Koehler

Independent
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QUESTIONS?



Do you have any questions?

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END PRESENTATION

