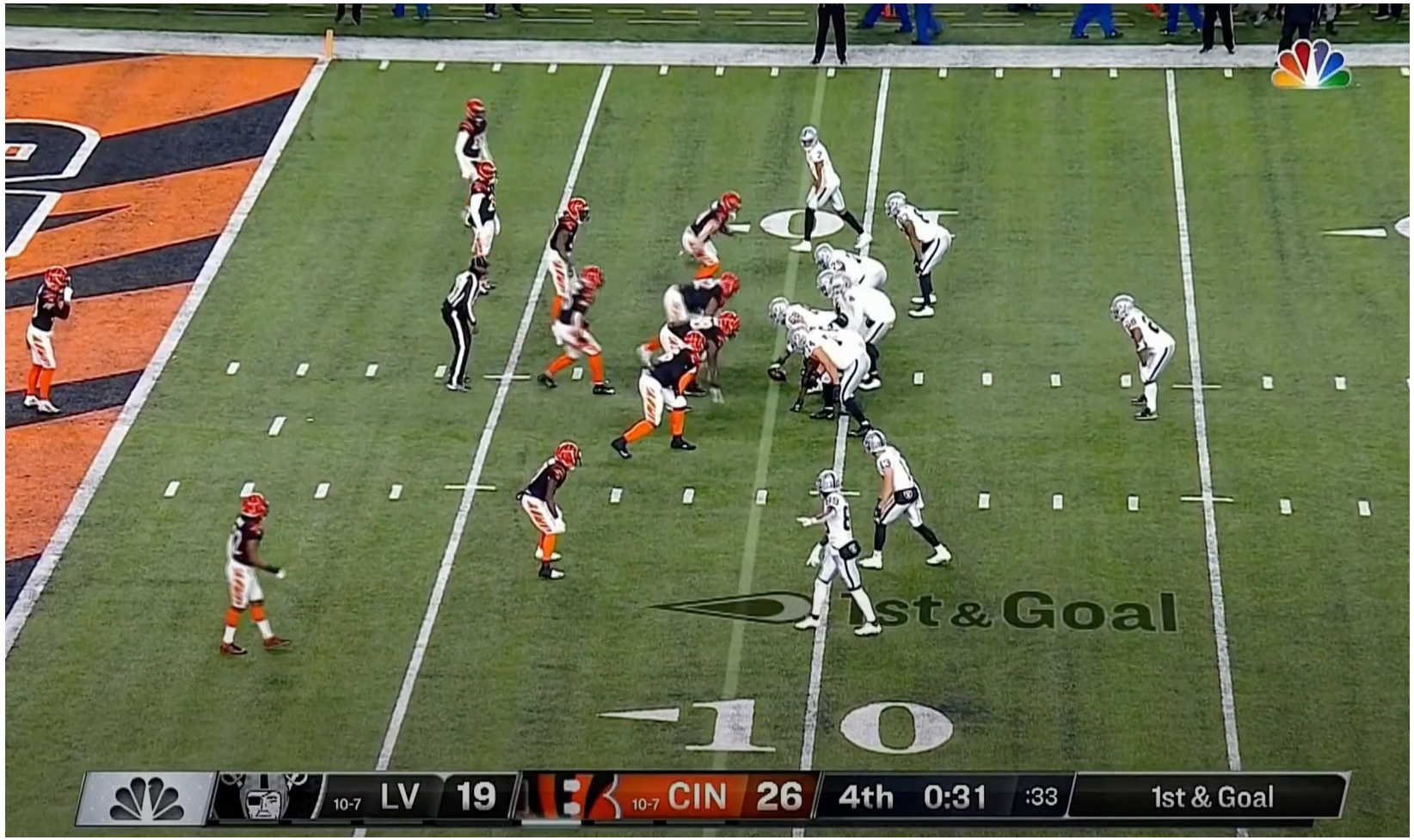
Syracuse University

Why Quarterback Spikes Need to Change

Jarrett Markman


1st & Goal
10-7 LV 19
10-7 CIN 26
4th 0:31
:33
1st & Goal

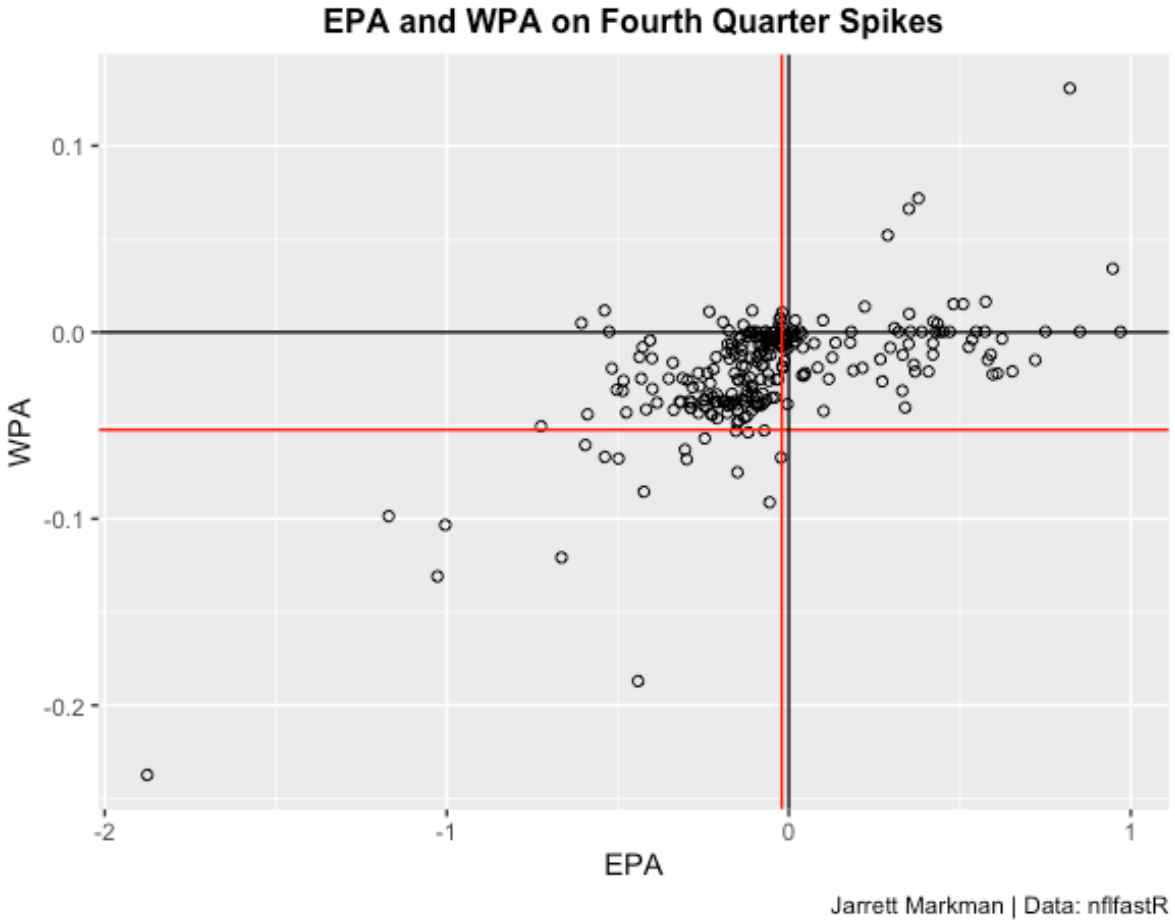
Steps 1 & 2: How to we get the data?

- Load the libraries
- Create a data frame for fourth quarter spikes in a one-possession game from the last 10 years.

```
library(tidyverse)
library(ggrepel)
library(ggimage)
library(gt)
library(caret)
library(nflfastR)
options(scipen = 9999)
```

```
fourth_quarter_spikes <- load_pbp(2012:2021) %>%
  filter(qb_spike == 1) %>%
  filter(qtr == 4) %>%
  filter(score_differential >=-8)
```

Step 3: Look at every fourth quarter spike in the last 10 years.



Step 4: What kind of variables are important for fourth quarter spikes?

- Score Differential (>3 points versus ≤ 3 points)
  - Touchdown Probability
  - Field-Goal Probability
- Time

Step 5: What do spikes look like in end-game scenarios?

- In field goal score games, there were 83 instances of spikes with a negative EPA, just below 60%.
- In touchdown score games, there were 105 instances of spikes with a negative EPA, just below 90%.

Step 6: Is there a way to create a multivariable regression to predict the EPA of a spike?

- To do this we must:
  - Create 2 data frames for fourth quarter spikes in field-goal and touchdown score games.
  - Use the “lm” command in R to create a linear model for a select number of variables dedicated to predict the EPA.

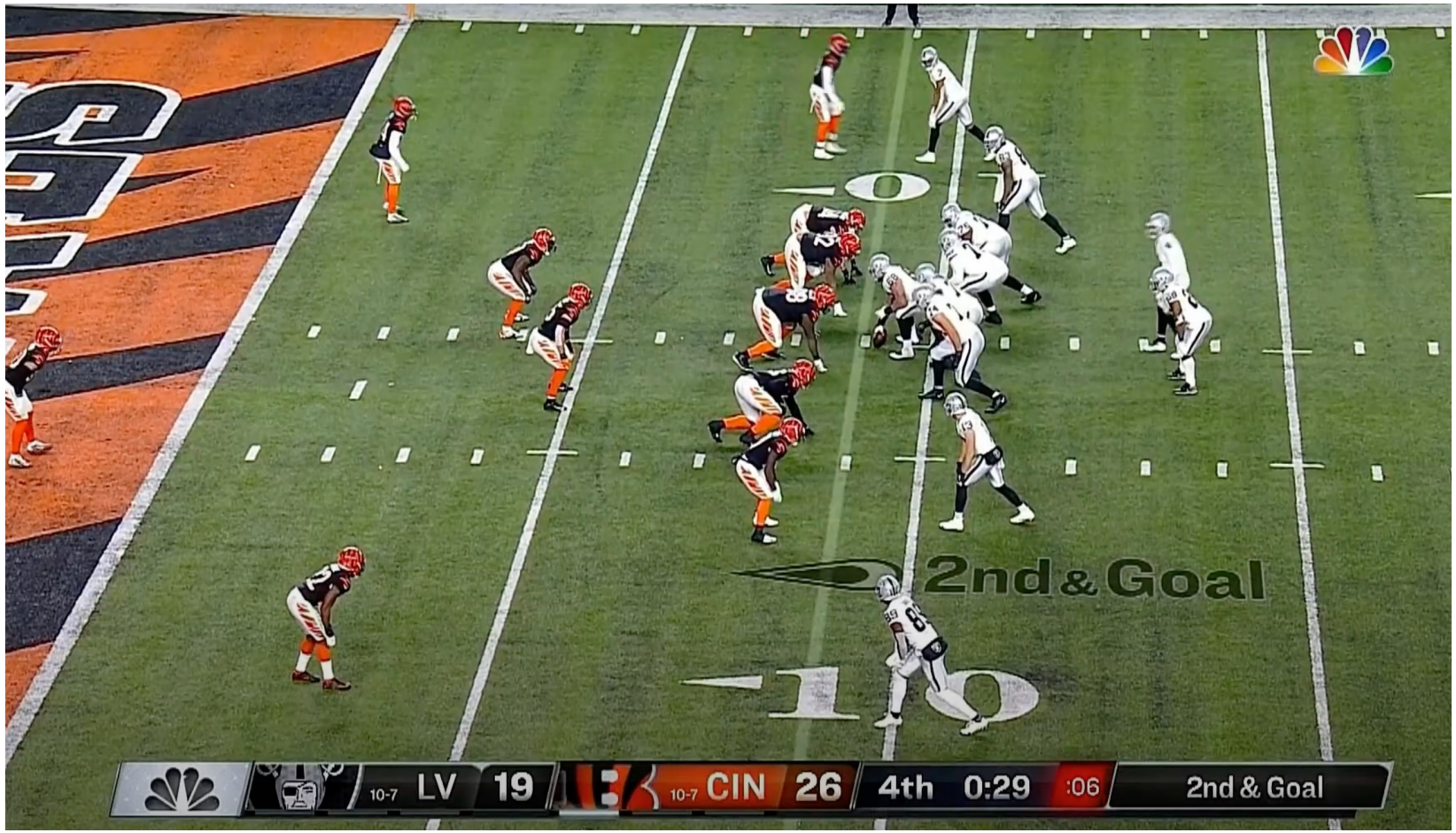
Results

```
##
## Call:
## lm(formula = epa ~ ., data = fg_model)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.72795 -0.10869 -0.02808  0.11767  0.83195
##
## Coefficients:
##                             Estimate Std. Error t value      Pr(>|t|)
## (Intercept)                -0.188510   0.124201  -1.518      0.131461
## game_seconds_remaining     -0.009314   0.001472  -6.326 0.00000000361 ***
## down                       -0.103985   0.037736  -2.756      0.006687 **
## yardline_100                0.006633   0.001685   3.935      0.000134 ***
## posteam_timeouts_remaining -0.273009   0.054400  -5.019 0.00000165020 ***
## score_differential          0.012075   0.017744   0.681      0.497379
## fg_prob                     1.020982   0.167045   6.112 0.00000001036 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2352 on 132 degrees of freedom
## Multiple R-squared:  0.5303, Adjusted R-squared:  0.5089
## F-statistic: 24.84 on 6 and 132 DF,  p-value: < 0.00000000000000022
```

```
##
## Call:
## lm(formula = epa ~ ., data = td_model)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.80719 -0.05991  0.01162  0.07509  1.28515
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                -0.073993   0.147102  -0.503   0.6159
## game_seconds_remaining     -0.001639   0.001963  -0.835   0.4055
## down                       -0.068575   0.055206  -1.242   0.2168
## yardline_100                0.001468   0.001978   0.742   0.4596
## posteam_timeouts_remaining  0.042754   0.119485   0.358   0.7212
## score_differential         -0.007623   0.019941  -0.382   0.7030
## td_prob                    -0.462032   0.251410  -1.838   0.0687
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2835 on 112 degrees of freedom
## Multiple R-squared:  0.1419, Adjusted R-squared:  0.09592
## F-statistic: 3.087 on 6 and 112 DF,  p-value: 0.007799
```

Testing the model:

- Let's say a team has the ball on 1st down with 30 seconds to go on the opponents 8-yard line, down 1. What's the predictive EPA? Field-Goal probability is estimated at 70%.
  - 0.2078993
- What if they were down 5 points instead of 1, touchdown probability is estimated at 50%.
  - -0.4491277


2nd & Goal
10-7 LV 19
10-7 CIN 26
4th 0:29
:06
2nd & Goal

Thank you!

Questions?