Package ‘nfl4th’

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Title Functions to Calculate Optimal Fourth Down Decisions in the National Football League

Version 1.0.0

Description A set of functions to estimate outcomes of fourth down plays in the National Football League and obtain fourth down plays from <https://www.nfl.com/> and <https://www.espn.com/>.

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BugReports https://github.com/guga31bb/nfl4th/issues

Depends R (>= 2.10)

Imports dplyr, glue, httr, janitor, jsonlite, magrittr, mgcv, nflfastR, purrr, stringr, tibble, tidyr, tidyselect, xgboost

Suggests future, gt, rmarkdown, tictoc, tidyverse, testthat (>= 2.0.0)

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add_2pt_probs

Get 2pt decision probabilities

Description
Get various probabilities associated with each option on PATs (go for it, kick PAT).

Usage
add_2pt_probs(df)

Arguments
df A data frame of decisions to be computed for.

Value
Original data frame Data frame plus the following columns added:

- `first_down_prob`, `wp_fail`, `wp_succeed`, `go_wp`, `fg_make_prob`, `miss_fg_wp`, `make_fg_wp`, `fg_wp`, `punt_wp`
- `wp_0` Win probability when scoring 0 points on PAT.
- `wp_1` Win probability when scoring 1 point on PAT.
- `wp_2` Win probability when scoring 2 points on PAT.
- `conv_1pt` Probability of making PAT kick.
- `conv_2pt` Probability of converting 2-pt attempt.
- `wp_go1` Win probability associated with going for 1.
- `wp_go2` Win probability associated with going for 2.

Examples
```r
play <-
tibble::tibble(
  # things to help find the right game (use "reg" or "post")
  home_team = "GB",
  away_team = "TB",
  posteam = "GB",
  type = "post",
  season = 2020,

  # information about the situation
  qtr = 4,
```
add_4th_probs

```r
quarter_seconds_remaining = 123,
score_differential = -2,
home_opening_kickoff = 0,
posteam_timeouts_remaining = 3,
defteam_timeouts_remaining = 3
)

probs <- nfl4th::add_2pt_probs(play)
dplyr::glimpse(probs)
```

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### Description

Get 4th down decision probabilities

### Usage

```r
add_4th_probs(df)
```

### Arguments

- `df` A data frame of decisions to be computed for.

### Value

Original data frame Data frame plus the following columns added:

- **go_boost** Gain (or loss) in win prob associated with choosing to go for it (percentage points).
- **first_down_prob** Probability of earning a first down if going for it on 4th down.
- **wp_fail** Win probability in the event of a failed 4th down attempt.
- **wp_succeed** Win probability in the event of a successful 4th down attempt.
- **go_wp** Average win probability when going for it on 4th down.
- **fg_make_prob** Probability of making field goal.
- **miss_fg_wp** Win probability in the event of a missed field goal.
- **make_fg_wp** Win probability in the event of a made field goal.
- **fg_wp** Average win probability when attempting field goal.
- **punt_wp** Average win probability when punting.
**get_4th_plays**

Get 4th down plays from a game.

**Usage**

`get_4th_plays(gid)`

**Arguments**

gid A game to get 4th down decisions of.

**Details**

Obtains a data frame that can be used with `add_4th_probs()`. The following columns must be present:

- game_id: game ID in `nflfastR` format (eg '2020_20_TB_GB')

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**Examples**

```r
play <-
tibble::tibble(
  # things to help find the right game (use "reg" or "post")
  home_team = "GB",
  away_team = "TB",
  posteam = "GB",
  type = "post",
  season = 2020,

  # information about the situation
  qtr = 4,
  quarter_seconds_remaining = 129,
  ydstogo = 8,
  yardline_100 = 8,
  score_differential = -8,

  home_opening_kickoff = 0,
  posteam_timeouts_remaining = 3,
  defteam_timeouts_remaining = 3
)

probs <- nfl4th::add_4th_probs(play)

dplyr::glimpse(probs)
```
Value

Original data frame Data frame plus the following columns added:

- desc  Play description from ESPN.
- type_text  Play type text from ESPN.
- index  Index number of play from a given game. Useful for tracking plays (e.g. for 4th down bot).
- The rest  All the columns needed for add_4th_probs().

Examples

```r
plays <- nfl4th::get_4th_plays('2020_20_TB_GB')
dplyr::glimpse(plays)
```

Description

Load calculated 4th down probabilities from nflfastR data.

Usage

```r
load_4th_pbp(seasons)
```

Arguments

- seasons  Seasons to load. Must be 2014 and later.

Value

nflfastR data on 4th downs with the add_4th_probs() columns added and also the following:

- go  100 if a team went for it on 4th down, 0 otherwise. It’s 100 and 0 as a convenience for obtaining percent of times going for it.

Examples

```r
probs <- load_4th_pbp(2019:2020)
dplyr::glimpse(probs)
```
make_2pt_table_data  Get 2pt decision probabilities

Description
Get a table with the probabilities associated with a 2-pt decision.

Usage
make_2pt_table_data(probs)

Arguments
probs  A data frame consisting of one play that has had add_2pt_probs() already run on it.

Value
A table showing the probabilities associated with each possible choice.

Examples
play <-
tibble::tibble(
  # things to help find the right game (use "reg" or "post")
  home_team = "GB",
  away_team = "TB",
  posteam = "GB",
  type = "post",
  season = 2020,
  
  # information about the situation
  qtr = 4,
  quarter_seconds_remaining = 123,
  score_differential = -2,
  home_opening_kickoff = 0,
  posteam_timeouts_remaining = 3,
  defteam_timeouts_remaining = 3
)

probs <- nfl4th::add_2pt_probs(play)
nfl4th::make_2pt_table_data(probs)
Description

Get a table with the probabilities on 4th down.

Usage

make_table_data(probs)

Arguments

probs A data frame consisting of one play that has had add_4th_probs() already run on it.

Value

A table showing the probabilities associated with each possible choice.

Examples

```r
play <-
tibble::tibble(
    # things to help find the right game (use "reg" or "post")
    home_team = "GB",
    away_team = "TB",
    posteam = "GB",
    type = "post",
    season = 2020,

    # information about the situation
    qtr = 4,
    quarter_seconds_remaining = 129,
    ydstogo = 8,
    yardline_100 = 8,
    score_differential = -8,

    home_opening_kickoff = 0,
    posteam_timeouts_remaining = 3,
    defteam_timeouts_remaining = 3
)

probs <- nfl4th::add_4th_probs(play)
nfl4th::make_table_data(probs)
```
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