



# ***Predicting Tommy John Surgery***

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# ***Business Understanding***

**Collect data on MLB pitchers to anticipate risk for TJ surgery before signing, & mitigate practices that may result in needing surgery.**





## ***Intro: Who is Tommy John?***

**First player to receive surgery on UCL (1974)**

**Replace with tendon from persons forearm/  
hamstrings**

- **Before this, considered career ending injury (dead arm)**
- **Had a successful career (retired 1989)**







# Protect Your Investment

Signed record deal - 10 Year, \$700 Million

## Potential Fees:

- Luxury tax
- (International signing fees)
- Insurance
- Ticket sales, merch, etc.

First TJ Surgery - 2018

September 2023

- Shutdown for injury
- MRI - torn UCL
- Underwent 2nd TJ Surgery



## Shohei Ohtani injury update: Angels superstar shut down for season, likely getting elbow surgery soon

Ohtani's on-field Angels career could be finished, but he will be around the team for the rest of the season



By [Mike Axisa](#) Sep 18, 2023 at 5:13 pm ET • 2 min read





# *Data*

General pitching statistics (1972-2023) from [baseball-reference.com](http://baseball-reference.com)

Running Google doc of baseball players who received TJ surgery

- Advanced pitching metrics gathered from [pybaseball](#)
- Collected, cleaned, and merged to create a dataset



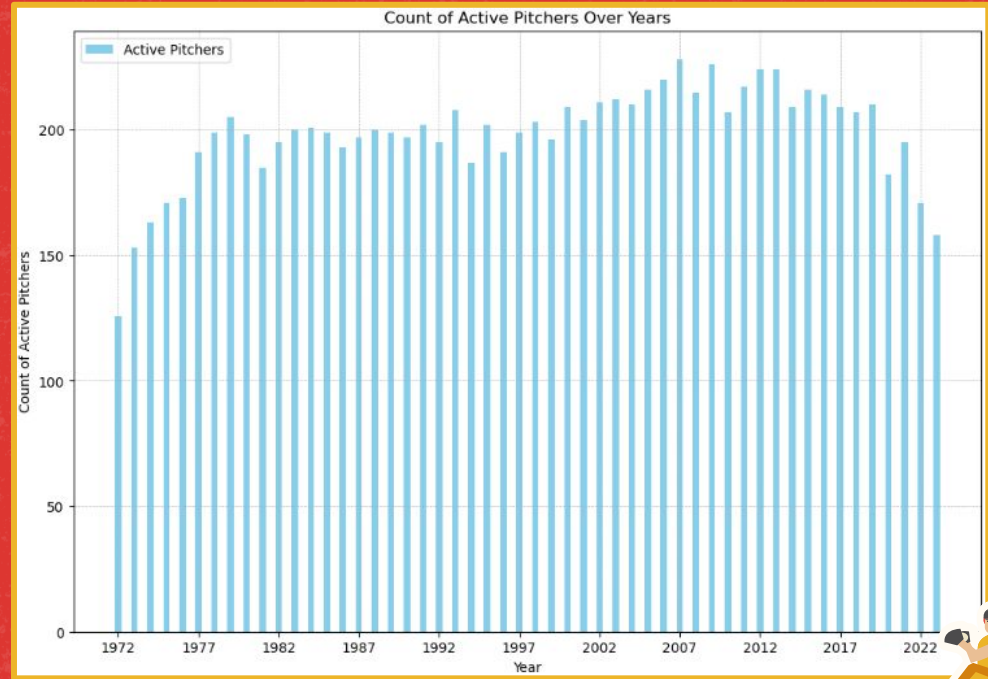
# Historic Data

1972 - 2023

Starting Pitchers only

Minimum 320 career innings thrown

- Early 2000's
- Dramatic rise in number of pitchers



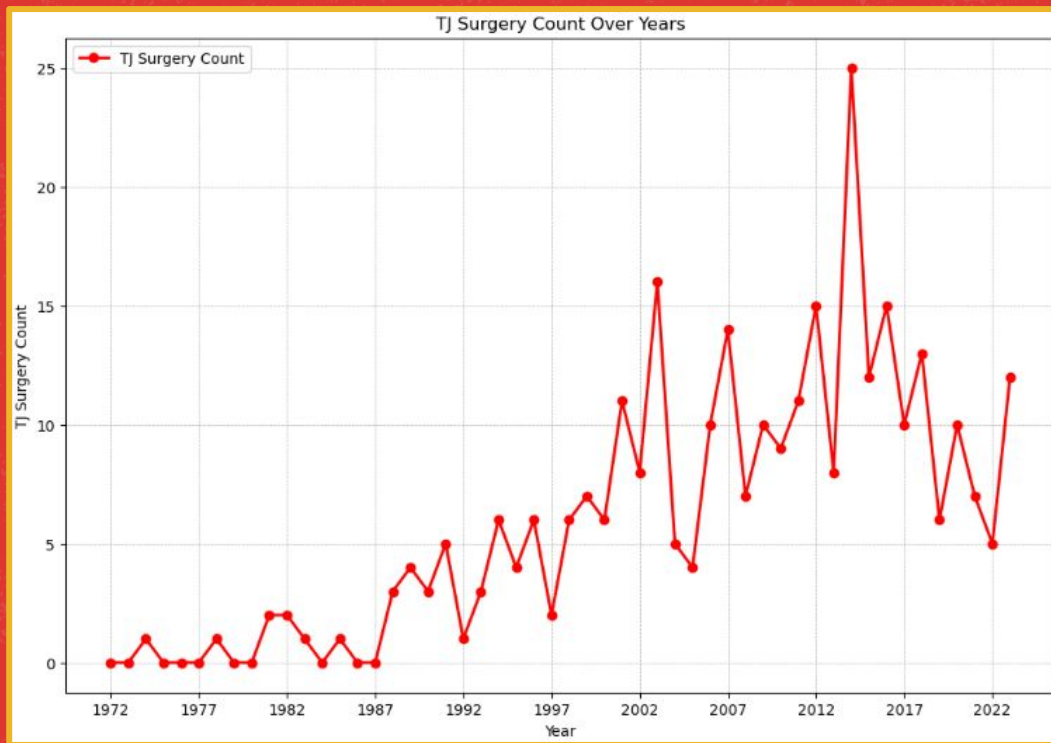


# Historic Data cont.

## TJ Surgery Count

### Dramatic spikes:

- 2003
  - 'Steroid Era'
- 2014
  - Increase in younger generation play, higher velocity



# *Advanced Pitching Metrics*

## Seasonal data - limited

- 2008-2023
- Starting Pitchers, min. 320 innings (career)

## Features - 129

## Target - 'Surgery'

- Binary (1.0 - yes, 0.0 - no)
- Count imbalanced
  - 1.0 - 916
  - 0.0 - 2772

## ★ Grouped features for each pitcher by season

- Age, season, Throws (L/R)
- Total number thrown for each pitch type
  - fastball, curveball, slider, etc.
  - Avg. speed, velocity, & release position





# ***Pitch Types***

## **Fastball**

- **Fastball (FF)**
- **Sinker (SI)**
- **Cutter (FC)**

## **Breaking ball**

- **Curveball (CU)**
- **Knuckle-curve (KC)**
- **Slow curve (CS)**

## **Other**

- **Eephus (EP)**
- **Absent (AB)**
- **Intentional Walk (IN)**

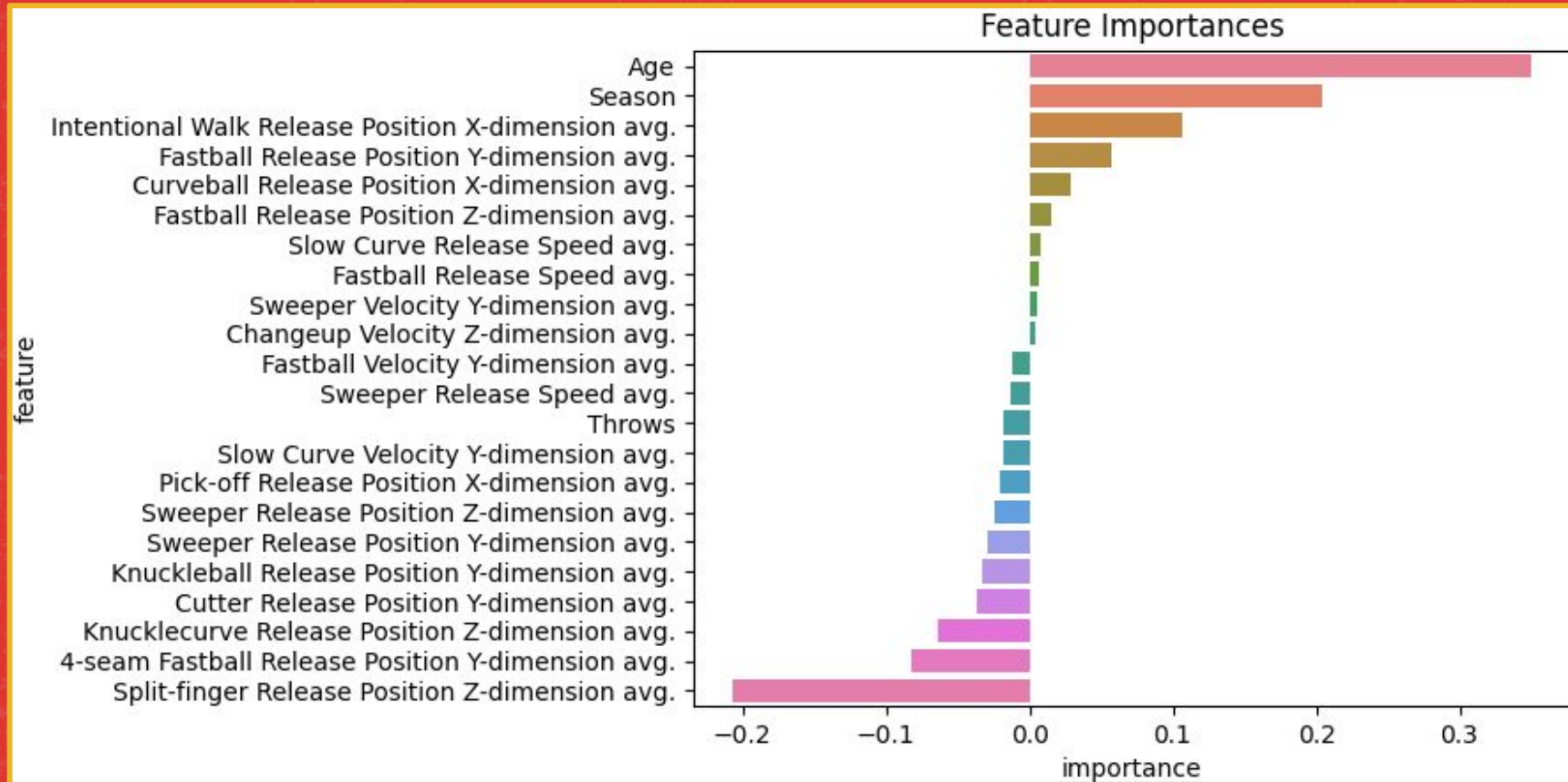
## **Off-speed**

- **Change-up (CH)**
- **Split-finger (FS)**
- **Forkball (FO)**
- **Screwball (SC)**

## **Slider**

- **Slider (SL)**
- **Sweeper (ST)**
- **Slurve (SV)**
- **Knuckle (KN)**

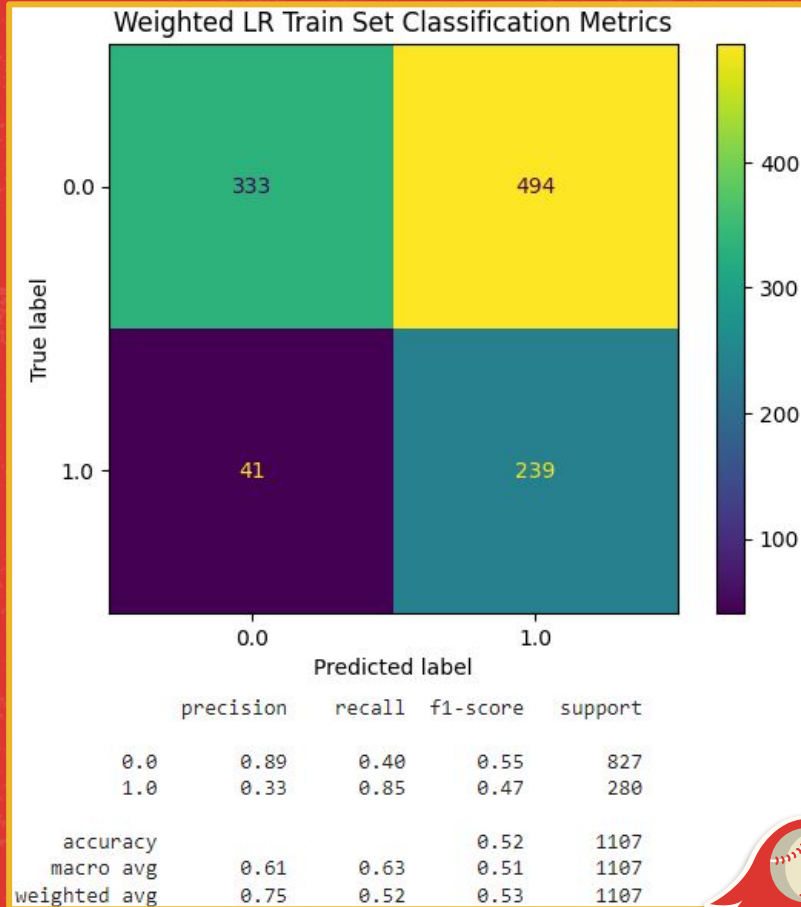




# *Best Model*

Logistic Regression Model

Adjusted class weights





# *Next Steps*

## Collect more data!

- Advanced pitching data prior 2008 (velocity, rotation, etc.)
- Video analysis - pitching mechanics
- Biological data (height, weight, diet, genetics, etc.)
- International leagues, minors, spring training, bullpen, college, etc.
- Other factors
  - Days rest, temperature, humidity, altitude, etc.





***Questions?***

