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SHOULD I STAY OR  
SHOULD I GO:  
MODELING WHO WILL  
RECEIVE A QUALIFYING  
OFFER IN MAJOR  
LEAGUE BASEBALL

# WHAT IS A QUALIFYING OFFER (QO)

<u>Year</u>	<u>QO Amount (Million \$)</u>
2012	13.3
2013	14.1
2014	15.3
2015	15.8
2016	17.2
2017	17.4
2018	17.9

- A Qualifying Offer is a one-year contract offer Major League Baseball teams can make to certain eligible players.
- A Qualifying Offer's worth is determined by averaging the salaries of the top-125 highest-paid MLB players each year.
- If a player accepts a QO, they accept this one-year contract.
- If a player rejects a QO, they become a free-agent.

# WHO QUALIFIES FOR A QUALIFYING OFFER

Player has never received a qualifying offer previously in their career



Player is an eligible free-agent, meaning they have accrued at least six year of MLB Service Time



Player has spent the entire season on the roster of the offering team

Not traded in-season

Not taken off 40-man roster

Not released in-season

# WHAT IS THE PURPOSE OF A QUALIFYING OFFER

To provide compensation for a team that is losing a top player to free-agency

- Draft Picks

To depress a player's value by attaching added costs to any potential acquiring team

- Loss of draft picks
- Loss of \$\$\$ from International Bonus Pool

# WHY IS THIS IMPORTANT

- QO's have been leveraged against players in recent years:
  - Craig Kimbrel
  - Dallas Keuchel
- Players in the non-elite tier who know a QO is coming might want to negotiate an extension beforehand.
- Teams risk overpaying for a player if a QO is accepted.
- Teams that fail to extend a QO to a player could be missing out on compensation for a player that leaves.



# TWO DATASETS

## Timeframe:

MLB player-seasons  
from 2012-2018

Hitters

192  
observations

Pitchers

193  
observations

# SOME VARIABLES/ FEATURES USED

## Hitters

- Age – Official age of player
- Salary – Actual salary
- WAR – Wins Above Replacement (FG) (proxy for production level)
- Dol – \$/WAR (proxy for Market Value)
- PA – Total Plate Appearances
- Off – Offensive run value
- G – Games appeared in

## Pitchers

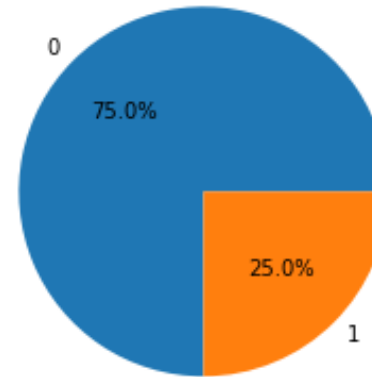
- Age – Official age of player
- Salary – Actual salary
- WAR – Wins Above Replacement (BR) (proxy for production level)
- Dol – \$/WAR (proxy for Market Value)
- TBF – Total Batters Faced
- G – Games appeared in
- GS – Games Started
- SV – Saves



# CLASS IMBALANCE PROBLEM

- Output variable: QO
  - Binary variable
    - 1 = did receive
    - 0 = did not receive

Did hitter receive a Qualifying Offer?



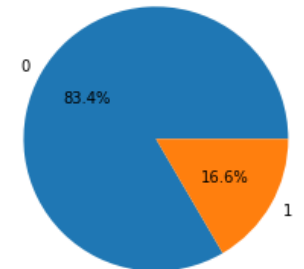
Hitters:

75/25 split class imbalance

Pitchers:

83/17 split class imbalance

Did pitcher receive a Qualifying Offer?





# SCORING METRIC

Presence of class imbalance means that using ROC\_AUC scoring metric is not good enough

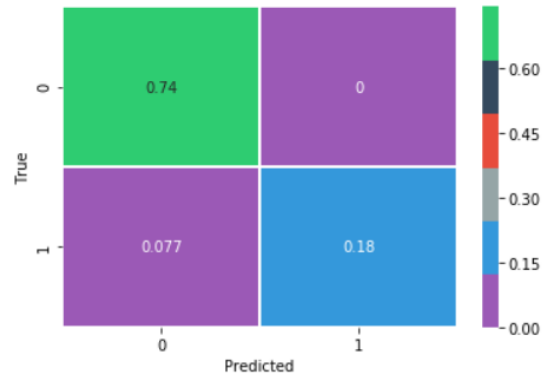


Need to use a metric that considers this

$$\text{F1 score} = 2 * (\text{precision} * \text{recall}) / (\text{precision} + \text{recall})$$

## Feature Importance:

Salary	0.248403
Dol	0.201596
WAR	0.164562
Off	0.135709
PA	0.115279
G	0.082309
Age	0.052141

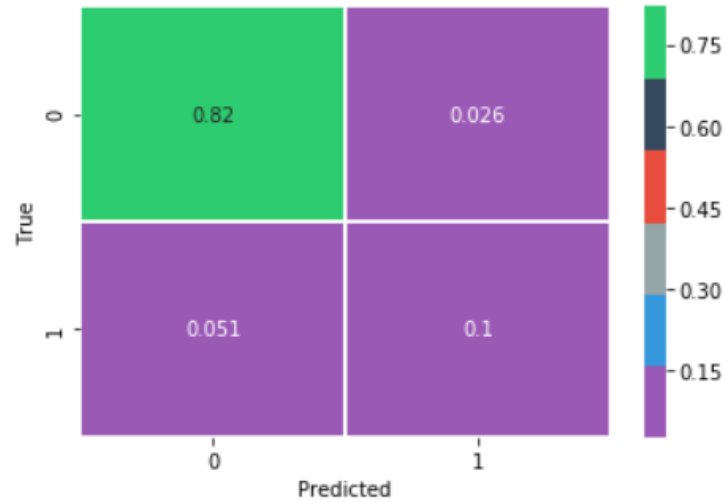


Classification Report:

	precision	recall	f1-score	support
0	0.91	1.00	0.95	29
1	1.00	0.70	0.82	10
accuracy			0.92	39
macro avg	0.95	0.85	0.89	39
weighted avg	0.93	0.92	0.92	39

Our test f1 score is: 0.9182  
Our test roc\_auc score is: 0.9586

# RANDOM FOREST (HITTERS)



Classification Report:

	precision	recall	f1-score	support
0	0.94	0.97	0.96	33
1	0.80	0.67	0.73	6
accuracy			0.92	39
macro avg	0.87	0.82	0.84	39
weighted avg	0.92	0.92	0.92	39

Our test f1 score is: 0.9202  
Our test roc\_auc score is: 0.9394

## LOGISTIC REGRESSION (PITCHERS)

# CONCLUSIONS

- Hitters
  - Best classifier was the Random Forest model
- Pitchers
  - Best classifier was the Logistic Regression model
- More effective at classifying hitters than pitchers
  - Many of the misclassifications were on relief pitchers
  - SP vs. RP distinction
- Can look at more hyperparameters and continue to improve my models
- Could include 2019 data

# DATA SOURCES



Lahman database



MLB Trade Rumors



MLB's published  
transaction logs

(2013 was weird)



Sports Illustrated's 2017-2018 salary data



MLB's Collective Bargaining Agreement  
(CBA)