

SUBJECTIVE VERSUS OBJECTIVE EVALUATION

Machine Learning for Performance

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Credit

- Joint work with Nikhil Byanna
 - At time of work undergraduate student in Industrial Engineering and Management Sciences at Northwestern University
 - Consultant at BCG



Metrics in Sports

- Basketball
 - Points, assists, steals, rebounds per game
- Baseball
 - Home runs, batting average, earned run average
 - Wins above replacement
- Football
 - Quarterback rating, rushing yards, yards per carry
 - Sacks

Football

- Quantitative metrics for offensive linemen
 - Points scored? Total yards?
 - Credit the entire team
 - Pro Bowl appearances?
- Practice
 - Watching game
 - Compare to others based on height, weight
 - Very subjective
 - Used to set compensation, signing deals



Objective

- Correlate salary with performance
 - Regression based on newly developed metrics
- Identify under and over paid players
 - Identify groups of similar players based on measures
 - Observe salary outliers in groups

Concepts

- Impossible to track individual statistics
- Lineman either left or right side
- Approach
 - Statistics an offensive lineman is responsible for
 - Direct contribution
 - Statistics an offensive lineman is not responsible for
 - Control
- Large number to side and larger number not to side
 - Great running back

Concepts

- Incorporate performance metrics
 - Difference of the two indicators
 - To side – Not to side
- Measure
 - Rush attempts to side/not to side
 - Stuffs to side/not to side
 - Yards after contact to side/not to side
 - Hurries and knockdowns to side/not to side

Concepts

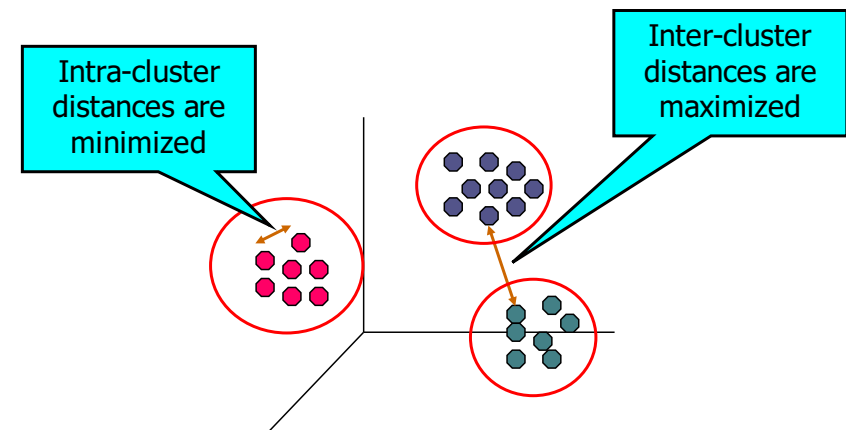
- Positive value
 - Outperforms peers on the other side
- Combine with traditional measures
 - Selections to Pro Bowl and All Pro
 - Demographic characteristics
 - Rushing yards per carry

Regression

- Predictor types
 - Performance
 - Based on most recent season
 - Experience
 - Prior seasons
- Dependent variable salary
- 7 significant predictors
- 4 among them to side/not to side

Under and Over Paid

- Create clusters based on the significant predictors
- Statistical test that mean salary in cluster same as population mean
- For each cluster identify outliers in salary
 - Distribution fitting within cluster
 - Tails in the distribution are outliers



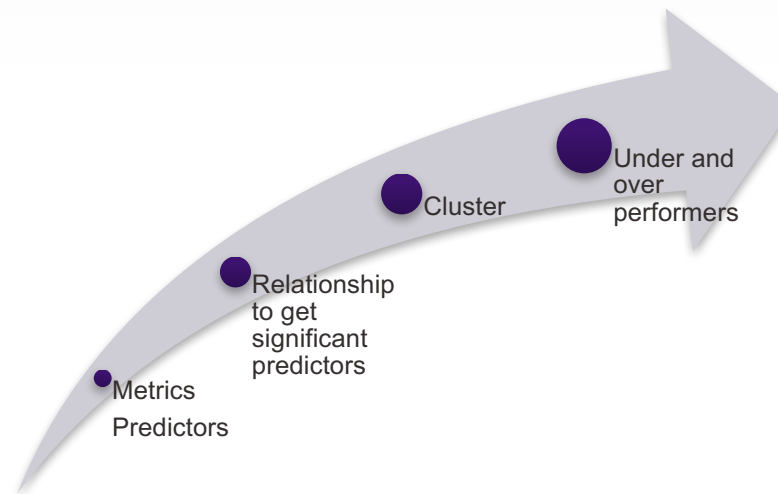
Chase Them or Drop Them

- 133 offensive linemen
- 4 identified as undervalues
- 2 overvalued
- Approximately 4M difference between actual and predicted salary

| Player | Year | Team | Position | Actual Salary | Predicted Salary | Overvalued/Undervalued? |
|----------------|-----------|--------------------|----------|----------------|------------------|-------------------------|
| Branden Albert | 2013 | Kansas City Chiefs | T | \$9,588,292.68 | \$5,820,659.08 | Overvalued |
| Doug Free | 2013,2014 | Dallas Cowboys | T | \$7,235,190.04 | \$3,521,875.32 | Overvalued |
| Eric Winston | 2013 | Arizona Cardinals | T | \$1,219,512.20 | \$4,666,476.67 | Undervalued |
| Joe Barksdale | 2013 | St. Louis Rams | T | \$528,701.62 | \$3,873,952.16 | Undervalued |

Concluding Thoughts

- Creative measures can be derived from 'limited' data
 - Ideally from videos other measures could be extracted
 - Too tedious and thus infeasible
- Possible to identify under and over achievers



Concluding Thoughts

- Team work in common in corporations
 - Similar to offensive linemen
- Find metrics that are personalized
 - Peer evaluations
 - Analyze internal collaboration tools
 - Tracking?
- Combine with team metrics

Thank you very much!

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