



*DESIGNING THE
OPTIMAL LINEUP
IN ENGLISH
PREMIER LEAGUE
FOOTBALL*

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Why do Managers Care About Team Composition?

- Wage Capital Scarcity
- Transfer Windows & Deadlines
- Dodging relegation is top priority
- Who do I buy?
- Who do I play?
- What combination of player types performs successfully?

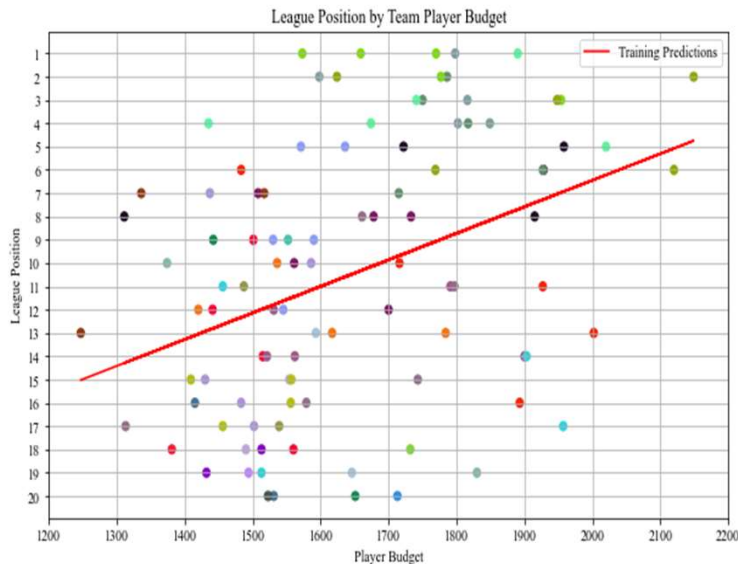


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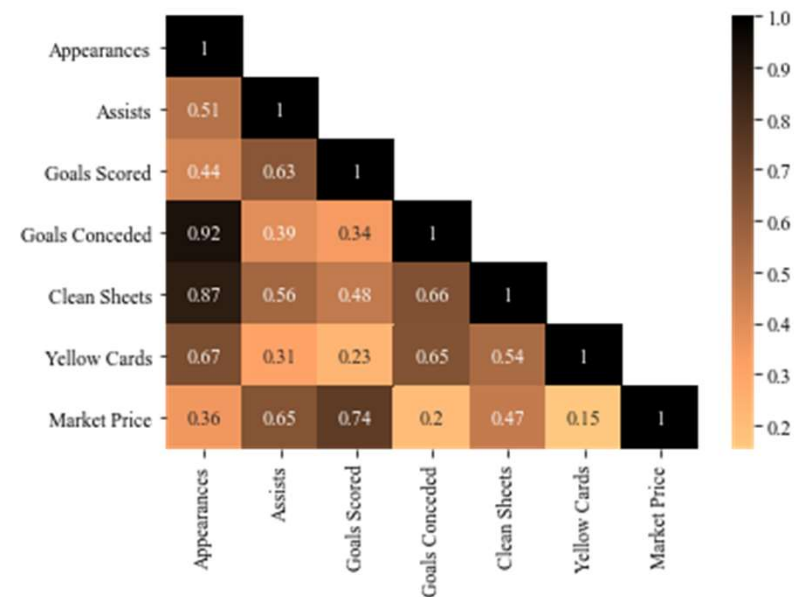
Does Money Impact League Position?



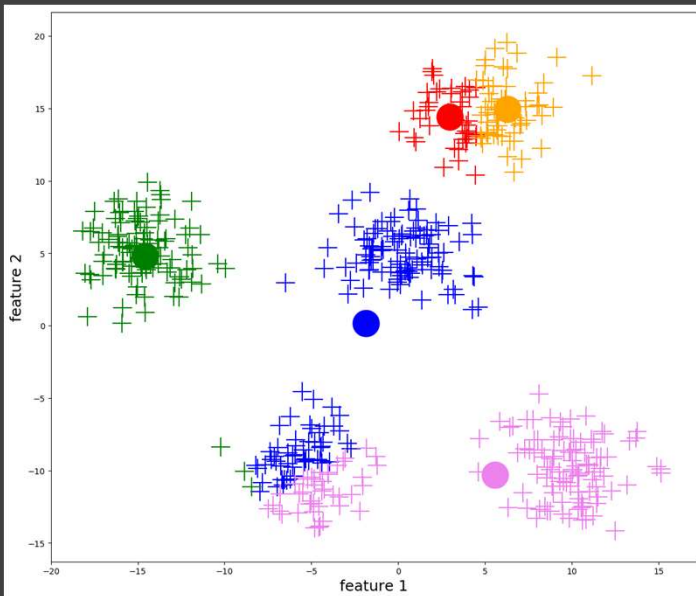
- Yes.
 - Ridge Regression
 - As wage capital expenses increase, the higher the position in the table
 - From 2016-2017 to 2020-2021 season
 - Each color represents a team throughout the time interval

What Features Determine a Player Tier?

- Market price correlated with assists & goals scored
- Goals conceded, clean sheets, & yellow cards are correlated with appearances.



How to Identify Player Type?



- *K-means++ Clustering*

- *Centroid Based Clustering*
- *Initialize by choosing a random centroid, then identify other centroids by maximizing the distance between clusters*
- *Iteratively calculate the mean of the cluster, then adjust the centroid until the mean is constant across iterations*
- *Higher quality results: initialization dispersed across the domain relative to a randomized initialization of a vanilla k-means algorithm*

- *Features:*

- *Appearances*
- *Assists*
- *Goals scored*
- *Goals conceded*
- *Clean sheets*
- *Yellow cards*
- *Market Value*

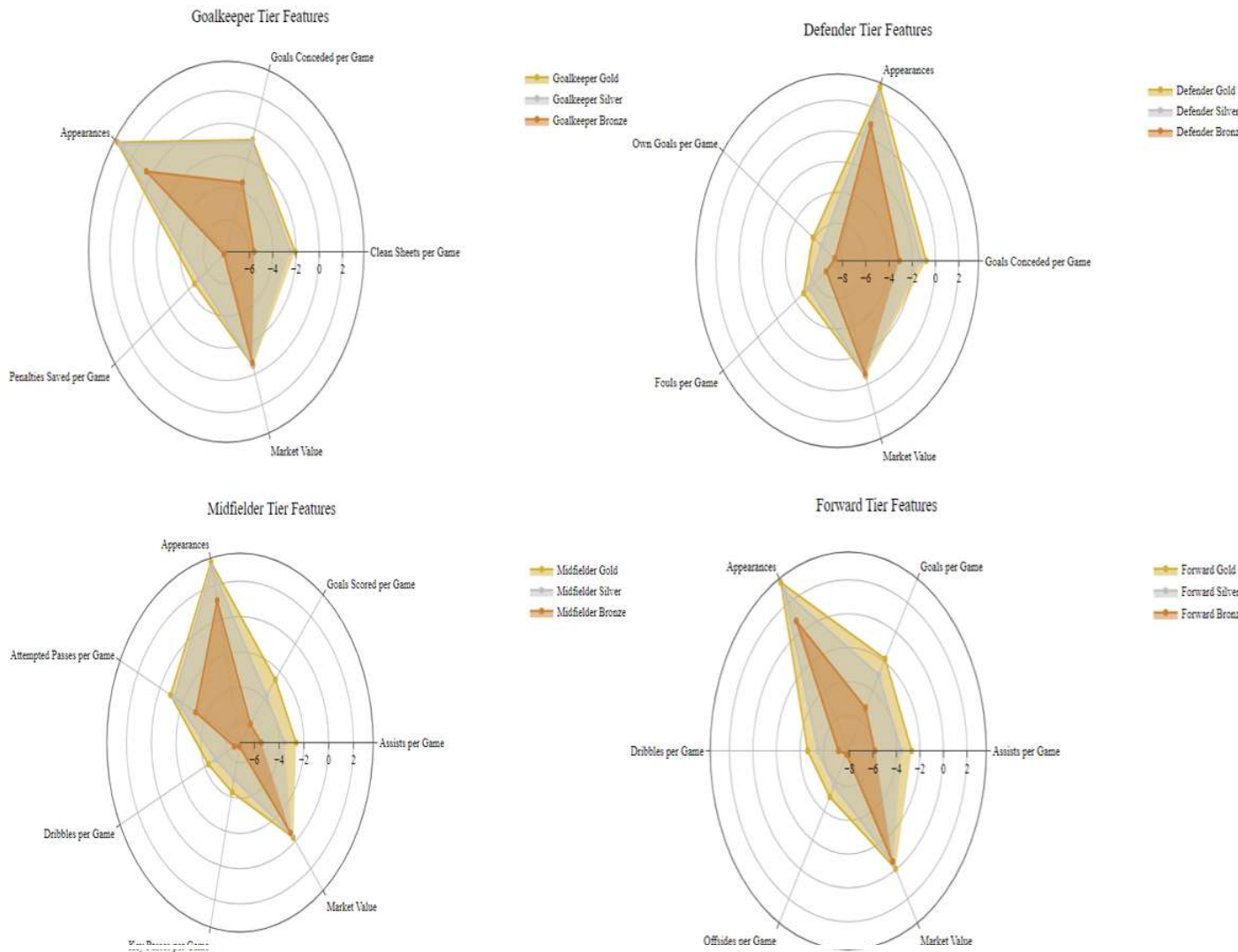
- *Three Clusters*

- *Gold, Silver, & Bronze tiers*



How to Correct for Season & Position?

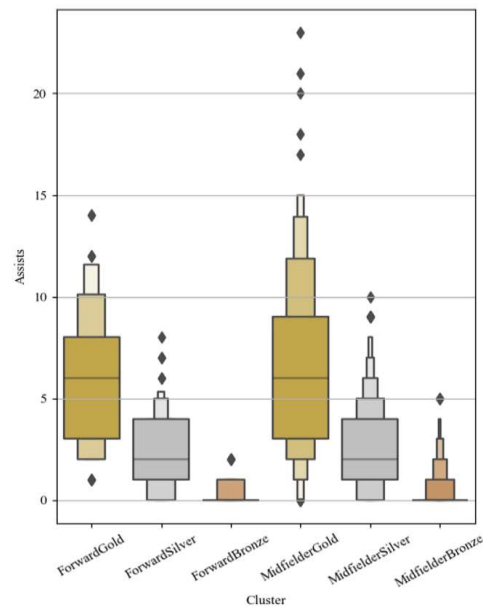
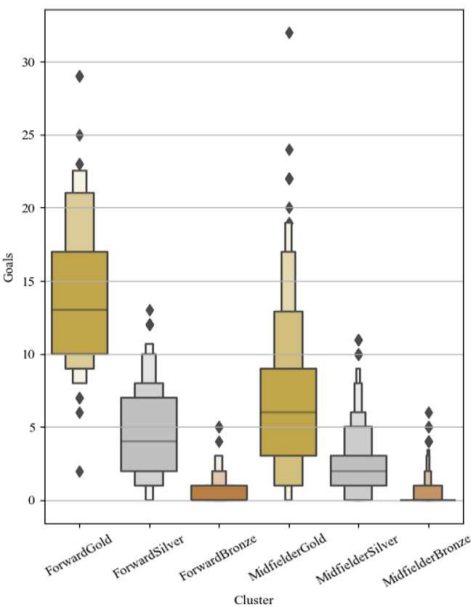
- *Partition Data Set by Season*
 - *Game Progression*
 - *Off Season Transfers*
 - *League Bolstering*
- *Partition Data Set by Position*



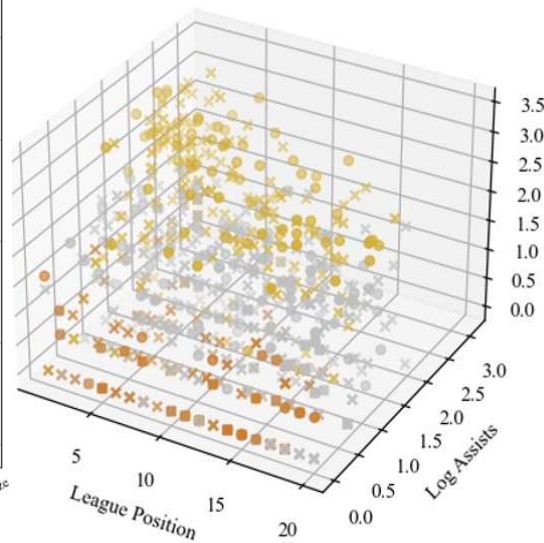
Are Forwards & Midfielders Similar?

- x represents midfielders & o exhibits forwards
- *Key Findings:*
 - Upper tier Gold Midfielder contribute the same expected goal count as a Gold Forward
 - Forwards rarely contribute to the number of assists midfielders provide
 - All teams possess Bronze players regardless of league position

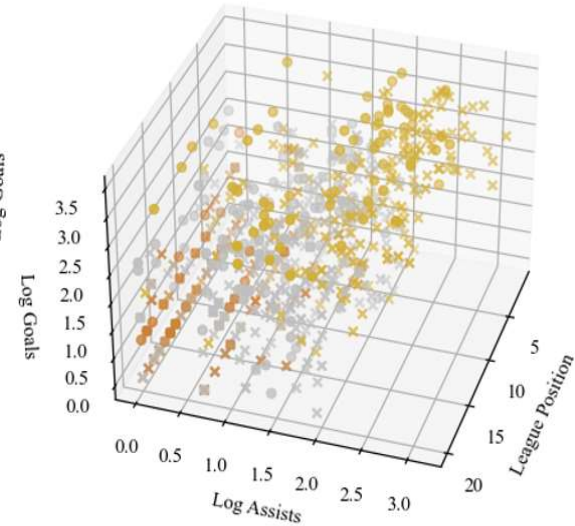
Goals & Assists by Cluster

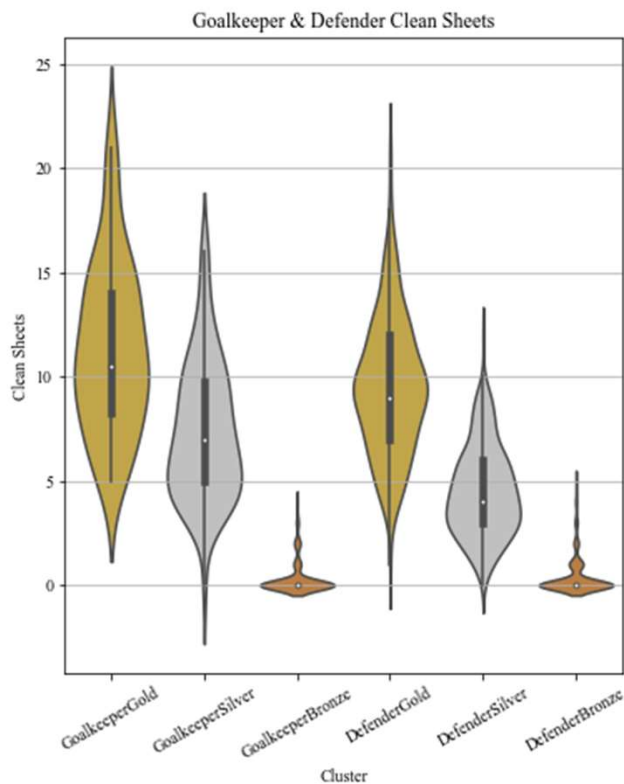


Attacker & Midfielder Features



Attacker & Midfielder Features





Are Goalkeepers & Defenders Similar?

- Gold Goalkeepers outperform Gold Defenders
- Gold Goalkeepers are scarcer than Gold Defenders
- Silver Goalkeepers outperform Silver Defenders
- Bronze Goalkeepers & Defenders contribute roughly congruent clean sheets

What Separates Top-Flight & Relegation Class Clubs?

- Team Composition & Tactics
- Frequent itemset analysis (Apriori) to identify frequent player combinations amongst Top-Flight clubs & Relegation Class Clubs
- Projection data set into two sets: The top 25% of teams & bottom 25% of teams
- For each partition, consider each game week as a transaction
 - {GoalkeeperGold1, DefenderBronze1, DefenderSilver2, DefenderGold1, MidfielderGold4, MidfielderSilver3, ForwardGold2}

Top-Flight Clubs

- {DefenderGold2, MidfielderGold1}
- {DefenderGold1, MidfielderSilver1, MidfielderGold1}
- {DefenderGold1, MidfielderSilver1, MidfielderGold2}

Relegation Class
Clubs

- {DefenderSilver1}
- {DefenderGold1, MidfielderSilver2}

How Do Top-Flight & Relegation Clubs Play?

Top-Flight Clubs

- Offense transitions
- Defense transitions
- Establish offensive presence
- Heavy emphasis on possession
- Gold tier wingback defenders to maintain possession & deliver crosses
- Gold tier midfielders to serve a strong, resilient forward

Relegation Class Clubs

- Establish defensive presence
- Heavy emphasis on gold tier center back
- Keep shots away from the middle
- Attempt to score on counter attacks & mistakes





What are the Key Points?

1. Invest in a strong gold tiered midfield accompanied by at least one strong wing back
 2. Tactically focus on transition moments relative to establishing defense
 3. Above average Gold Midfielders score the expected value of Gold Forwards & provide more assists
 4. Gold Midfielders reap the highest return on capital investment
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QUESTIONS?