

Finding Math in the Madness: Predicting Upsets in the March Madness Basketball Tournament

Louisa Brown, Lily Feingold,
Manu Skora, and Claire Woodrow
Furman University



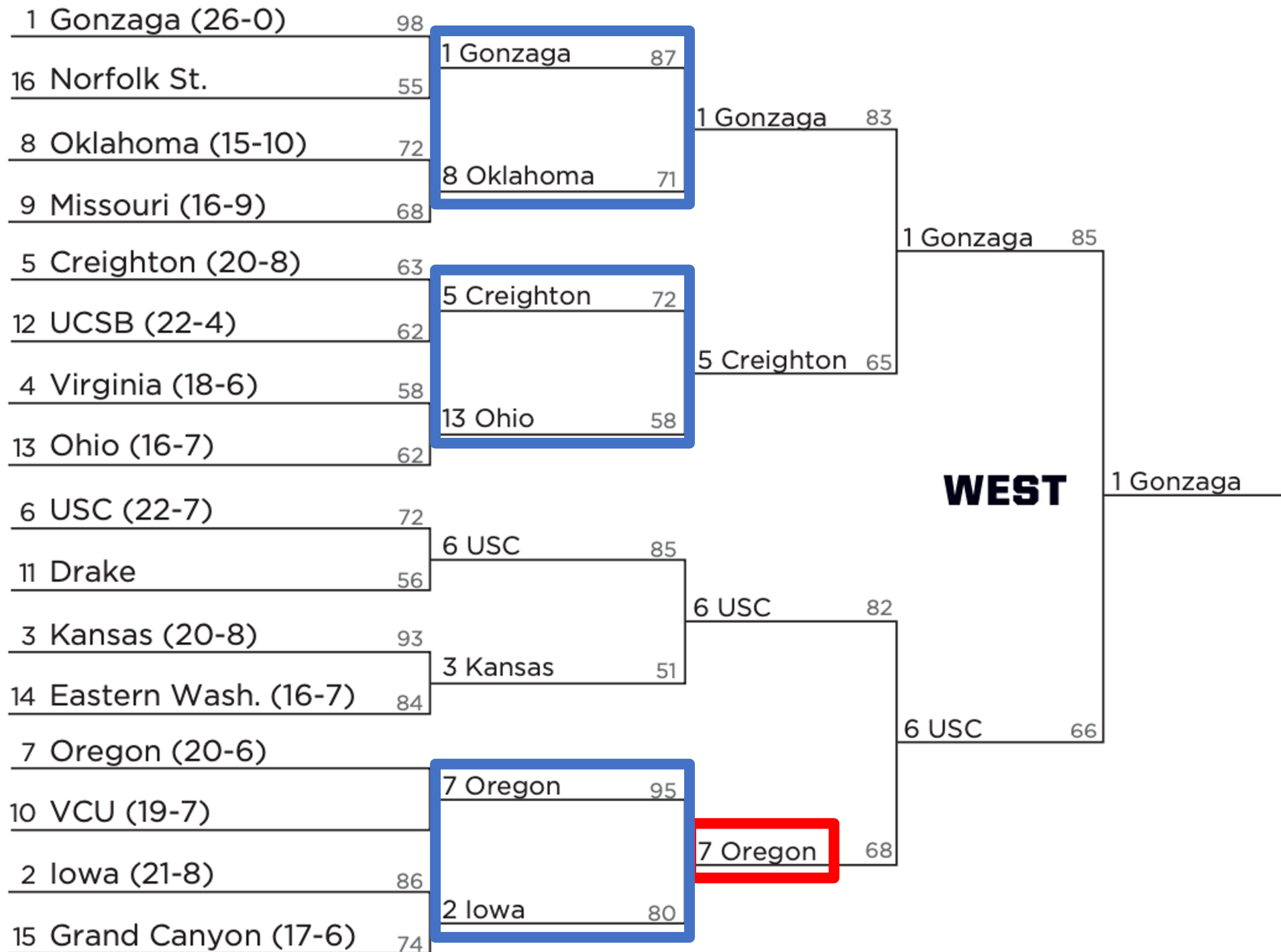


Bracket structure

- 68 teams
- 4 regions
- 16 teams per region ranked by seed
- 6 rounds

2021 West Region

At least 5 seed difference for Favorite/Underdog matchup



Focus of our Research

- Historically, 23% of matchups with at least a 5-seed difference were upsets
 - Goal: Determine which regular season characteristics of favorites and underdogs result in upsets more/less often than historical average
 - Use these characteristics to predict future upsets
-



Understanding our Data Set

- Regular season and tournament data from 2007–2022
 - Regular season data – all D1 teams
 - Tournament data – only contains games with seed difference of at least five
 - Use 2007–2021 for model training
 - Reserve 2022 data for future testing
 - No tournament in 2020

Simple Rating System (SRS)

- Used to form a rating, r_i , for each team i
 - r_i represents how much better team i is than an average team on a neutral court
-



Simple Rating System (SRS)

For each team i :

$$r_i = \frac{\sum_{j \in O_i} pd_{i,j}}{totalgames_i} + \frac{\sum_{j \in O_i} r_j}{totalgames_i}$$

Average margin of victory (MOV)

Average opponent strength
(SOS)

SRS example

3 Kansas

Favorite

$$15.9267 = \text{SRS}_{\text{KU}}$$

14 E Washington

Underdog

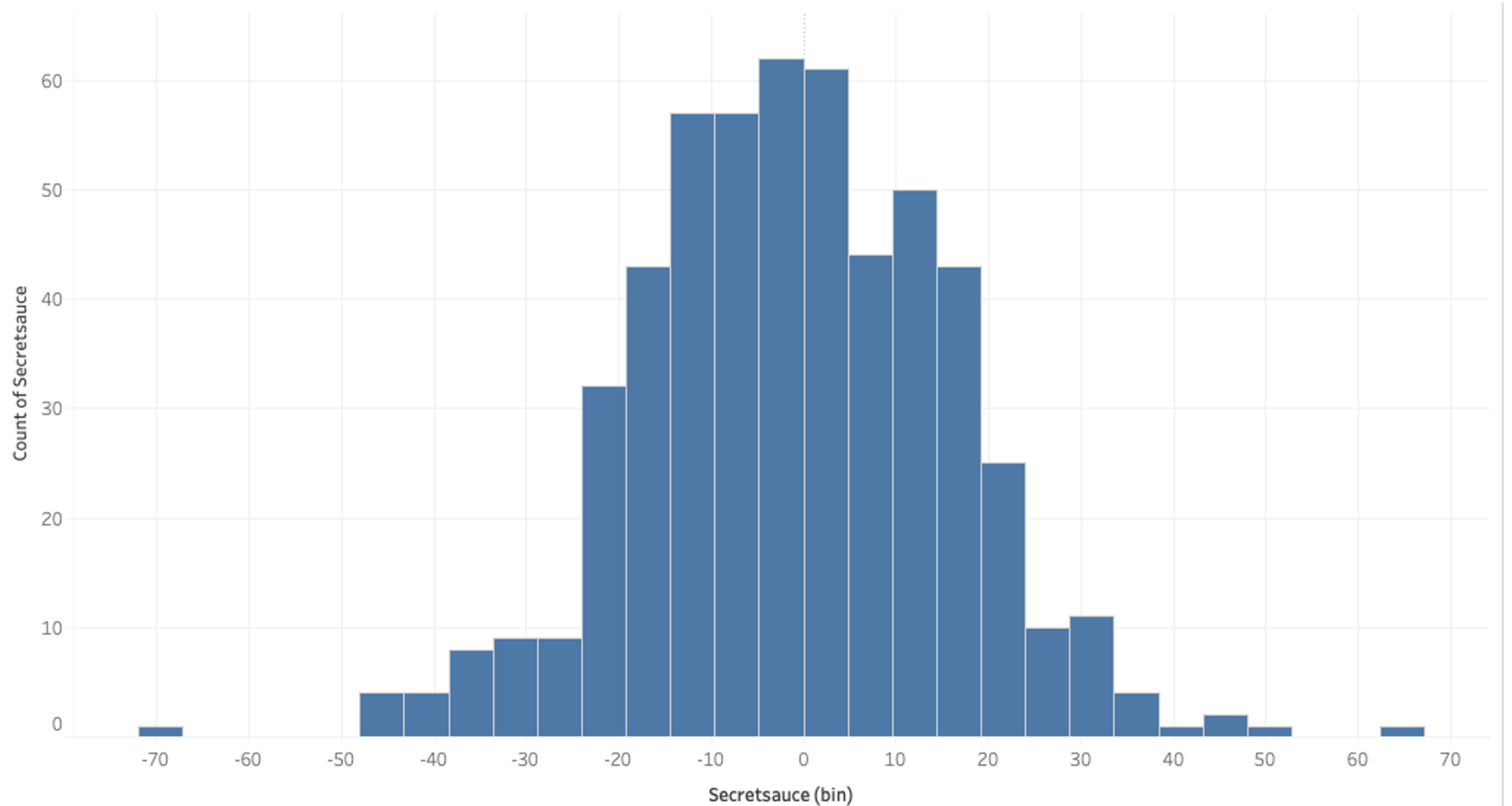
$$3.7227 = \text{SRS}_{\text{EWU}}$$

Predicted MOV: $\text{SRS}_{\text{KU}} - \text{SRS}_{\text{EWU}} = 12.2040$

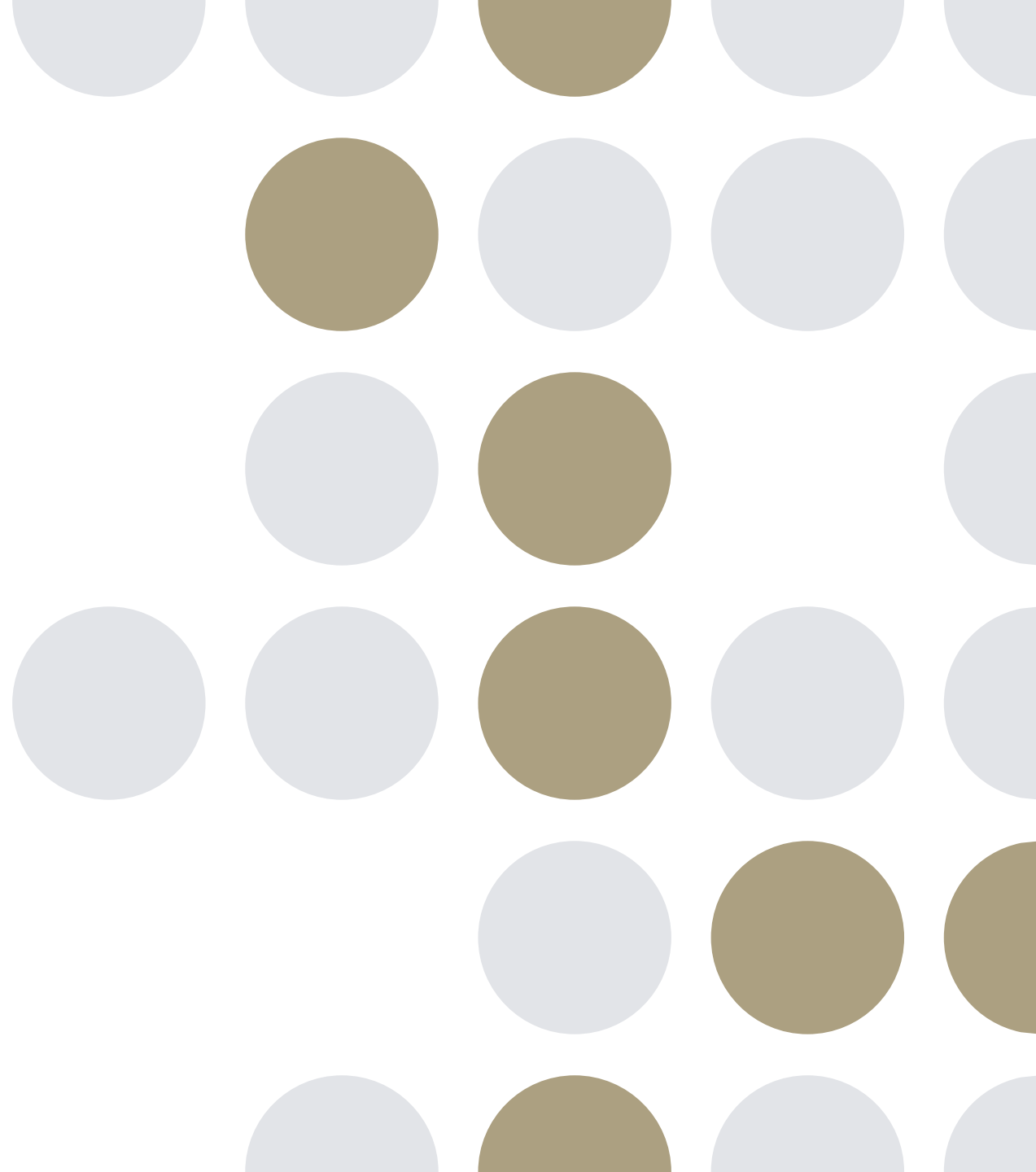
Actual MOV: 12.0684

Secret Sauce: Actual MOV - Predicted MOV = -0.1356

Histogram of Secret Sauce

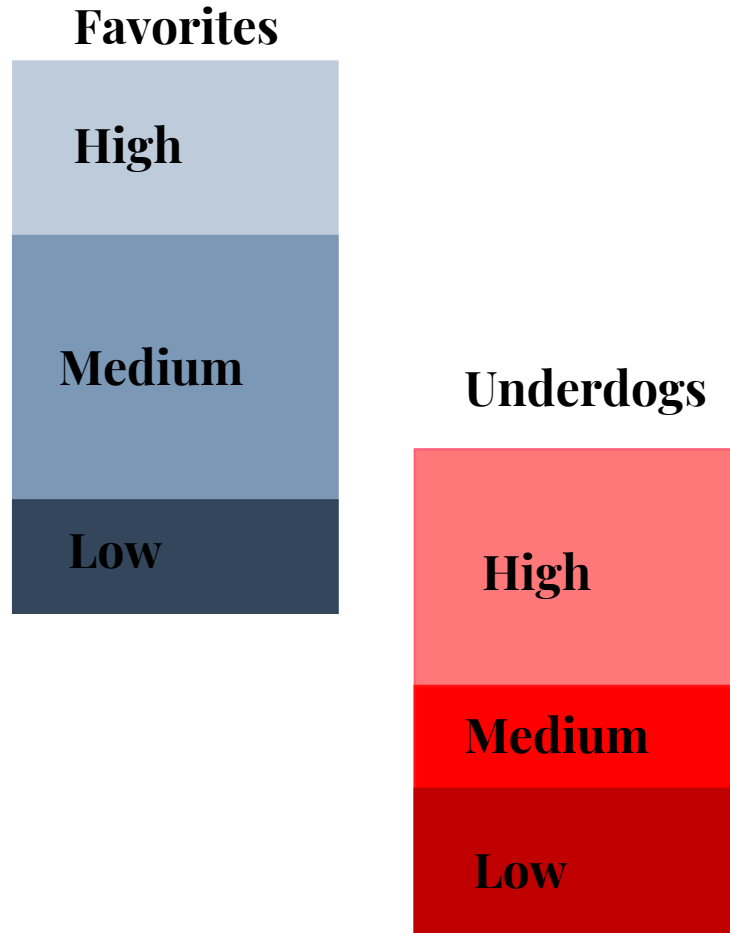


Multi Variable Analysis



Analysis

- Use data to find historical percentage of upsets in each category

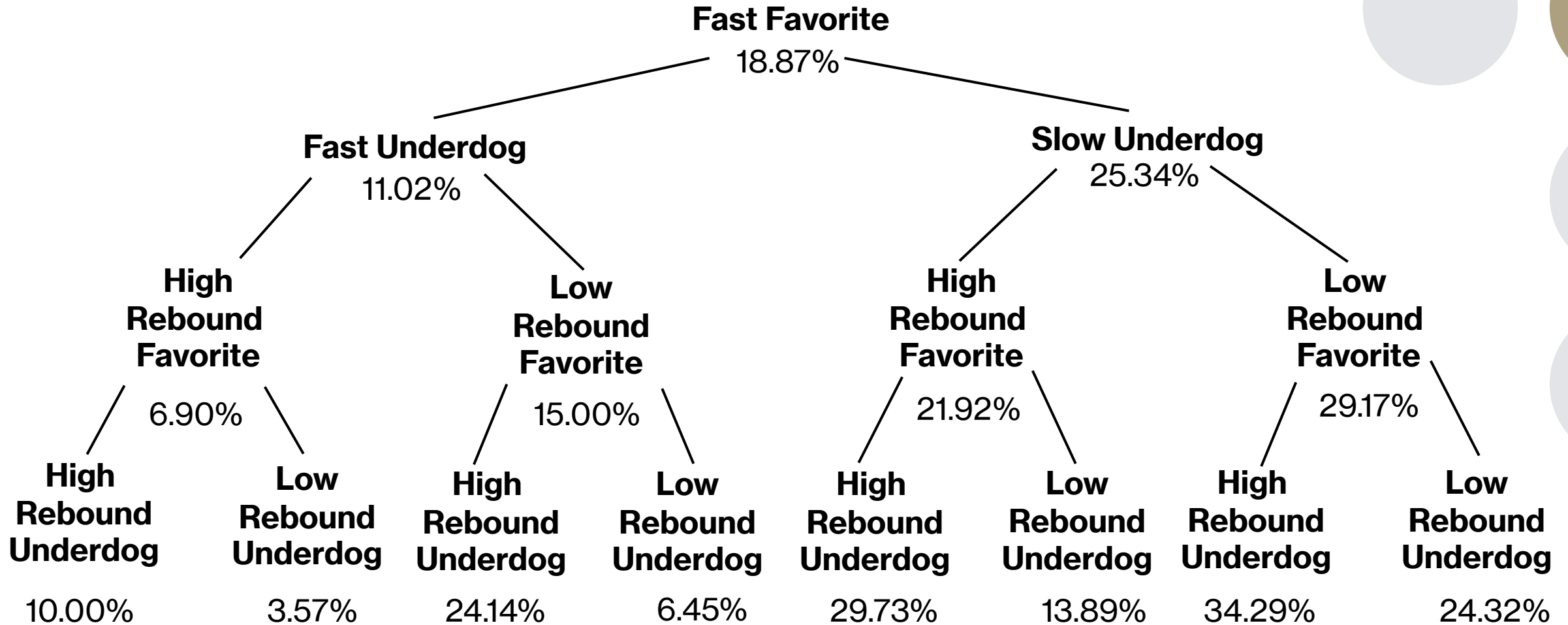


Favorite Offense

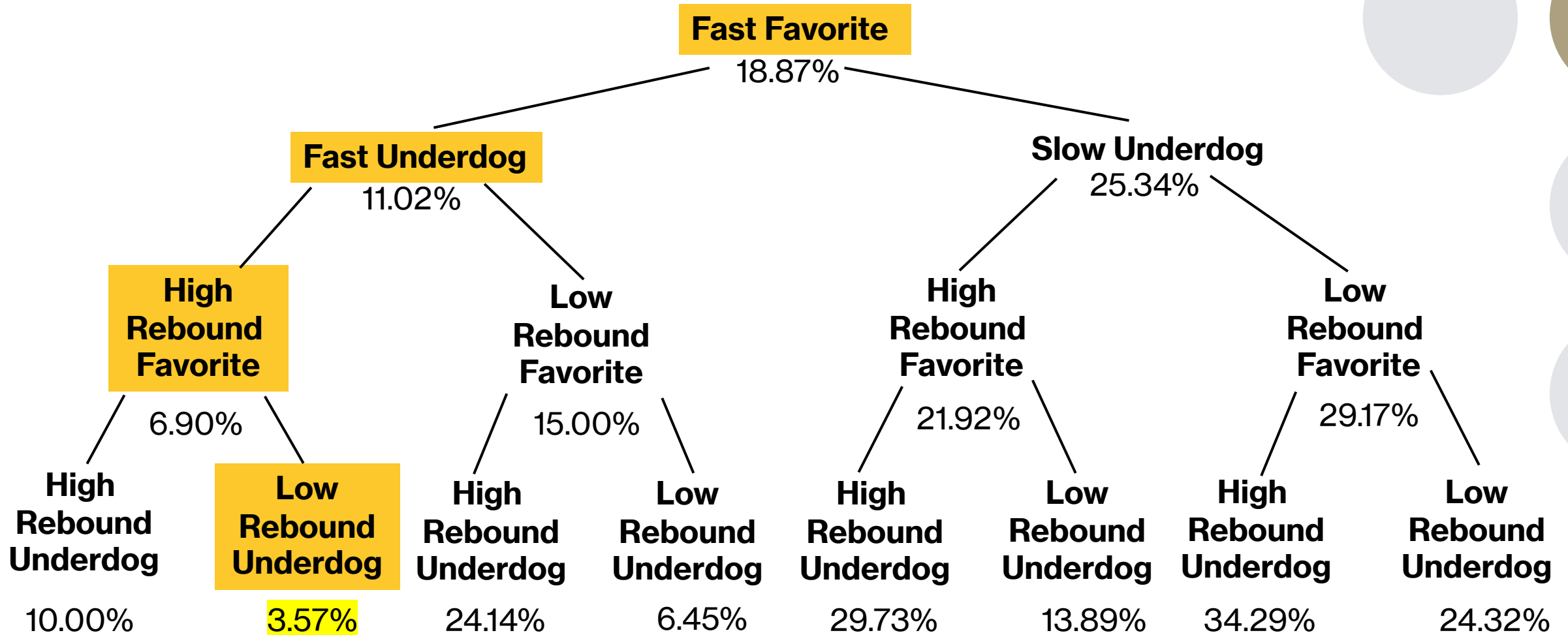
		Low	Medium	High	
Underdog Defense	Low	22.81%	15.51%	2.99%	13.11%
	Medium	27.54%	26.67%	12.77%	23.03%
	High	45.10%	32.76%	25.53%	32.58%
		31.07%	25.00%	13.19%	

Historical Upset
Percentage: 23%

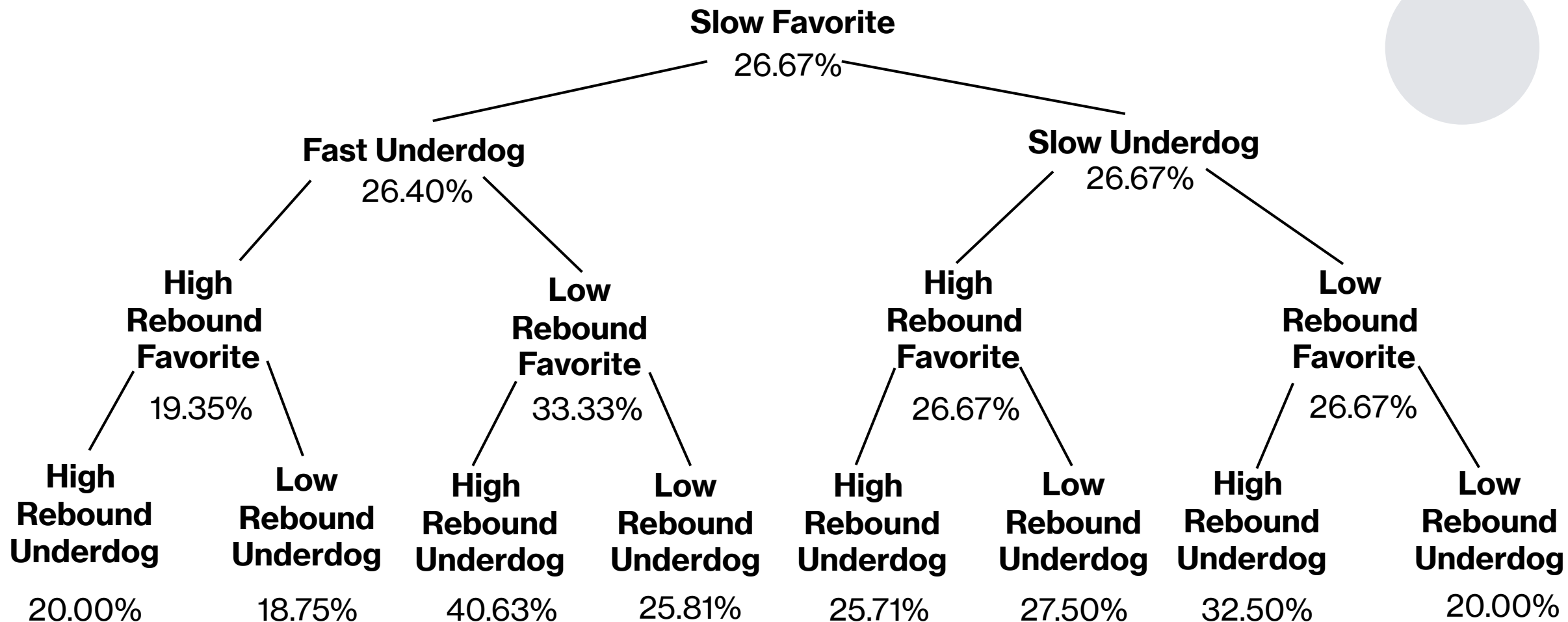
Fast Pace + Rebounds Decision Tree



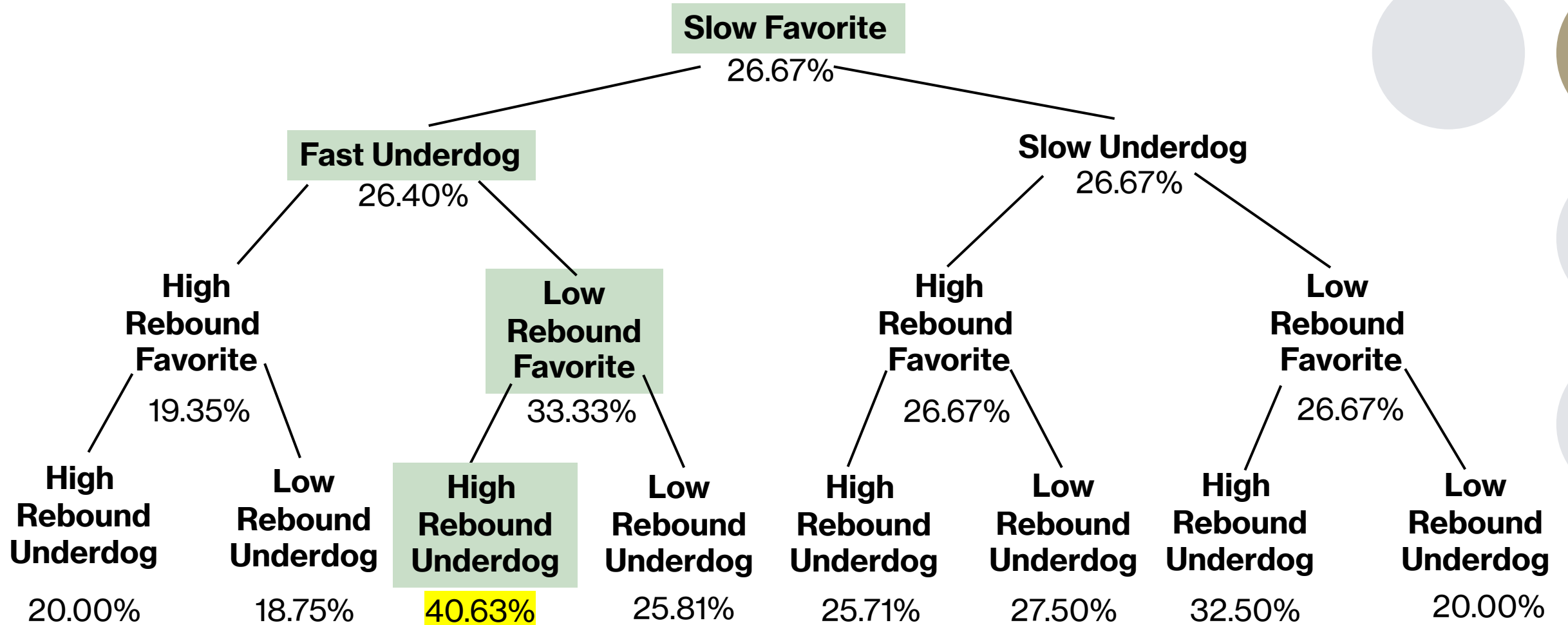
Fast Pace + Rebounds Decision Tree



Slow Pace + Rebounds Decision Tree



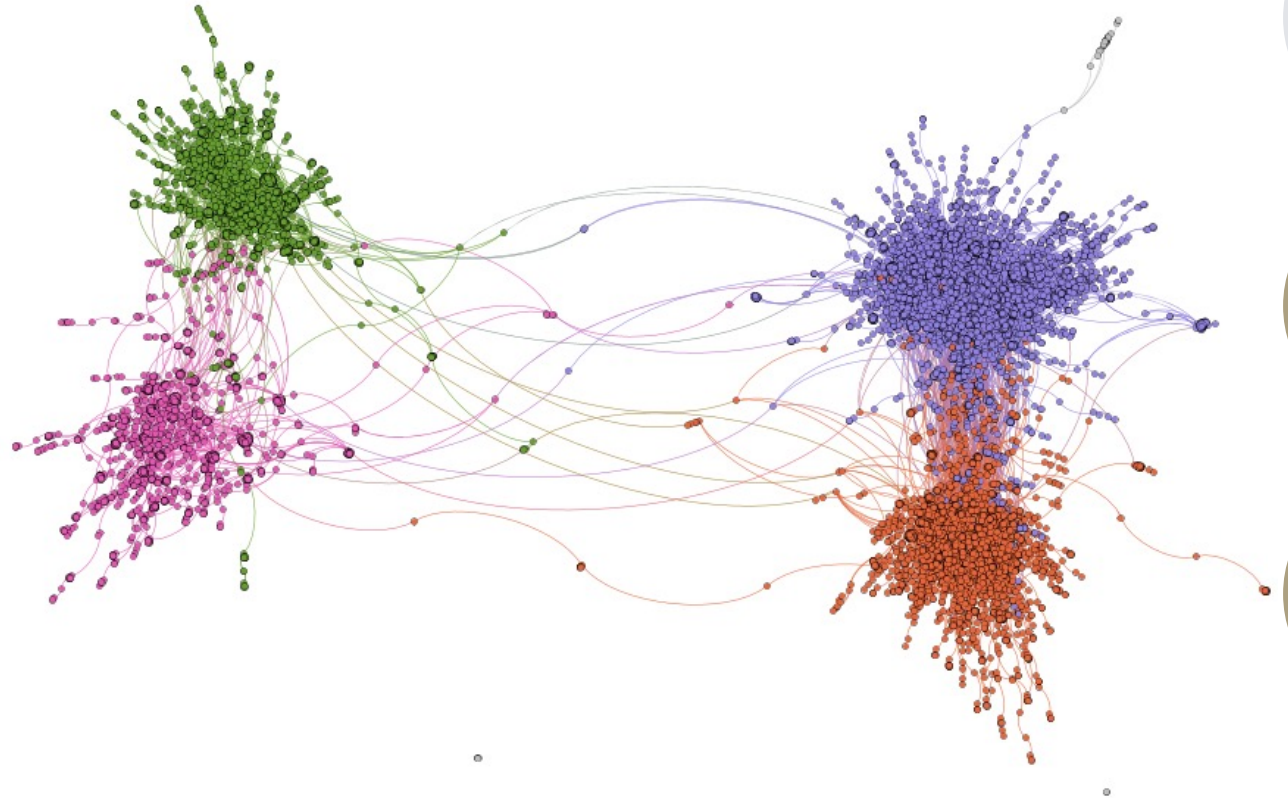
Slow Pace + Rebounds Decision Tree



Community Detection

Two different clustering algorithms

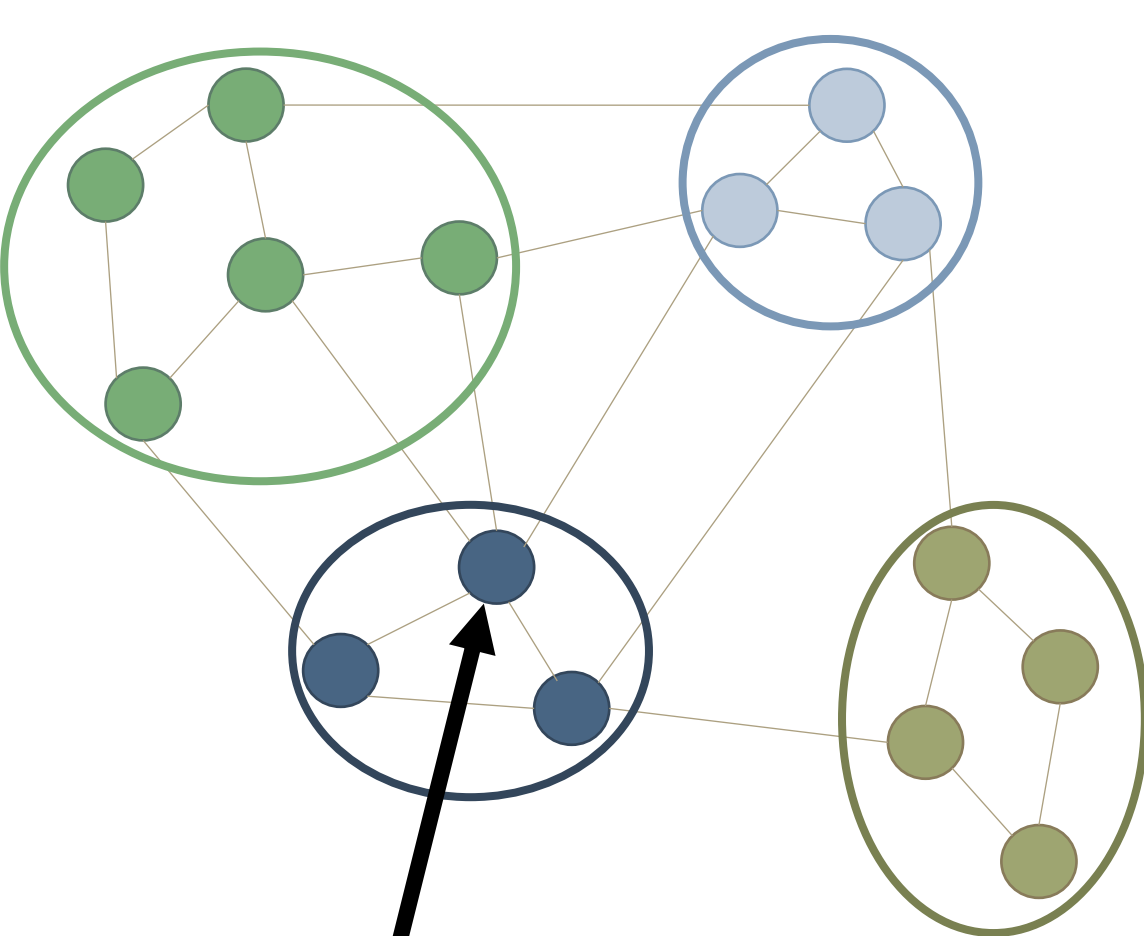
- ***k*-means** clustering
 - Used to cluster similar **teams**
- **Louvain** clustering algorithm
 - Used to cluster similar **games**



Underdogs

Favorites				
		Butter-fingers	Offense Focused	Average Joe
Power	Power	50%	23.81%	26.15%
	Defense Focused	35.85%	20.0%	26.42%
	Lucky Team	26.79%	9.09%	4.60%
		37.11%	16.57%	17.07%

Butterfinger-Power Matchups
Alabama vs UCLA 2021
Tennessee vs Oregon St. 2021
Wisconsin vs Iowa St. 2022



Louvain Clustering Algorithm

Cluster Number

1	2	3	4
18.58%	23.53%	34.59%	16.44%

Upset percentage

Gonzaga vs Georgia State (2022)

- Michigan vs Texas Southern (2021)
- Kansas vs Detroit Mercy (2012)
- Villanova vs Radford (2018)
- Kansas vs Boston University (2011)
- Florida vs Jackson St (2007)
- Oklahoma vs CSU Bakersfield (2016)
- Kentucky vs Western Kentucky (2012)
- Oklahoma vs Morgan St (2009)
- Florida vs Northwestern St (2013)
- Kansas vs Western Kentucky (2013)

0 of the 10 most similar games were upsets

Villanova vs Michigan (2022)

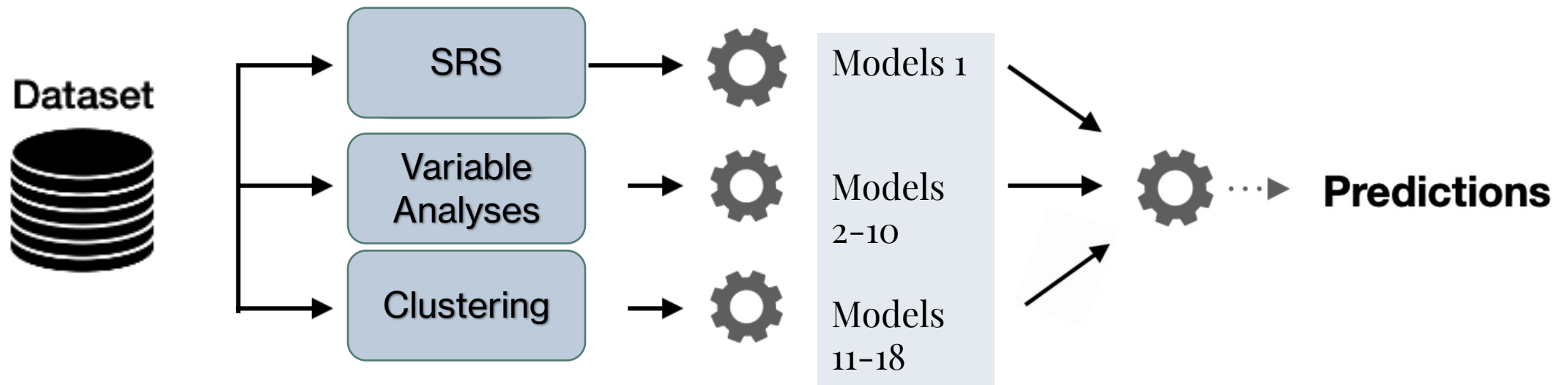
- Brigham Young vs Gonzaga (2011)
- SMU vs UCLA (2015)
- Memphis vs Saint Mary's (2013)
- Duke vs California (2010)
- Villanova vs Saint Mary's (2009)
- Villanova vs Saint Mary's (2010)
- Texas A&M vs Utah St. (2010)
- Duke vs West Virginia University (2008)
- St. Johns vs Gonzaga (2011)
- Memphis vs Nevada (2007)

3	4
34.59%	16.44%

4 of the 10 most similar games were upsets

Ensemble Model

Singular model made up of our 18 initial models, with preferential weighting given to models that are more predictive



Ensemble Model

- Purpose: pick models that offer new information other models lack
 - After each iteration, each newly picked model has less voting power
 - Newly picked model is the best model at correctly predicting the games that the previous models mispredicted
 - Drawback: risk of overfitting our ensemble model to predict rare occurrences
-

Testing Our Model on 2022 Games

		Actual		Correct predictions: 76.74%
		Upsets	Non upsets	
Predicted	Upsets	6	3	
	Non upsets	7	27	

2022 Games our Model Predicted as Upsets

Game	Score	Is upset
Saint Mary's vs Indiana	82 - 53	0
Colorado St vs Michigan	63 - 75	1
Texas vs Virginia Tech	81 - 73	0
Alabama vs Notre Dame	64 - 78	1
LSU vs Iowa St	54 - 59	1
Baylor vs North Carolina	86 - 93	1
Tennessee vs Michigan	68 - 76	1
Texas Tech vs Notre Dame	59 - 53	0
Wisconsin vs Iowa St	49 - 54	1

Thank you!













We would like to acknowledge the following people who made this research possible.

ESPN
The Athletic

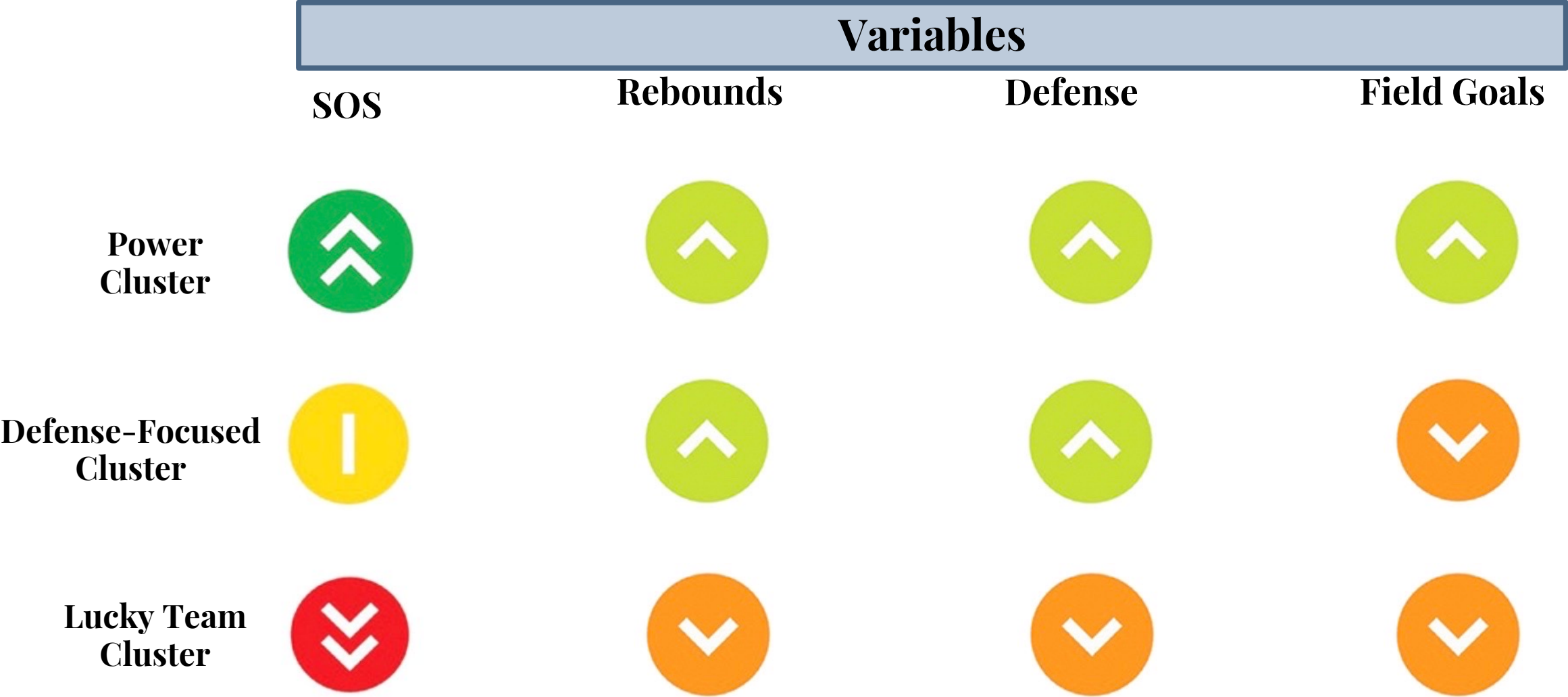
Dr. Liz Bouzarth
Dr. John Harris
Dr. Kevin Hutson

Furman Math
Department

k-means Clusters of Favorite Teams

	Variables			
	Rebounds	Rebound prevention	Turnover rate	Offense
Butterfingers Cluster				
Offense-Focused Cluster				
Average Joe Cluster				

k-means Clusters of Underdog Teams





A diagram with a central text label 'Louvain Variables' surrounded by five light blue circles. The circles are arranged in a pentagonal pattern. Clockwise from the top, the circles contain the text: 'Blocks', 'Field Goals', 'Field Goal Prevention', 'Rebound Prevention', and 'Rebounds'.

Blocks

**Field
Goals**

Louvain Variables

Rebounds

**Rebound
Prevention**

**Field
Goal
Prevention**

Current Models

Single and Multi-Variable Analyses

- Pace
- Rebounds
- Turnovers
- Three pointers
- Strength of Schedule
- Offense
- Defense

Clustering

- Similar teams: k -means and Louvain
- Similar games: Louvain

SRS Scores

- Simple SRS

		Favorite SOS			
		Low	Medium	High	
Underdog SOS	Low	10.53%	13.85%	10.81%	11.86%
	Medium	24.0%	14.81%	31.91%	23.30%
	High	28.13%	31.58%	36.67%	32.04%
		23.03%	20.22%	25.14%	

Historical Upset
Percentage: 23%

Lift chart

