



Evaluating Basketball Player Performance via Statistical Network Modeling

Piette, J., Pham, L., and Anand S. / The Wharton School of Business and Boston University / jpiette@wharton.upenn.edu

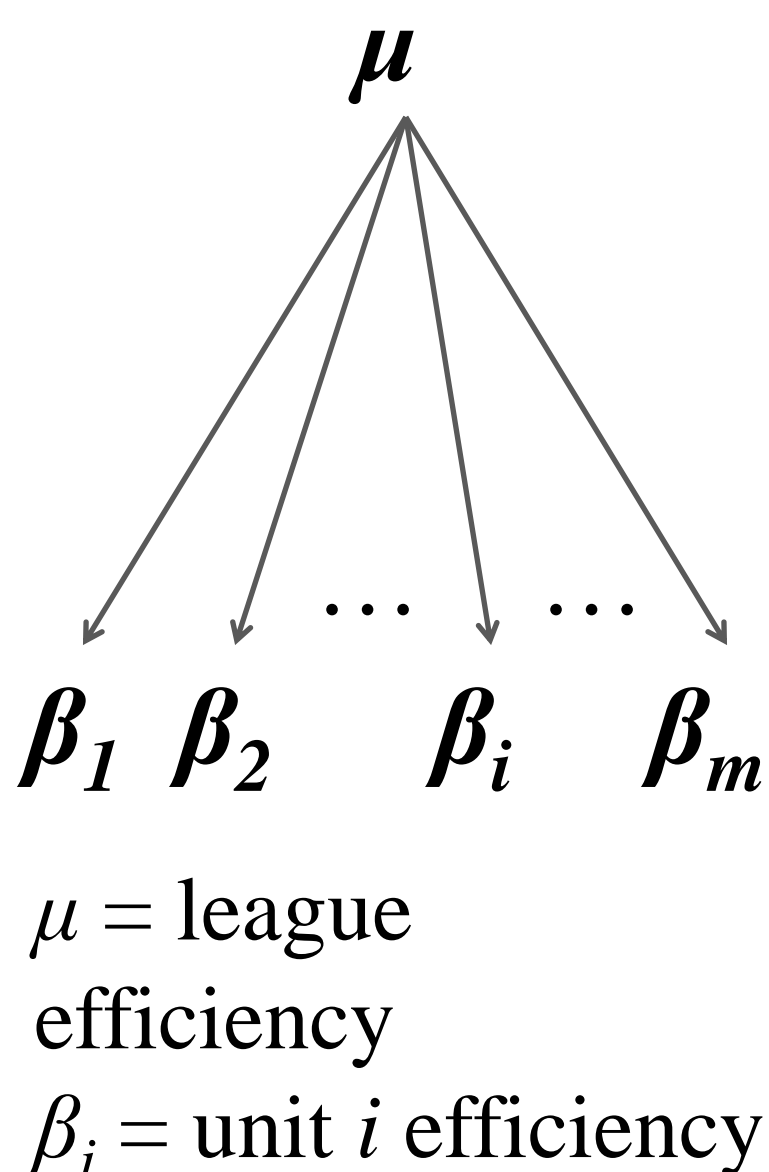
Purpose

Given all 5-man units, we aim to answer two questions about an individual basketball player's ability:

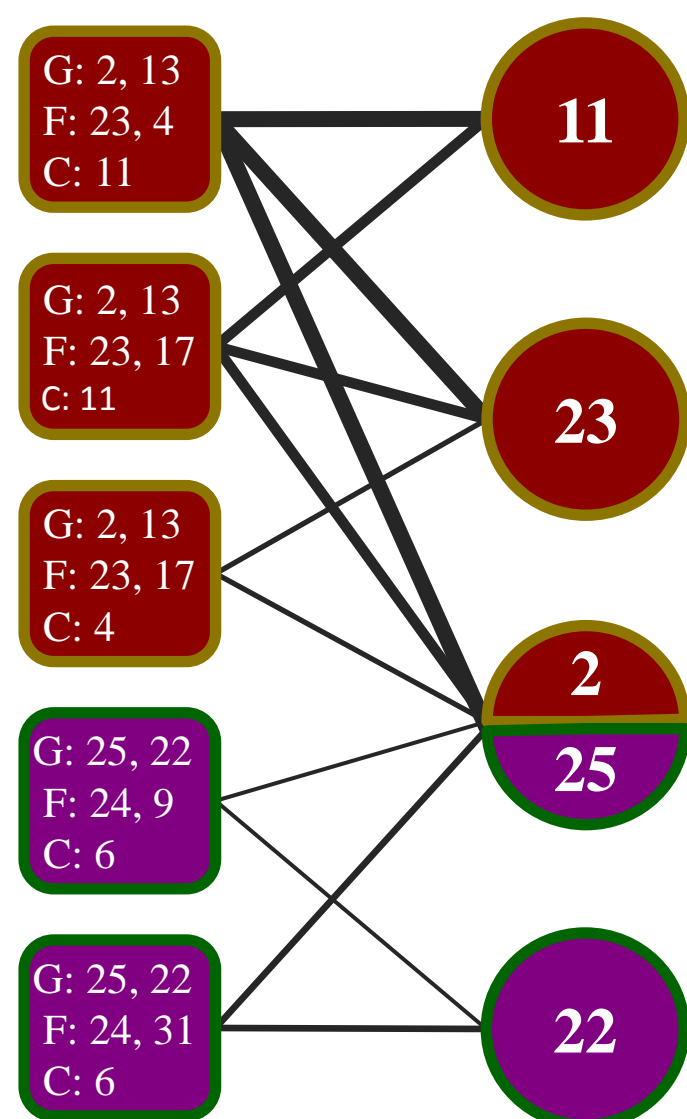
1. How much of an impact did that player have on their unit(s) relative to all other players?
2. Did that player perform exceptionally; that is, was their impact significantly more/less than expected?

Network Construction

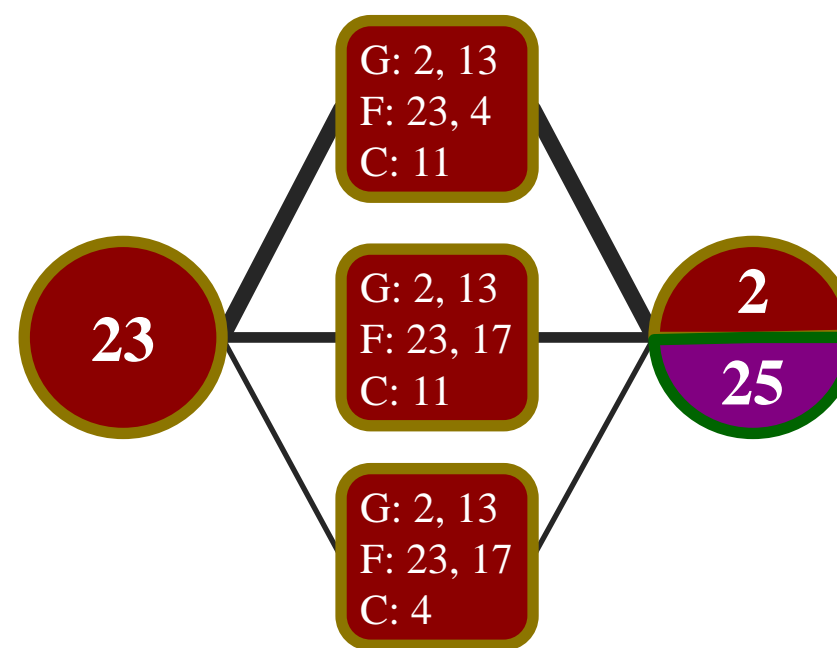
Step 1: Use Gibbs sampling to estimate the initial edge weights (i.e. unit efficiencies).



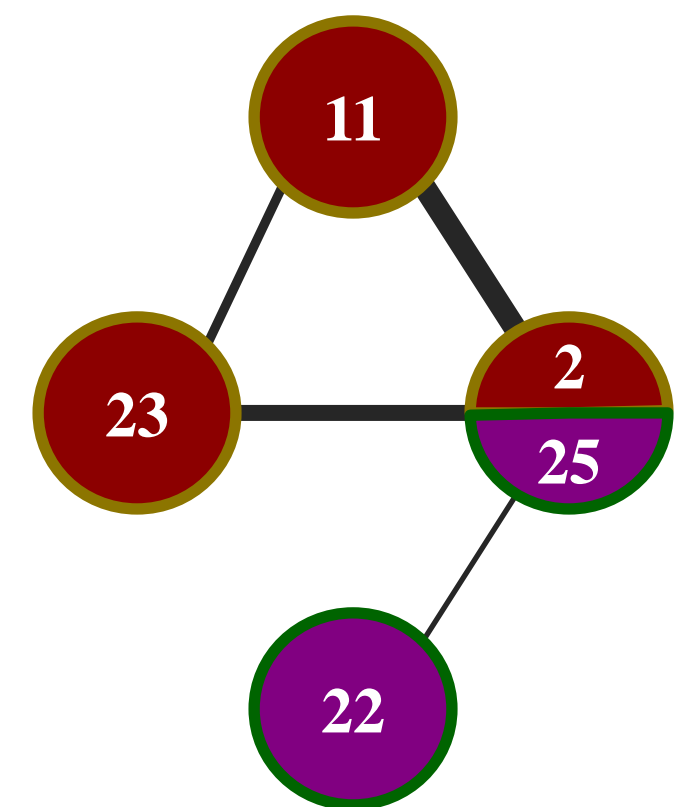
Step 2: Construct a Boards-member, bimodal network using initial edge weights.



Step 3: Calculate interaction between two player who played in the same units.

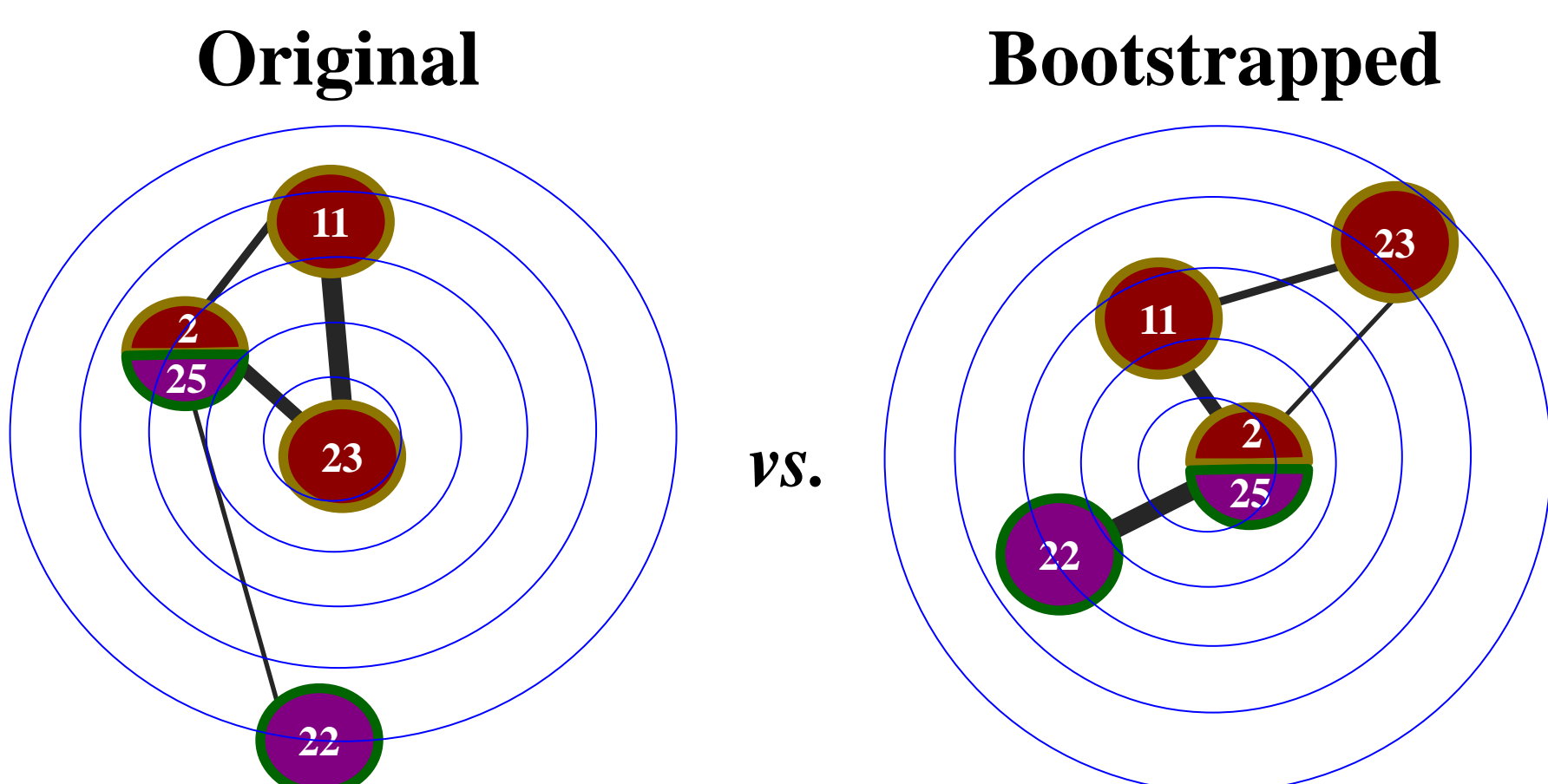


Step 4: Map these interactions onto a unimodal network, where nodes are players.



Statistical Analysis

Eigenvector centrality with random restart is used to calculate the centrality (i.e. impact) of a player in the network. Then, we bootstrap the initial edge weights and reconstruct the network. By repeating this process, we generate a reference distribution for each player, which we use to test the hypothesis that a player's centrality score is statistically significant (p-value).



Results

Exceptional Over-Performers (Green) and Under-Performers (Red) on OFFENSE

Name	C-Rank*	P-value**	Name	C-Rank*	P-value**
LeBron James	1	0.017	Fred Jones	237	0.000
Dirk Nowitzki	2	0.000	Ime Udoka	264	0.040
Chris Bosh	6	0.000	Antoine Walker	307	0.000
Kobe Bryant	25	0.000	Marcus Williams	315	0.029
Deron Williams	29	0.000	Shelden Williams	328	0.055

Exceptional Over-Performers (Green) and Under-Performers (Red) on DEFENSE

Name	C-Rank*	P-value**	Name	C-Rank*	P-value**
Eddie House	101	0.073	Chris Bosh	35	0.084
Daniel Gibson	121	0.086	Kobe Bryant	57	0.051
Tony Allen	174	0.073	Josh Smith	66	0.084
Glen Davis	209	0.086	Carmelo Anthony	93	0.034
George Hill	210	0.086	Steve Nash	137	0.000

Exceptional Over-Performers (Green) and Under-Performers (Red) in TOTAL

Name	C-Rank*	P-value**	Name	C-Rank*	P-value**
LeBron James	1	0.000	Al Jefferson	18	0.034
Dirk Nowitzki	5	0.000	Rudy Gay	20	0.000
Dwight Howard	17	0.000	Jarret Jack	21	0.000
Paul Millsap	27	0.000	Ryan Gomes	24	0.000
Anderson Varejao	31	0.000	Troy Murphy	36	0.070

* - a player's centrality rank. ** - a player's p-value calculated by bootstrapping.