

Statistical physics algorithm helps basketball fans fill out NCAA bracket

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The Power Rank's bracket of the 68 NCAA basketball teams. On the website, the bracket is interactive and shows the winning predictions of each team based on a statistical physics-based algorithm. Credit: Ed Feng, The Power Rank

(Phys.org) —Back in the early 2000s, Ed Feng was a Ph.D. student at Stanford studying chemical engineering. At the time, he never thought that his research on the dynamics of liquids using statistical physics would one day lead to an algorithm that ranks sports teams. Yet now, more than a decade later, he's running a website devoted to sports analytics based on statistical physics that works much in the same way as Google's PageRank algorithm works for ranking websites.

With March Madness right around the corner, Feng's website, called The Power Rank, has an [interactive bracket of the 68 NCAA basketball teams](#). The visual bracket display shows every team's probability of winning each of its games up

to and including the final championship. The team with the highest probability of winning it all is Arizona, at 11.3%.

How likely is this prediction to be correct? From 2002 through 2013, The Power Rank's efficiency rankings have predicted the winner of 72% tournament games, a sample of 777 games.

However, in his blog, Feng cautions that this year's NCAA tournament is a competitive one. To put it in perspective, in 2012, Kentucky had a 16.5% chance to win (and they did). But Arizona's lower 11.3% chance will leave the doors open for other [teams](#) to have a good chance, too.

For college basketball enthusiasts who are feverishly working on filling out their brackets this week, The Power Rank's data may provide some helpful statistics and predictions.

Although the Power Rank is one of many [sports analytics](#) websites, Feng thinks that it has certain advantages over others that improve the accuracy of its predictions. One of its biggest advantages is that it adjusts for a team's strength of schedule throughout the year—a feat that involves crunching lots of numbers.

"It starts with an algorithm I've developed that does for [sports analytics](#) what Google's PageRank did for web search: brings order and insight into a messy system," Feng writes on the site. "The method uses concepts from my Ph.D. thesis at Stanford as well as my research at Berkeley in understanding single molecule experiments. It requires simultaneously solving for 702 (2 times 351 teams) variables."

The key, he explains, is figuring out what all the "little" interactions between [sports teams](#) reveal about the "bigger picture" of the team's overall strength.

"Statistical physics studies how the interactions of

molecules on the nanometer scale produce bulk behavior on the human scale," Feng explains. "For example, the attractive forces between molecules in a liquid result in the spherical shape of a water drop. Statistical physics considers all of these interactions in describing the properties of the drop surface, such as its energy.

"In sports, teams are the molecules. These teams or molecules interact by playing games. The [statistical physics](#) of our algorithm considers all interactions or games to produce team rankings, which are like the bulk properties of the water drop."

The results of these calculations are then represented by clear visualization that allow anyone to instantly evaluate a game. While the NCAA interactive bracket is free, there is an annual \$69 fee for sports fans who seek more detailed information that includes a page for every team showing a breakdown of its stats, such as field goal percentage, rebounding, turnovers, free throw rate, etc.

This year, Feng has also analyzed Warren Buffett's offer to award anyone who picks the perfect bracket a \$1 billion prize. Up to 10 million entries are allowed. While the offer sounds enticing, Feng and other sports analysts have calculated that the chances of anyone winning the money are very small—depending on how you look at it, anywhere from 1 in 128 billion to 1 in 885,000.

"Think of The Power Rank as a research institute devoted to sports," Feng writes. "Just like academic groups that study statistical physics, we spend our days working out mathematics on paper and the writing computer code to compute answers. Well, the publishing model is a bit different..."

More information: <http://thepowerrank.com/>

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