# Disney Research builds computer models to analyze play in pro basketball and soccer

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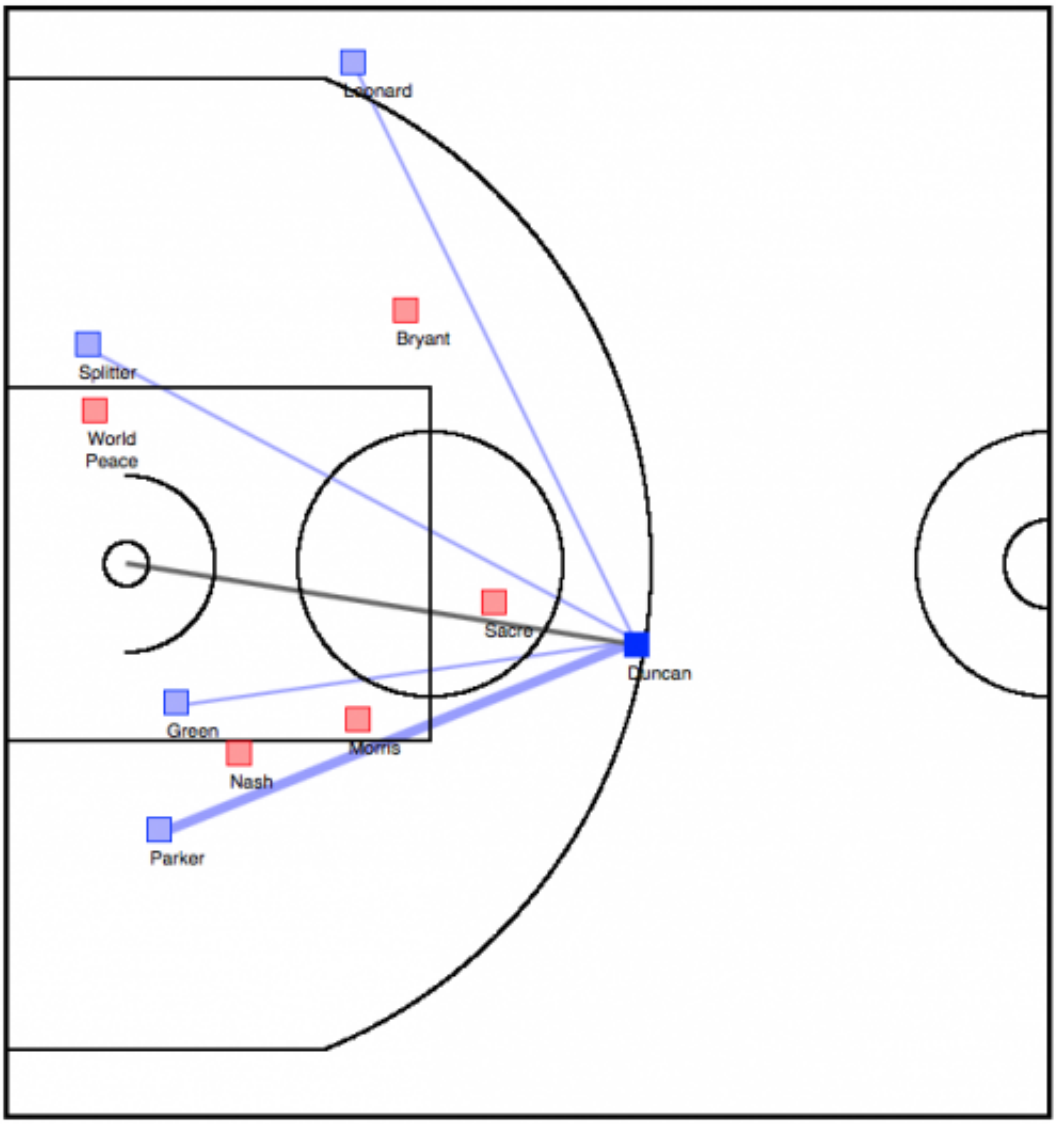

With the ball at the three-point line near the top of the key, what will Tim Duncan of the NBA's San Antonio Spurs do? Pass to a player posting up? Or does he take a shot? An analysis by Disney Research of player tracking data, however, suggests the highest probability is a pass to guard Tony Parker on his left.

It's just one play, by one player, in one sport - and perhaps not that hard for the average courtside observer to anticipate - but with the field of sports becoming more driven by sports analytics, predicting the next thing that a player will do has become a major challenge in computer modeling of player behavior.

In a new study, researchers at Disney Research Pittsburgh showed they could use player tracking data from more than 600 basketball games of the 2012-13 NBA season to build models that can make accurate in-game predictions of what each player is likely to do next in a game situation: pass or shoot.

In a separate study using a season's worth of ball and player tracking data from a professional soccer league - more than 400 million data points - Disney Research Pittsburgh researchers performed a different type of analysis that looked at team behavior rather than individual players. They showed their system could accurately detect and visualize team formations - well enough that they could identify teams based just on their style of play 70 percent of the time.

Both studies will be presented at the International Conference on Data Mining in Shenzhen, China, Dec. 14-17.


Patrick Lucey, an associate research scientist at Disney Research Pittsburgh, said such automated, data-driven methods might simply back up the intuition of a coach, but they can also serve as tools for educating players in the limited time available for practice, or as tools for scouting opposition teams and planning for specific game situations.

In the NBA study, the researchers were faced with the difficult, complex task of modeling the behavior not only of the ball handler, but of his teammates and defenders and their shifting positions on the court.

Instead, the researchers, directed by Yisong Yue, now an assistant professor of computing at California Institute of Technology, used a machine learning approach in which the models were trained based on the tendencies of each player to take shots or pass or receive passes in

certain locations. It also incorporated such factors as how those tendencies varied in the presence of opposition and on the duration of their possession of the ball.

The approach utilized a "latent factor model." It not only made accurate predictions, but the model's learned factors were interpretable and corresponded with known intuitions of basketball gameplay.

In the soccer study, the researchers faced a different problem. "In basketball, you have a lot of events and outcomes - a score or a change in possession every 24 seconds," Lucey said. That provides a lot of data points for evaluating individual play. Soccer, on the other hand, is a famously low-scoring sport. "It means you have to understand behaviors in the absence of scoring," he added.

In fact, focusing on individual players can be misleading, he explained. A player may play left wing at one point in the game and later to switch to the right wing; the decisions the players make will be based on their relative position to their teammates and opposition. So simply evaluating the player without considering that context will yield meaningless statistics. The Disney researchers developed a "role-based" representation of teams that doesn't track individuals but instead automatically identifies the players in each position and how they play that position. This provides a view of the team's behavior as a whole and also provides more meaningful, contextual information about individuals.

In addition to Yue and Lucey, the Disney researchers included Alina Bialkowski, Peter Carr, and Iain Matthews. Sridha Sridharan of Queensland University of Technology participated in the soccer analysis.

**More information: —** www.disneyresearch.com/wp-cont … Prediction-Paper.pdf

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