ALL ABOUT THE NUMBERS

For SPS sports fans, analytics is the new frontier

In 1962, when the Dallas Cowboys were fairly new to the NFL and desperate to put together a winning roster, team management made a groundbreaking move: they contacted computer giant IBM for help. The Cowboys wanted to improve on football's old-style scouting methods in order to find the best players available, so IBM sent a brilliant young Indian mathematician—who knew little about the game—to Dallas.

A. Salam Qureishi was asked to write a computer program that would sort through hundreds of athletes and statistics to quantify what makes a great football player. Dallas scouts and coaches provided him with characteristics and criteria ranging from speed and competitiveness to mental alertness and athletic success in college—and much more.

It was one of the first forays by a pro team into sports analytics, the method by which teams collect data, look for significant patterns, and draft the best players they can based on the results.

Once the Cowboys started using Qureishi's system, they began to find athletes who previously would have gone undiscovered. There were players from tiny schools, like Jethro Pugh from Elizabeth City State College, and Yale's Calvin Hill, who became the first Ivy Leaguer to be drafted in the NFL's first round. The Cowboys even discovered college basketball players like Cornell Green, who went on to play 13 seasons for the team. Though other teams initially doubted the new methods, a record-breaking string of playoff appearances by Dallas proved them wrong: the Cowboys have since become one of the world's most successful sports franchises.

Today nearly every professional sports team uses cameras and other devices to capture heaps of data. In the NFL, radio frequency identification technology embedded in players' shoulder pads tracks speed, position, and distance, and the NBA and professional soccer leagues use high-definition cameras above the playing surface to track the movement of the ball and of every player, for every second of a game. In basketball, sophisticated software and statistical algorithms produce data that include how many times someone touches the ball and where that player is most successful shooting and passing. Systems determine not only a player's shooting average but also the average after dribbling once versus twice, or when a defender is three feet versus five feet away from the basket.

"Analytics really involves moving beyond the traditional box score to find meaningful numbers that allow you to dissect and enjoy the game in new and innovative ways," says Tom Robinson, professor of sports management analytics at Northwestern's School of Professional Studies. Today, says Robinson, who is also director of football research for the Cowboys, the team is fully invested in analytics, with a staff of experts on both the player and business sides. Robinson joined the Cowboys in 2010 after a 10-year corporate career, and in 2014 he earned an MS in predictive analytics from SPS.

"You're furthering your own understanding, and your organization's, about the drivers of success," he says. "We find good data that we can work with, then use tools and techniques used by other industries and sciences and apply them to the sports context to understand the game better."

In the NFL draft every team is trying to figure out a potential player's likelihood of success—will he become a starter? A perennial Pro Bowler? A role player or a backup? Every year, each pro team attends

the NFL Scouting Combine, a gold mine of statistical information. Some 300 players are measured in a consistent way, from height, weight, and arm length to performance on such benchmarks as vertical and broad jumps, timed agility drills, and the 40-yard dash.

The ideal player has size and athleticism, comes from a prestigious program, has had athletic success in college, and has put up big stats. But in one way or another, Robinson explains, almost everyone lacks something—even the best players have flaws.

"Some don't fit the right parameters for height and weight, but they can still be excellent football players," he says. "We're always looking for ways to figure that out."

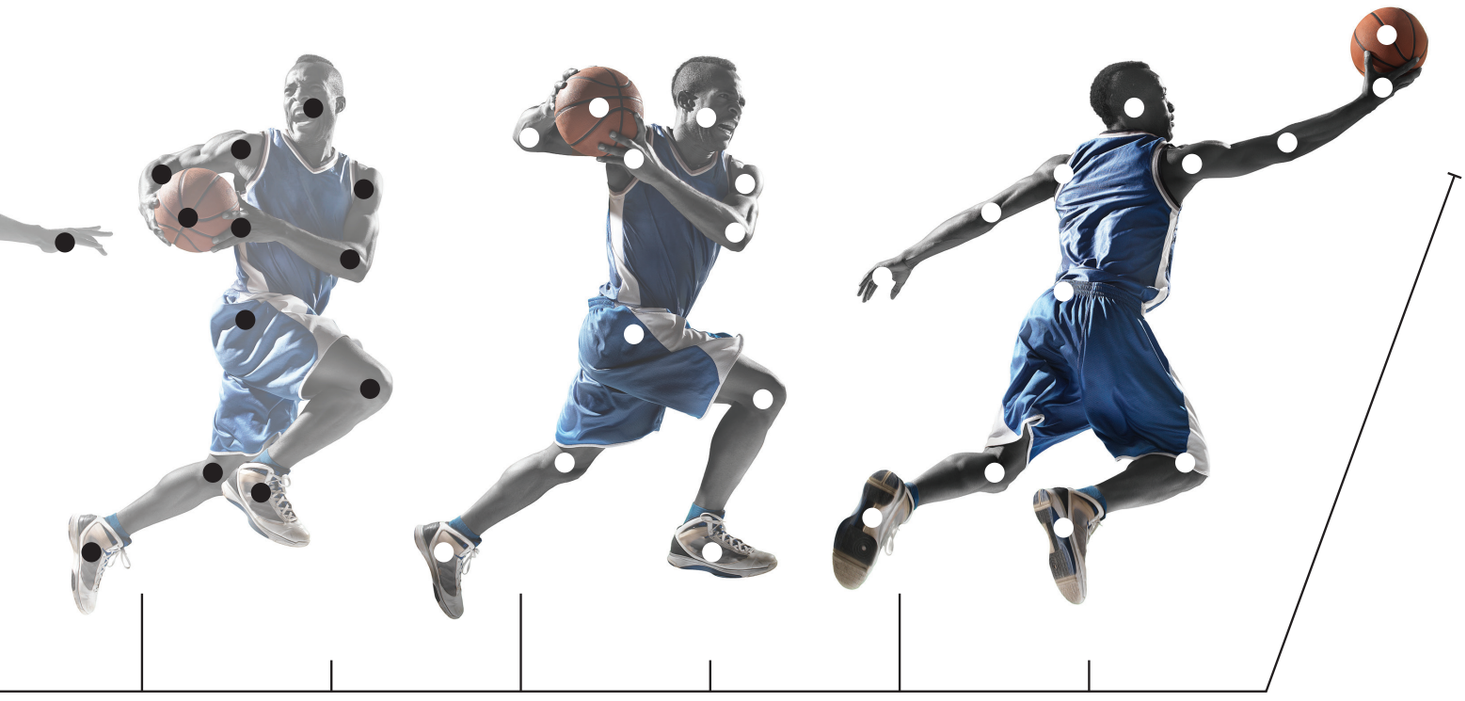
While scouts and managers used to watch films of past games—a laborious and time-consuming process—Robinson notes that programs today break the field into a grid, capturing 10 measurements per second per player. "If you watch that over enough plays and games, you start to learn things," he says.

Perhaps the most effective approach is combining human and statistical evaluations of talent—in other words, old-school plus new-school scouting. "It's hard to argue against general managers who've been in the league for a long time with a lot of success, and at times it's because they have this internal computer in their head," Robinson says. "Through life experience and what they know about the game, they intuitively make good decisions. But humans and computer models are imperfect, so using both approaches can provide a sound way to improve decision-making."

In his 2016 book *Sports Analytics and Data Science: Winning the Game with Methods and Models*, SPS's Thomas Miller, faculty director of the Master of Science in Data Science program (formerly the predictive analytics program), shows how franchises can use advanced data science and modeling to assess their competitive advantage and make more accurate predictions about future performance.

"More and more data are being collected about individual athletes and what's happening on the fields and courts," he says.

High-definition cameras above the court track the movement of every player for every second of the game.



"Teams recognize that these data are useful in making strategic decisions. They have to decide, for example, which players to include on the team—draft day and free agent decisions." Such big decisions, and even contract negotiations, can be informed by data. "These data are extensive," Miller adds, noting that on today's NBA court, teams know 25 times a second the location of the ball and every player on the court. In baseball, it's 35 times a second.

SportsVU is one of many tools teams use to measure their athletes' performance. In baseball, the pro sport that has most fully embraced analytics, everything from a runner's speed passing second base to the launch angle of the bat (and thousands of other statistics broken down by day of the week) is available. It's why the Chicago Cubs have a 10-person analytics staff headed by Chris Moore, who has a PhD in neuroscience and machine learning. "There's a strong push from the top to ingest data and maximize the use of analytics within the organization," he says.

Analytics isn't just for choosing the best players; it's also good for business. Especially popular in ticket departments, analytics is used to determine prices and ascertain why fans attend games. Patterns in data inform decisions about how much to charge not just for tickets but even for beer—analysts track scenarios like whether fans will purchase more food at the arena when the beverage costs two dollars less.

Chicago-based Adam Grossman, coauthor of *The Sports Strategist: Developing Leaders for a High-Performance Industry*, teaches two courses in SPS's Master of Arts in Sports Administration (MSA) program. In Entrepreneurship in Sports and Sports Management Analytics, he outlines how analytical models are used to understand value on the business side and how data are used to drive decisions.

Grossman is also CEO and founder of Block Six Analytics, which uses models to measure the value of advertisements and sponsorship for clients that include Pepsi and the Cleveland Browns. When companies spend millions of sponsorship dollars on team sports, analytics is critical to determine the advertising value of stadium billboards that can be seen on TV, as well as the value of social media conversations around a particular team or game.

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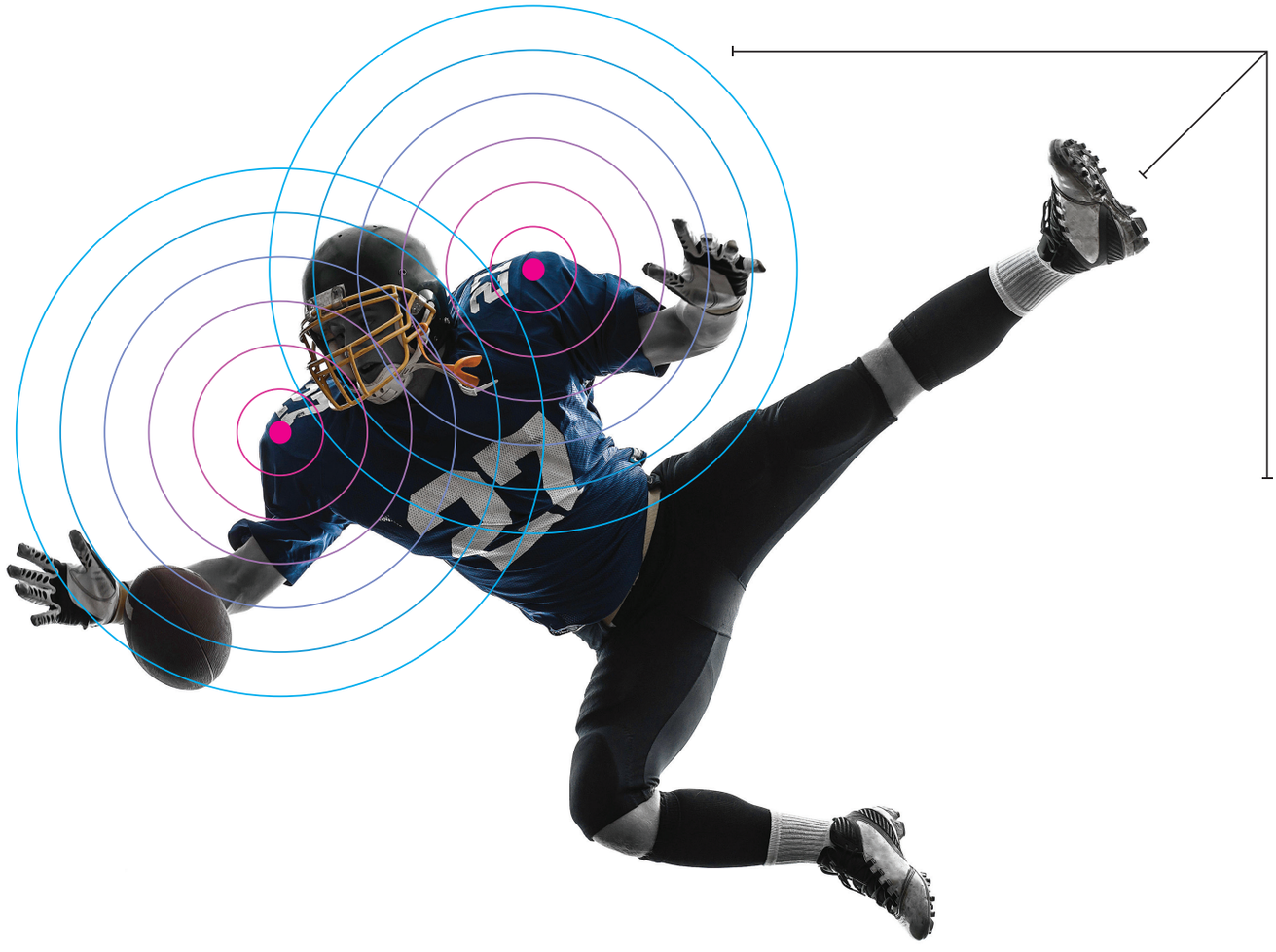

Block Six uses its machine learning technology to accomplish these goals by automating data collection and analysis. For example, it determines how often a sponsor's logo appears on a television screen during a game, how much of the screen it takes up, and how close it is to the center of the screen—all of which affect how many viewers see the logo.

When it comes to social media, Block Six can analyze posts and tweets, measuring positive and negative reactions as well as how many people are seeing posts and their overall value to the brand. The results are then housed on the company's web-based platform, complete with insights into what drives value.

"My company has seen a big shift in people looking for data on sponsorship, event marketing, who goes to events, and levels of engagement," Grossman explains. "Sports analytics is only going to grow as the technology and amount of data coming out get better. People want data and numbers more than ever to drive decision-making, and people who can communicate that will have a significant advantage."

For Bryan Joel, assistant basketball coach at the University of Chicago, earning an MA in sports administration from SPS and specializing in data science have given him the math and computational skills he says are necessary for a future job in pro sports.

"I love coaching," says the Caltech graduate, who played point guard and captained his team in college while earning a bachelor's degree in mechanical engineering. "A lot of NBA organizations, along with a few college programs, have sports analytics teams to help guide their coaching staff, whether it's for player acquisition, scouting reports, or how to help your team win," he says. "The SPS program gave me the skills I need, and I want to apply this skill set on the operations side."

EXPLORING SPORTS ANALYTICS

Interested in sports analytics? Students can take courses through the School of Professional Studies by pursuing any of these three routes:

Enroll in the **Master of Science in Data Science** program and choose Sports Performance Analytics and Sports Management Analytics as electives. (This fully online option requires 12 courses, with two focused on sports analytics.)

Enroll in the **Master of Arts in Sports Administration** program and pursue the Sports Analytics specialization. (This option requires 11 courses, with two focused on sports analytics. All classes are offered online, and the non–data science courses are also offered on campus.)

Enroll in the **Sports Analytics Certificate** program, open only to students with an advanced degree. (This online option requires four courses, with two focused on sports analytics.)

For more information on these degree and certificate programs, visit **sps.northwestern.edu**.

Current MSA student Kelly Noonan, who works in marketing for a food company, is focusing on the business end of analytics. "This is the most exciting change I've made in my career," says Noonan, who's already applied elements from the program at her current job. Her dream is to work for the new NHL franchise Vegas Golden Knights after graduation. "The MSA program is a great synergy of my passion for marketing with sports—an industry that I love," she says.

That industry will only keep growing. "Computers are getting smarter, we're getting smarter, and algorithms are getting smarter," concludes Doug Bakker, faculty director of the MSA program and associate athletic director at DePaul University. "Analytics is the new frontier."

—Anne Stein