Big Data Analytics Drives New Athletic Advantage

The fall of Lance Armstrong, Alex Rodriguez, and other American sports heroes illuminates how widespread PEDs (performance enhancing drugs) have been as a route to optimizing athletic performance. Quite simply, PEDs enable athletes to recover from training faster. More recently, a new movement, known as “Quantified Self”, is showing great promise through the use of data and technology as a safer option to naturally increase strength, endurance, and accelerate recovery. With a flood of sensors and smartphone apps that record physiological and psychological data, athletes are able to analyze performance factors like never before.

In a sport where milliseconds matter, the 2012 U.S. Women’s Olympic cycling team found their competitive edge in an unlikely place – in the data and the insights within the data. After a disappointing finish in the 2012 World Championships, the cycling team turned to Olympic cyclist Sky Christopherson, who had personally leveraged the quantified-self movement in his training to break a world record. Sky established an experimental project to help the team record and analyze relevant data that could reveal actionable insights for optimizing their athletic performance.

Three months prior to the 2012 London Olympics, the indoor velodrome proved to be an ideal experimental space. In addition to controlling temperature and humidity, velodrome cycling also has the unique feature of precise quantifiable athlete output via stress sensors contained inside the bicycles and recording every 100 milliseconds. By correlating this performance data with health data tracking such as sleep cycles, circadian rhythms, continuous blood sugar levels, blood biomarkers such as Vitamin D, and hormone levels, Sky set out to uncover patterns between health and performance. Not only did they have the challenge of recording relevant data, they also had to find a way to integrate, analyze and visualize all of these data points to reveal insights they could incorporate into training.

Faced with a complex and vast set of raw data, the team needed a solution that could help them bring all of the data together and quickly reveal critical patterns that could optimize performance. The sheer amount of data, and with each device producing different types of data (often in unstructured formats) meant that traditional database and business intelligence technologies were not an option.

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Sky Christopherson, 2012 U.S. Women’s Olympic Cycling Team Professional Trainer

“This deluge of big data created a new set of problems. “In the beginning we said to each other, ‘Wow, we have all this great data,’ but it became very hard to manage,” he noted. “You know, we were sampling at one second, 24 hours a day, 7 days a week from all these different devices. And it got really overwhelming.”
The data eventually became impossible to manage with their existing software applications. “I remember at one point the spreadsheet was taking longer and longer to open, until one day I got the spinning wheel of death, and it just completely locked up,” said Christopherson.

Instead, they turned to Datameer’s big data analytics application. Because Datameer sits on top of Hadoop, an unlimited storage and computing platform that can take in any amount of data and any data format, the team could easily ingest, join, analyze and visualize how all of the sensor and device data was interconnected. Datameer “had nice ways to integrate, evaluate and see the data, which gave us insights that were impossible to see before,” said Christopherson.

Immediately, the team learned how daily routines and behaviors could be adjusted to naturally maximize human performance. For example, patterns revealed how room temperature affected the number of minutes spent in deep sleep, a state where bodies naturally release testosterone and human growth hormone. One insight his team uncovered was related to the athletes’ circadian rhythms.

“We saw in the data that early morning sun exposure … not just on the skin for Vitamin D synthesis, but actually in the eyes … was kind of anchoring biorhythms, and that was related to sleep latency and quality, which improved recovery,” Christopherson recalled.

“When we got to London, where it was cloudy and overcast, we actually used light box therapy in (the athletes’) rooms in the Olympic village to ensure they had the same sleep cycles, along with temperature control and some other things,” he added. To increase the amount of deep sleep the team experienced, they adjusted temperatures accordingly. Ultimately, adjustments such as these ended up making the difference between winning and losing. The team went from a five-second deficit at the world championships to earning a Silver medal in the 2012 London Olympics by 8/100th of a second. — a triumphant feat that was achieved not only through dedication and athletic ability, but also through enhancing training with insights gained from analyzing big data.

The cyclists’ silver medal performance was far better than expected, a showing that Christopherson attributes, at least in part, to insights gleaned from the collected data. “I think the exciting thing about this project is that we went into this five seconds down, not even close to the medals, and we came away with a silver medal. And I think that’s more than any of us could have asked for,” he said.