Undergraduate Thesis Prospectus

Design of a University of Virginia Sports and Performance Analytics Center

(technical research project in Systems Engineering)

Performance and Privacy: The Proliferation of Data Analytics in Athletics

(STS research project)

by

Sarah Nelson

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Technical Project Collaborators:
Aniket Chandra
Jacqueline Hoedge
Rishab Iyer
Rachel Kreitzer
Mary Lansing
Ben Metzger
Carl Rhodes
Daniel Ungerleider
Peter Worcester

On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

signed: _____ date: _____

approved: _____ date: _____
Peter Norton, Department of Engineering and Society

approved: _____ date: _____
William T. Scherer, Department of Systems Engineering

General Research Problem

How are advancements in data analytics affecting collegiate and professional sports?

The explosion of data has transformed athletics. Ramon Alonso, holder of the sports telemetry system patent, says that the "gathering, processing, and use of data and statistics are an important aspect of the business, analysis, and appreciation of sports" (Alonso, 2012). The publication of the book Moneyball (Lewis, 2003) sparked a new national appreciation for sports analytics, evident in "Fantasy" leagues, sports betting, and commercial sensors such as Fitbit. As analytics develops, controversies over data collection and usage ensue.

Design of a University of Virginia Sports and Performance Analytics Center

How should a performance and sports analytics center be designed at UVa for maximum athletic, academic, and financial benefits?

The advisor for this capstone is Professor William Scherer of the Systems Engineering department and the collaborators are Aniket Chandra, Jacqueline Hoedge, Rishab Iyer, Rachel Kreitzer, Mary Lansing, Ben Metzger, Carl Rhodes, Daniel Ungerleider, and Peter Worcester. This capstone project will, via a systems analysis approach, develop design options for a sports and performance analytics center at the University of Virginia. Our overarching goal is to enhance performance and collaboration among academia and athletics at UVa.

The 2018-2019 collegiate athletic season for the Virginia Cavaliers was considered one of the most successful years for any college sports program (McElroy, 2019). The Virginia Cavaliers were awarded "National Champion" status in two sports: NCAA Division 1 Men's Basketball and Men's Lacrosse. However, for the Virginia Athletics department to continue to operate at the highest level they must adapt their approach. Bradley Smith, a sports performance

analyst at Northwestern University, stated “I think that very soon we’re going to see that the teams that don’t use analytics — they’re going to be left behind.” (Smith, 2019).

Currently, data collection methods vary across Virginia sports teams. For example, the Women’s Soccer head coach, Steven Swanson, recently introduced impressive analytic tools he used while working with the U.S. Women’s National Team. This data includes tracking heart rate through Catapult and Polar sensors, real-time game analysis via film and sports code, as well as self-reported personal health data. (Swanson, 2019). Yet there are some teams at UVA that do not use analytics yet. When asked about the prospect of an analytics center, Andres Pedroso, director of Men’s and Women’s tennis at UVA, said:

> It would be incredible to have a team of experts help us monitor the volume, intensity and toll on the bodies that our student-athletes are experiencing in their training and competition. [They] could help us individualize how we prevent injury, regenerate their bodies and help them recover from their training and matches. (Pedroso, 2019)

Ted White, the Assistant Athletic Director and this capstone project’s sponsor, argued; “We need a structure that would allow all the teams to collect, process and analyze the data efficiently with dedicated resources to provide a competitive advantage.” (White, 2019).

The University of Virginia’s Strategic Plan, or “The 2030 Plan,” is an outline of goals and initiatives the university’s administration has set out to be achieved by the year 2030. One of the aims of the plan is “To become the best public university in 2030, and one of the very best in the world, whether public or private …To support this work, we will invest in our data and analytics capabilities.” (U.VA. Office of Communications, 2019). One proposed way to utilize data and analytics and raise U.Va’s reputation is through increasing opportunities in sports

analytics. This will allow students to take classes in data analytics or work with teams to get real-life exposure.

The objective of the team's technical project is to design and develop a proposal for a Sports and Performance Analytics Center at the University of Virginia. This center will encompass both athletic and academic initiatives, and be integrated as a "pan-university resource" for all stakeholder departments at the University of Virginia (Scherer, Personal Communication, 2019). This project is a two-semester long research capstone that will cover a range of areas starting with initial out scoping and ending with the hopeful outcome of a presentation to the Office of the President. We will conduct interviews with several stakeholders, research the established programs at comparative schools, and produce financial models for the center.

Whilst working with the Athletics Department on designing the sports analytics aspect of the project, we aim to collaborate with various academic departments on the education analytics side. As with most academic initiatives, funding for the project is a critical factor in development (Groves, 2019). We will research the various fundraising mechanisms the university already has at its disposal, including the donation programs and alumni outreach. We aim to write a group paper in the form of a proposal or the findings of a feasibility study.

Performance and Privacy: The Proliferation of Data Analytics in Athletics

How does increasing data analytics in sports divide athletes, coaches, fans, and leagues?

Sports analytics can improve both team and individual performance, but with ethical implications about data collection, usage, and dispersion. Biometric and performance data in athletics threatens athletes' personal privacy. Some athletes may be traded or faulted on the basis

of their biometric health data. Coaches will support analytics if it helps them improve. Can data analytics replace human expertise in sports, or merely supplement it? Groups are divided over such questions.

Participants include the athletes represented by the National College Players Association (NCPA, 2019), coaches and trainers (NCAA, 2018), sports analysts (Jahnke, 2019), and sports fans (ESPN, 2019). Athletes are represented by the National College Players Association, which seeks to "protect future, current, and former college athletes." According to Katie Yentz, a men's hockey analyst at Boston University, the goal of sports analysts is to "help the coach know the team as well as he can," so as to "*objectively* assess strengths and weaknesses" (Jahnke, 2019). The NCAA claims that coaches "mentor college athletes" (NCAA, 2018). Sports fans are evidently interested in the statistics, as ESPN provides constant data on its website.

Sports analysts claim data analysis is an indispensable tool for team performance, individual improvement, injury prevention, and fan base growth. Coaches and players can use predictive technology to study their opponents and develop game-winning strategies accordingly. For example, analyst Ray Hensberger used Major League Baseball data in a machine learning model to predict pitching behavior during games with 74.5% accuracy (Fried & Mumco, 2017). Players can also use analytics to their advantage. Brandon McCarthy, once a pitcher for the Arizona Diamondbacks, began to study his own statistics relative to successful pitchers, and improved his performance enough to receive a better contract offer with the Oakland Athletics (Davenport, 2014). Coaches can use biometric data to improve injury performance and recovery. For example, after implementing analytics, the Seattle Sounders saw a 67% reduction in game days lost due to muscle injury from 2012 to 2014 (Karkazis & Fishman, 2017).

Data analytics requires consistent monitoring, which can be intrusive to an athlete. According to the Karkazis and Fishman (2017), “there are few regulations governing the use of biometric devices in professional sports.” Thus, some athlete data could harm the athlete’s employment prospects (Osborne & Cunningham, 2017). Alex Ferguson, British soccer manager, traded his defender, Jaap Stam, due to match data. He later called it the “biggest mistake of his career” (Anderson & Sally, 2014). Analytics serves manifest and latent functions (Merton, 1949). The manifest function is to improve a team’s overall game performance; a latent function is to evaluate players.

Some college athletes may not trust the data produced by wearable sensors and what is done with it. At the University of Michigan, a $170 million contract allowed Nike to collect data from the student-athletes wearing their sensors. A hidden clause grants Nike “the right to utilize … Activity Based Information … in any and all media…” (Nike & Michigan, 2016). While analytics can enhance performance, it can also threaten privacy and damage relationships. University of Virginia Men’s Soccer trainer Peter Alston claims he wants to build an honest relationship with his players – one where he can trust their self-reported data regarding hours of sleep and stress levels (Alston, 2019). Requiring student athletes to wear sensors, such as Nike’s, may break this trust.

Some contend that data collection and automation can be dangerous when it marginalizes the human expert. To those critics, data analytics is no better than traditional coaching. They argue that they do not need advanced technology to improve their players’ performance, and that because sports situations are unique, they cannot be reduced to numbers (Morgulev, 2018). A good coach must know a player’s mental state, personal life, and relationship to competitors require human expertise. This conflict is embodied in the career of Parag Marathe, chief

operating officer for the San Francisco 49ers. Marathe, a Stanford MBA and former Bain consultant with extensive analytics experience, has been disparaged as not a pure "football guy" (Morgulev, 2019). The growth of analytic capabilities in sports, while beneficial for performance improvement, may incur a loss of both sport expertise and data privacy.

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