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# AI as Infrastructure

*To address the essential needs of fans, sports venues need to reimagine AI technologies as a new form of infrastructure, solving problems that used to be addressed through brick, mortar, pipe, and personnel.*

# Introduction

The thrill of standing shoulder to shoulder with other fans, on your feet as the game clock expires, as your team buries the buzzer-beater, is inimitable and irreplaceable. It's this feeling of shared experience and the "power of togetherness" that keeps live sports, with attendant fans, a primary pillar of the sports industry. The global COVID-19 pandemic of 2020 that continues to shake the world has not only forced the sports industry to take a closer look at how we construct and design our live sports entertainment, it has also shaken the confidence of fans who continue to want the power of togetherness but who harbor concerns about the safety of attending live sports. The "return to play" has forced the whole of sports, from the professionals producing the contests to the fans adoring the action, to rethink our priorities and the role technology plays in bringing us all back together.

**Health**, **safety**, and **security**, will be three of the sports industry's top priorities over the next decade. The global COVID-19 pandemic demanded changes to our current approaches to infrastructure, exposing that the systems in place were not adequate for addressing a challenge of this magnitude.

Location-based entertainment, such as sporting events, concerts, and conventions, were postponed or cancelled to keep fans safe, and to buy time to begin identifying solutions to this challenge. With all the knowledge gained over the past year living with the pandemic, with intelligence developed through rigorous public health data analysis, and with the progress made through global vaccination efforts, the sports world is opening back up. Consequently, approaches to ensuring fan health, safety, and security must be reimagined.

At the heart of this reimagining is **Artificial Intelligence**. Advances in AI and Machine Learning are supporting the development of new solutions to old problems that used to be addressed by the live sports industry through **Infrastructure**. Whether providing data to better operationalize staff and personnel, creating contactless experiences that used to require physical interaction, or providing essential information to keep fans safe, AI is changing the live sports experience.

## What is Artificial Intelligence?

AI is technology that has been and will continue to work in conjunction with humans to improve overall human performance.

Artificial intelligence leverages computers and machines to mimic the problem-solving and decision-making capabilities of the human mind (IBM, 2021). Robert Muehlbauer, Senior Manager of Business Development at Axis Communications described artificial intelligence in its simplest form as using a machine or a computer to do tasks that a human would. The benefits are myriad and significant—with AI and computation, we can make workflows quicker and more efficient.

Over the years, popular conceptions of AI and Machine Learning have been shaped, for better or worse, by depictions in popular media such as film, television, games, and beyond. Sometimes presented as a seemingly endless futuristic possibility space, sometimes presented as a great threat to humanity, AI captivates popular imaginations. Not surprisingly, the realities of AI and ML do not conform to popular media depictions. AI is neither a technological panacea nor an existential threat. AI and ML are computational tools that have the power to make us more efficient and to make us smarter. At the end of the day, AI and Machine Learning exist to make our work and our lives easier and better.

## What is Infrastructure?

Infrastructure is the underlying system that creates the stability/foundation used to create a more healthy, safe and secure environment.

Infrastructure is the set of underlying systems, objects, materials, and operations that allow for the function of a venue. From the literal brick, and mortar of construction, to the plumbing for the bathrooms, to the wi-fi Distributed Antenna Systems, infrastructure represents the often invisible building blocks that create the platform of an arena, upon which live events like sports or concerts can run. Traditionally, infrastructure is conceptualized in terms of materiality—the physical matter, or substrates, that comprises the roads, pipes, electric lines, and beyond that make up our world. Perhaps not surprisingly, a turn in the late 1990s and into the 2000s toward considering digital and networked "cyber infrastructure" developed as our lives became increasingly networked and online (Edwards et. al, 2009). For the purposes of this report, and because of a focus on fan experience, we are adopting a broader, and as such complicated, framing of infrastructure that is put into a human-centered context, rather than focusing on the objects themselves (Star, 1999). Infrastructure is the set of systems, physical, digital, and operational, that enable a venue to function, and as such, enable fan experience.

It is incumbent upon stadia operators and sports properties to change their thinking about the design of fan experience, and new pandemic-generated challenges that need to be addressed to ensure fan health, safety, and security. AI provides a suite of technologies, specific to problem-solving. that will play a foundational role in this change.

Today, because of the rapid evolution of AI technologies, we can consider the impact of AI on a larger scale. AI is the future of sports stadium infrastructure—replacing traditional building and repair practices and implementing data solutions to create a live sports environment that is healthier, safer, and more secure for fans.

**To address the essential needs of fans, sports venues need to reimagine AI technologies as a new form of infrastructure, solving problems that used to be addressed through brick, mortar, pipe, and personnel.**
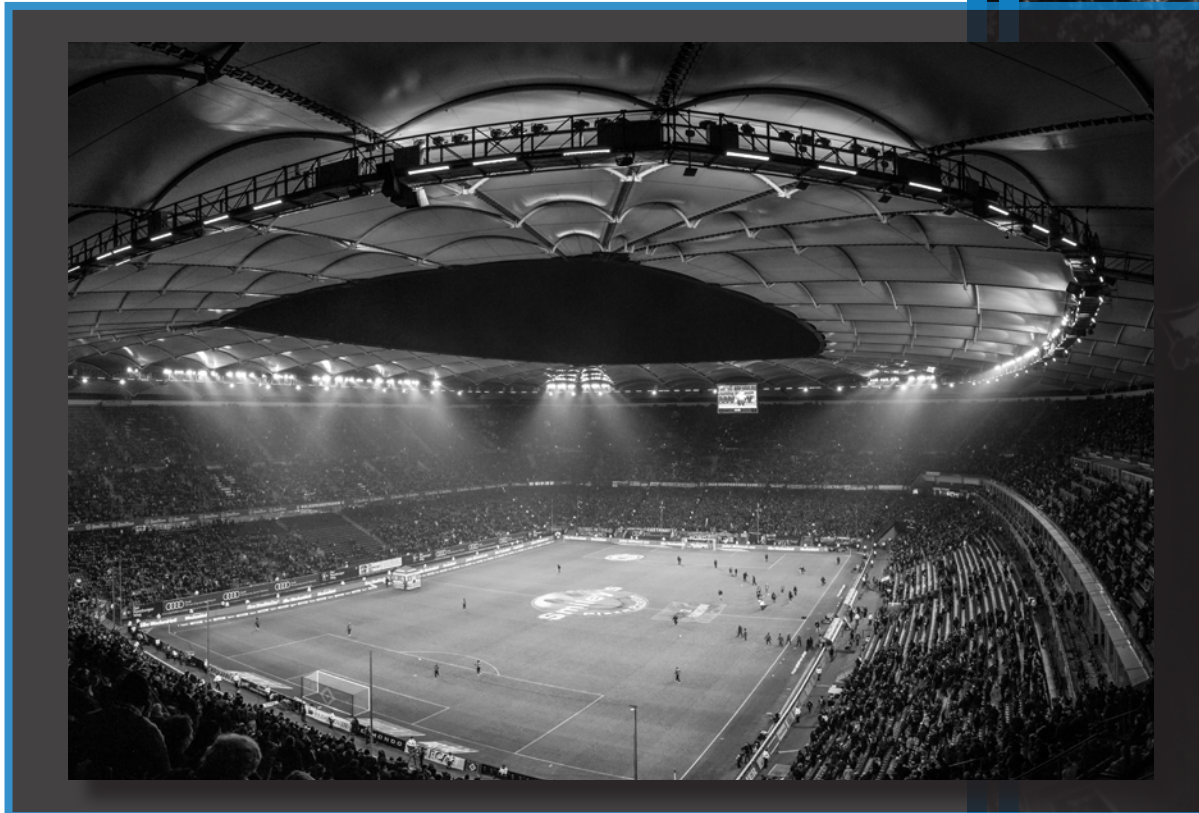
# Key Findings

## Health

Striving for a healthy community, new AI and ML technologies are pushing the boundaries of human capabilities to trace and prevent future health crises.

Public health is defined as promoting and protecting the health of people and the communities where they live, learn, work and play. At Sports Innovation Lab, we focus heavily on technology in sports and how data drives fan behaviors. Therefore, the communities we are concerned with are the venues/stadiums and the fans who attend. In efforts to change the existing infrastructure to be more innovative, we took pre-existing points and enhanced them with AI and Machine Learning. As we all know 2020 took the world by storm, the world-wide pandemic shut down everything. As we turn the corner into the new year the world is opening back up, and people want to get out of the house. The last thing people want to worry about is whether or not leaving the house will negatively impact their health. With AI solutions, venues across the globe can create healthier environments for everyone in attendance. Different places within the venue such as the medical triage or concession stands will be able to identify problems and react before people are made aware. In other cases AI and Machine Learning will enable Telehealth communications to allow video calls to be made to a doctor in an emergency. All of these applications of AI can improve the health, safety and security at venues.

## Safety

From reactive to predictive, AI and ML are creating an autonomous environment where people and things flow seamlessly through a space.

Data is how we keep people safe (William Baver from NTT). Taking a holistic view of venue operations, safety is the top priority. What people tend to overlook is the idea that both the fans and the venues have to work in partnership. AI enhances this communication between person and thing, creating an autonomous environment where touchless transactions and digital passports allow movement and flow through any space. The technology advancements in AI and

Machine Learning have allowed the sports world to evolve to a predictive model instead of a reactive model, telling stakeholders in real time when a problem could possibly arise and enable them to attend to it before it becomes a real threat. This is a game changer for venue operators, because it enables them to use preventative technology along with track customer behaviors. In this industry the fans drive change and implement progress, whereas venue operators implement change and track progress. With AI and Machine Learning, venues like MGM Resorts can lean on the data and create a predictive model to help with on site business and the flow of customers through the venue.

## Security

Knowledge is power, and with AI and ML, solving problems is as simple as collecting data, analyzing that data and then communicating findings, turning a potential problem to a non existent one.

AI and Machine Learning are being implemented in every facet of security. Physical and cyber security will continually be a main focus for venue operators and fans. Knowledge is power, so the more that technology knows, the better it will be able to output improved processes. In return, when the knowledge is made public, fans are able to digest it and change their behaviors to feel more secure. CTO and co-founder of Armored Things, Chris Lord, spoke on the democratic nature of data and the importance of understanding the problem, resources, partner companies, and areas to scale in order to be successful. The idea that data is a democracy, and understanding the problem, resources, and partner companies and where you want to scale can differentiate success.

# Case Studies:

## AI Model Detects Asymptomatic COVID-19 Cough

**Who:** Massachusetts Institute of Technology

**What:** MIT researchers have found that people who are asymptomatic for COVID-19 may differ from healthy individuals in the way that they cough. These differences are not decipherable to the human ear. But it turns out that they can be picked up by artificial intelligence.

**Why it Matters:** The evolution of AI is allowing for human capabilities to be enhanced. This AI model distinguishes asymptomatic individuals from healthy ones through forced-cough recordings, which people voluntarily submit through web browsers and devices such as cellphones and laptops. This will change the game for how people are screened before entering a sports venue, ensuring the health of the fan and preventing other fans from getting sick.

## Sell Beer Faster with AI

**Who:** Aramark

**What:** Aramark Concession company has created a "Walk Thru Bru", to increase sales and touchless interactions. These Mashgin units, which look a bit like large heat lamps, are able to scan multiple items at once, no barcode necessary. The kiosk uses AI technology to recognize that you've got a can of Corona and a bottle of Sierra Mist and charges you accordingly. Pay with your credit card, an attendant checks your ID, and you're on your way.

**Why it Matters:** Rethinking what health means in concessions AI is changing how we interact with each other and within a venue. The ability to order and self check out will decrease the touchpoints between individuals. This also increases sales and decreases long lines which will help with crowd control as well.

## "Selfie" Biometrics to Prove Identity

**Who:** Clear "Heath Pass"

**What:** Fans can use selfie biometrics to confirm their identity in the app, before answering a health survey. Clear kiosks for thermal body temperature scans and QR code checks are also expected to be available in at least some NBA arenas.

**Why it Matters:** Returning to live sporting events during a pandemic is difficult, but this technology will help facilitate the health, safety, and security of fans allowing them to watch games. Digital validation that fans are who they say they are and their vaccination status, will improve the overall health protocols and allow for venue operators to create an environment conducive to the overall health of all persons and personnel attending.

## Los Angeles Dodgers Partner With WaitTime

**Who:** WaitTime

**What:** WaitTime is a patented technology that is used to enhance attendee experiences through sophisticated crowd intelligence and management innovations.

**Why it Matters:** This artificial intelligence solution provides real-time insights about fans' experiences in and around Dodger Stadium.This enables management to ensure capacity and social distancing requirements necessary for the health, safety, and personal privacy of their guests. The overall understanding of where people are in the venue helps to ensure that they are safe but also to enhance the fans experience.

## INDYCAR using NTT Smart Solutions

**Who:** NTT

**What:** NTT Smart Solution at the core is a secure platform that captures real time data via sensors and micro data centers. With machine learning and AI helping to piece together data led content and storylines, NTT Smart Solutions looks to create a dynamic visual environment to enhance the fan experience.

**Why it Matters:** The goal of every sports venue is to create a safe environment for fans to feel comfortable to come back and participate in live events. NTT's Smart Solutions brings historical data, and learned patterns to detect and alert operations teams of a possible problem. Thus, allows for the peace of mind of fans, as they know that the venue operators are taking a closer look into what is going on in the venue. The integration of machine learning and AI technology allows for better decision making to be made for the entire operation. Understanding where people are and what they are doing helps with safety protocols.

## Uber and AI

**Who:** Uber

**What:** The Computer Vision Platform team has worked closely with product teams across Uber to enable scalable, reliable, and quick validation of driver identity when drivers go online. This facilitates the best end-to-end experience possible for users, making communication with the customers easier and more accessible.

**Why it Matters:** Transportation is a part of the fans journey, enabling them to get from point A to point B. By using AI to enhance the fans experience through safer vetting processes of drivers and ransparent communication with the fan, Uber is positively impacting the fan's journey from the moment they leave their home.

## Minimizing Lag Between On-premise and Cloud-based Security System

**Who:** Genetec

**What:** Genetec Security Center 5.10, a security platform that reduces the gap between on-premises and cloud-based security systems.

**Why it Matters:** This new security system allows more system components to run in the cloud, reducing the gap between cloud and on-premises security systems and making it easier to connect external systems and tap external data for use in dashboards, maps and investigations without relying on complex, specialized integrations. All of this enhances an operator's situational awareness which in return creates a safer environment for those in the venue.

## Contact Tracing Applications using ML

**Who:** Kinexon SafeZone

**What:** The SafeZone tag alerts users when they break social distancing rules and monitors who they are in close contact with.

**Why it Matters:** Contact tracing has proven to be very beneficial in the last year. These tags that were once for tracking an athletes performance are now tracking things, people and assets. This allows teams to not only know where they have been but also where other teams and athletes who tested positive.

## Innovative Metal Detection

**Who:** Liberty Defense

**What:** Hexwave is an artificial intelligence-powered security system that uses AI to search for potentially dangerous metallic and non-metallic objects. The entire scanning and decision process takes less than 0.2 seconds, reducing the amount of time that is usually taken for fans to file through security scanners when entering sports stadiums.

**Why it Matters:** Security is a main priority for venue operators, with the assistance of AI security can analyze and react to problems before they are noticeable. The implementation of this technology will ensure the safety and security of the fans attending the game. The scanners are very discrete and a passing fan might not even know they are under surveillance.

## Conclusions

As fan expectations at venues continue to evolve, and there continues to be heightened awareness around health, safety, and security considerations, it is critical for the broader live sports ecosystem to embrace technological approaches to ensure safe, comfortable, and ultimately enjoyable experiences for fans. Artificial Intelligence and Machine Learning are no longer "nice to have" technologies in the smart venue network, they are increasingly essential. AI and ML are infrastructure—critical systems that, together and as part of the broader infrastructure of a venue, provide the platform for fan experience.

Though we have reached an inflection point with AI and ML transitioning from possibility to necessity, the road forward is neither clear nor easy. As referenced throughout this report, computational technologies are best understood in the context of problems to be solved or needs to be satisfied, not as flashy or exciting integrations that simply check a technology box. Here are some considerations for sports properties and venue operators exploring how to more seamlessly integrate AI and ML technology into their operations.

### 1. Avoid Point Solutions

A point solution, or a single technology applied to one discrete problem, is an inefficient approach to addressing complex systems that can and should be supported by computation, AI, and data science. The right technology partners will help you understand that with proper and organized collection and analysis of data, myriad situations and challenges can be researched and intelligence generated to support strategy. Do not adopt a single technology that promises to "make bathroom lines shorter"—instead, understand the challenge, and explore technologies that will help you get smarter about strategizing solutions more broadly.

## 2. Data Is Only As Good As Your Network

Collecting, analyzing, and operationalizing fan data is of critical importance to the future success of live sports, but your ability to effectively do so depends on the quality of your network infrastructure. To put it simply, fans expect to be able to have fast and frictionless connectivity at your venue. This means that the first and most important step to making use of AI technologies is to ensure you have a robust network of DAS and Wi-Fi access points installed and ready to handle the bandwidth load of your venue at capacity.

## 3. Expand Your Technology Partnerships

Just as important as avoiding point solutions, is understanding that no one technology partner can address all computational and data science needs. Interoperability of data and processes, especially as infrastructure incorporates computation like AI and ML, requires technology partnerships that work hand-in-hand. To push forward with AI solutions, establish a broad set of technology partnerships, and make sure to ask about how a vendor's technologies cooperate and function with other technologies in the marketplace. The stronger your network of technologies is, the more efficient and effective it will be in addressing needs and providing intelligence and solutions for challenges.

## 4. Give Your Technology Vision An Owner

Even the best ideas, with the most possibility for success, can only work with the proper guidance and vision. Your venue operation team needs to include a technology and innovation vision holder who can think systemically, and have a vision for how AI and ML technologies can work in an integrated way to address challenges and create new opportunities in your venue. This vision holder needs to have responsibility and vision beyond just Information Technology—they need to be thinking about fan experience, revenue opportunities, and venue operations as parts of an integrated technology system. This vision holder will be able to avoid costly and inefficient point solutions, instead opting for technology integrations that work to address multiple needs.

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