Five Ways Data Science Is Improving EMS

ImageTrend

Introduction

EMS and healthcare are more data-driven than ever. With access to vast data and the ability to use it to build predictive models, EMS teams can gain insights that help streamline operations, make care more efficient, and ultimately improve patient outcomes while driving down costs.

However, for all it can do, data science is not a magic box. Humans are still needed to collect and assess data, ensure that models are accurate, and verify the results. By working together, data science and EMS teams can achieve better outcomes with insights that inform decisions on everything from treatments to work scheduling.

What Is Data Science?

Data science refers to the study of information to extract meaningful insights. It combines principles and practices from fields like mathematics, statistics, artificial intelligence, and computer engineering to analyze large amounts of data. Data scientists design relevant questions, organize information, and translate the results to find solutions to problems or to improve products or services.

While data science and artificial intelligence (AI) are closely related, they aren't the same. AI systems rely heavily on data to function by finding patterns in it. Data science provides the methods for collecting and analyzing this data, which AI systems then use to learn and improve.

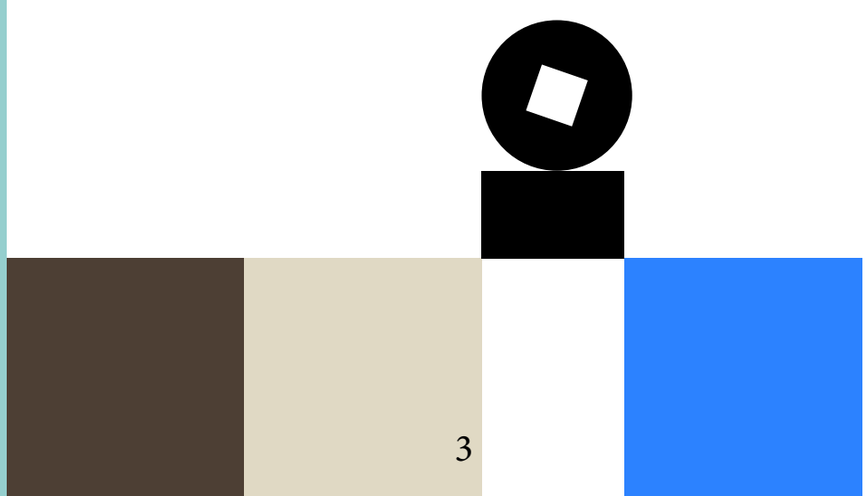
In essence, data science provides the information and analytical techniques, while AI uses that data to learn, make decisions, and perform tasks that mimic human intelligence. With its powerful computational ability, AI generates data-driven insights much faster and at a larger scale than humans can.

Examples of Data Science and AI in Everyday Life

Chatbots

Facial recognition software

Product recommendations



Limitations and Bias

Many people worry that AI will put them out of a job. AI excels at automating repetitive, predictable, and rule-based tasks, but it has significant limitations. It can misinterpret data, omit information, and even generate misleading or incorrect outputs.

AI SHOULD ALWAYS BE VIEWED AS A DECISION SUPPORT SYSTEM, NOT A DECISION MAKER, particularly in healthcare. While AI can assist in analyzing data and identifying patterns, relying solely on AI-generated diagnoses or recommendations without human clinical judgment is reckless and risks patient safety. Human providers bring invaluable expertise and the ability to assess immeasurable factors that may influence a diagnosis or decision. EMS providers should feel confident in questioning any AI-generated output that seems inconsistent with their clinical observations or judgment.

The effectiveness of AI also hinges on the quality and quantity of the data it's trained on. This means humans must recognize where errors might be introduced into predictive models. For example, in the case of a 12-lead ECG, patient or ambulance movement can affect the baseline, potentially leading the model to misinterpret ST-segment elevation. In such scenarios, clinicians should verify the data by obtaining a new ECG under better conditions or rely on their own interpretation to ensure accurate assessment.

Bias is another ongoing challenge. EMS and healthcare already face disparities in areas like stroke recognition, trauma triage, and pain management. If AI tools are trained on biased data, they may create models that reinforce and even amplify these biases. Addressing bias in data requires vigilance and ongoing oversight by humans to ensure tools provide accurate, fair, and equitable insights.

For these reasons, human oversight remains essential. By combining the power of AI with clinical judgment, healthcare professionals can enhance decision-making while safeguarding patient outcomes.

AI Errors & Bias in Data

AI ERRORS

AI has shown its value in many areas but isn't without flaws. AI tools can misinterpret data or generate incorrect outputs, underscoring the need for human oversight.

Example:
Predictive models, such as those used for 12-lead STEMI interpretation, have demonstrated bias in certain cases. For instance, young, healthy African American male patients often exhibit benign ECG patterns that may mimic ST-segment elevation myocardial infarction (STEMI). This can result in false positives, where the model inaccurately interprets a STEMI when the patient is not experiencing one. Such errors underscore the importance of considering clinical presentation alongside model outputs when deciding to activate specialty teams. Learn more.

BIAS IN DATA

Bias is an ongoing challenge in healthcare data. It has been shown that certain areas, such as those with a larger proportion of minority groups or communities characterized by residents with lower socioeconomic status, have historically received slower responses from EMS. An AI system trained on this data might predict lower urgency for those areas, thereby reinforcing the bias and potentially harming patient outcomes.

Five Uses of Data Science in EMS

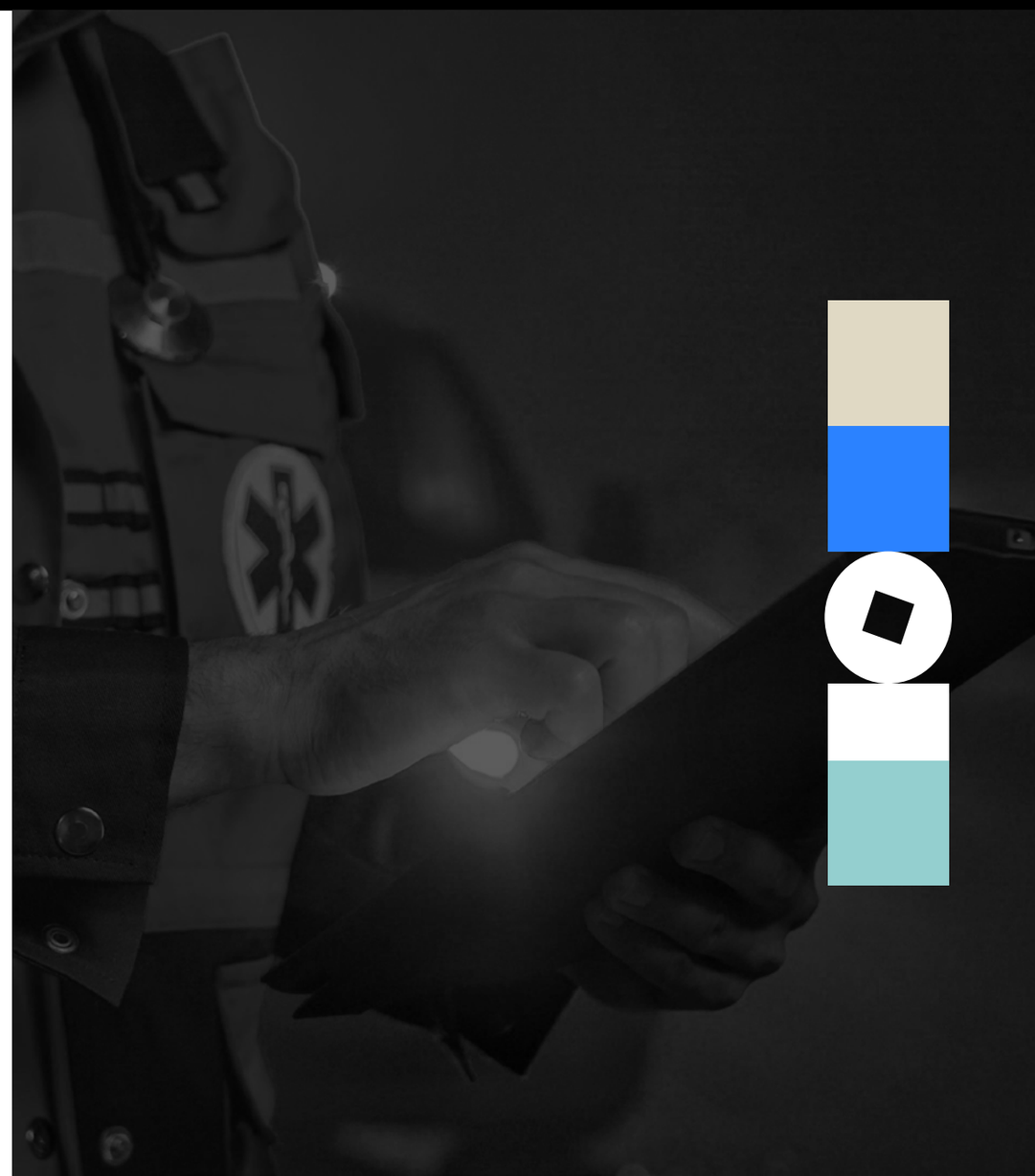
These are five ways that EMS agencies can use data science to support operations and enhance planning.

1 Enhancing ePCR Narrative Efficiency

The EMS narrative is essential for capturing details not included in structured data fields, such as how the patient was found, who called EMS, and changes in condition. These critical elements require human judgment and should not be replaced by AI-generated text.

However, AI can assist by suggesting data inputs based on voice dictation or other structured elements, as seen with ImageTrend's new AI Assist feature. Rather than auto-populating fields, this tool provides suggested inputs that the end-user can review and verify for accuracy before accepting. This ensures the integrity of the narrative while streamlining documentation tasks.

To save time while maintaining high-quality documentation, EMS providers should consider tools like voice dictation and AI-assisted input suggestions. Importantly, all AI-generated data must be verified by the EMS provider before it is incorporated into the patient care record, ensuring accurate, patient-centered reporting.



Five Uses of Data Science in EMS

These are five ways that EMS agencies can use data science to support operations and enhance planning.

2 Workload Management

EMS agencies can use data to improve the precision of priority dispatch and build models that distribute the workload among teams more evenly. The model could learn to distinguish between low-priority and urgent 911 calls. The agency could then assign units that typically experience fewer calls to specific shifts to even out the workload. This could even be used to determine if a call is appropriate for a scheduled visit from a community paramedic unit instead of using emergency resources.

3 Fatigue Management

Fatigue among healthcare and EMS providers is a common issue that can lead to job dissatisfaction and impact patient care quality. Data analytics platforms can help by analyzing factors such as EMS providers' self-reported fatigue levels, call volume, shift timing (day versus night), documentation requirements, and the ratio of transports to refusals. With these insights, EMS agencies can identify strategies to help reduce fatigue among their teams.

Five Uses of Data Science in EMS

These are five ways that EMS agencies can use data science to support operations and enhance planning.

4 Predicting Operational Fluctuations and Long-Term Trends

Hospitals use predictive models to forecast admission rates and occupancy, weeks or even months in advance. This allows them to take proactive measures to prevent a decrease in care quality by discharging low-risk patients or canceling unnecessary surgeries when a spike in ER or urgent care is predicted.

EMS agencies could use similar models to predict call volume and severity, enabling them to divert less severe and low-priority calls to community paramedicine groups or schedule a later visit.

On a larger scale, data on EMS usage, combined with population trends and growth, can help agencies accurately forecast the need for additional ambulances, equipment, and workforce resources.

5 Improving Diagnostic Accuracy

AI can support EMS teams by enhancing diagnostic accuracy, especially in high-stakes situations. For example, Corti, a Danish software company, developed an AI model to recognize instances of cardiac arrest during emergency calls. With this tool, cardiac arrest recognition improved by more than 10%. The time to recognize cardiac arrest was also shortened, enabling EMS teams to start CPR and other treatments faster.

However, Corti's creators emphasize that this AI model should complement, not replace, human dispatchers. The model works best when it alerts dispatchers, who can then ask follow-up questions to gather essential information and make the final decision. This approach reduces the risk of false positives while ensuring critical information is accurately assessed.

Transforming and Enhancing EMS with Data Science

Data science is a powerful tool for EMS agencies, helping to improve decision-making, optimize response times and resources, and enhance diagnostic accuracy—all of which lead to better patient outcomes. As the volume and variety of available data continue to grow, EMS agencies and their patients will benefit from new insights and predictive models.

However, using these solutions responsibly requires ongoing human oversight. Ensuring data quality, validating results, and eliminating bias are essential for accurate and fair AI outputs.

These data-driven tools are designed to support EMS teams, not replace them. As data science continues to evolve, EMS agencies will play an increasingly vital role in advancing public health and safety.

About ImageTrend

ImageTrend transforms incident data into actionable intelligence, empowering frontline teams to effectively manage surging demands and resource constraints, driving impactful change in the communities we support.

Founded in 1998, we serve more than 4,000 customers, including 20,000 agencies across Fire, Emergency Medical Services and Hospital segments. With our deep industry knowledge and advanced data analytics capabilities, we help our customers streamline operations, shape long-term strategies, and dramatically improve outcomes. Our comprehensive software solutions and dedicated team provide the confidence and intelligence first responders need to tackle today's challenges and prepare for tomorrow's uncertainties. Learn more at www.imagetrend.com.

ImageTrend

Intelligence that unlocks impact.