REPORT SUMMARY

FTA Report No. 0256
September 2023

FTA RESEARCH
FEDERAL TRANSIT ADMINISTRATION

UTILIZING ARTIFICIAL INTELLIGENCE WITH VISION-BASED SYSTEMS FOR MONITORING TRESPASSING – BEST PRACTICES

Background

As part of FTA's effort to promote continuous safety and operational improvements in the public transit industry, the research described in this report was conducted to give bus transit agencies helpful information on AI and vision-based monitoring systems that can help mitigate injuries and fatalities associated with trespassing events.

AI is a term that encompasses many functions in different systems. For this project, AI refers to all machine vision, computational algorithms, pattern recognition, and other tools applied to data collected specifically with vision-or video camera-based systems in the application of transit safety. As part of the process, online reviews, coupled with stakeholder interviews and surveys, were conducted to reach findings. The review identified vision-based AI applications, existing relevant standards, and areas for standards development for improving the safe operation of public transportation systems, all captured in the report.

Objectives

The primary objective of this project was to evaluate the deployment of AI applications with vision-based systems for monitoring trespassing to improve transit safety. It also identifies existing standards and recommended practices to address trespassing risk and includes a gap analysis to establish the need for additional standards, guidance, or recommended practices to support and further the safe operation of the nation's public transportation industry. the Salt Lake Sugar House Streetcar. The results of this research will serve to inform policymakers about the extent to which streetcar investments support USDOT strategic goals.

Findings and Conclusions

The online review revealed that there are several AI applications in the context of trespassing, including the AI algorithm known as Mask R-CNN (which has been effectively used in analyzing big video data in railroad trespassing cases), as well as other video analytics-integrated solutions. Existing documents revealed that AI-based algorithms are available to detect, identify, and categorize various types of events that occur along rail tracks. The concept of using vision-based AI systems for monitoring trespassing could be categorized into three main areas: 1) agency deployments, 2) vendor products, and 3) research studies.

Stakeholder input was gathered related to AI applications and the use of AI standards. Nine agencies responded to the survey and 44 percent confirmed using vision-based systems without the use of AI. Among the nine respondents, only the Tri-County Metropolitan Transportation District of Oregon (TriMet) was in the process of deploying vision-based AI systems. In addition, respondents indicated they are not currently using standards, guidance documents, or protocols related to vision-based AI systems. The two most important areas for standard development that were identified included 1) camera placement and specifications (e.g., field of view, operating temperature, resolution etc.) and 2) detection algorithm accuracy (e.g., false positive rate, false negative rate).

The review conducted as part of this project uncovered various standards related to vision-based and AI systems, including standards related to the selection of camera type for monitoring, detection and video surveillance systems; data output formats and privacy; and robustness, trustworthiness, and licensing of AI systems. However, documents elaborating on the behavior of AI systems, especially vision-based AI systems are limited.

Benefits

The use of vision-based AI systems may prove very useful in identifying areas with significant trespassing events and allowing adequate and timely response to these trespassing events. The benefit of this response and the utility of this technology overall may lead to reduced trespassing-related injuries and fatalities.

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Project Information

This research project was conducted by the Center for Urban Transportation Research (CUTR) at the University of South Florida (USF). For more information, contact FTA Project Manager Raj Wagley at (202) 366-5386 or Raj.Wagley@dot.gov.

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