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Driving Innovation

Artificial Intelligence (AI) and FHWA Office of Research, Development, and Technology (RD&T)

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SAXTON LABORATORY

Outline

- Federal Government Initiatives and Priorities.
- Early FHWA AI Research.
- AI and FHWA Projects.
- Traffic Management.
- Sensor Detection.
- Pedestrian Accessibility.
- Automation.
- Early Benefits of AI.

Overview

Executive Order on Maintaining American Leadership in AI

- **Issued on February 11, 2019.**
- **Purpose**: To sustain and enhance the scientific, technological, and economic leadership position of the United States in AI Research and Development (R&D) and the deployment through a coordinated Federal Government strategy.

Overview

Executive Order on Maintaining American Leadership in AI

- **Coordination**: The initiative shall be coordinated through the National Science and Technology Council (NSTC) Select Committee on AI.
- The coordination shall be implemented by agencies that conduct foundational AI R&D, develop and deploy applications of AI technologies, provide educational grants, regulate, and/or provide guidance for applications of AI technologies, as determined by the co-chairs of the NSTC Select Committee.

The Five Guiding Principles

1. **Drive technological breakthroughs in AI** across the Federal Government, industry, and academia in order to promote scientific discovery, economic competitiveness, and national security.

2. **Drive development of appropriate technical standards and reduce barriers to the safe testing and deployment of AI technologies** in order to enable the creation of new AI-related industries and the adoption of AI by today's industries.

The Five Guiding Principles

3. **Train current and future generations of American workers with the skills to develop and apply AI technologies** to prepare them for today's economy and jobs of the future.

4. **Foster public trust and confidence in AI technologies** and protect civil liberties, privacy, and American values in their application in order to fully realize the potential of AI technologies for the American people.

5. **Promote an international environment that supports American AI research and innovation and opens markets for American AI industries**, while protecting our technological advantage in AI and protecting our critical AI technologies from acquisition by strategic competitors and adversarial nations.

Federal Investment in AI R&D

The Executive Order results in the following:

1. The United States Department of Transportation (USDOT) considers AI in transportation an agency **R&D priority through a multimodal AI task force.**

2. The USDOT AI task force takes AI R&D priority into account when developing **budget proposals and planning for the use of funds in Fiscal Year 2020 and in future years** and increasing funding where applicable in Fiscal Year 2019.

FHWA AI Research

Overview

What is AI?

- Rule-Based Systems.
- Machine Learning.
- Generalized Human Intelligence.

What's New in AI Research?

- Traffic Signal Control.
- Transportation Network Services.
- Assistive Mobility.
- Cross-cutting Data Inference Tools.

FHWA AI Research

Overview

Traffic Management

Using AI incident detection and data collection versus conventional algorithms.

Sensor Detection

Datasets that offer continuous video and sensor-reading data.

Pedestrian Accessibility

Exploring AI machine learning to transform independent mobility for people with disabilities.

Automation

Equip vehicles and infrastructure with the ability to enable the safer and more efficient movement of goods and services.

FHWA AI Research

Project

Traffic Management

- Delaware DOT.
- Exploratory Advanced Research (EAR) Program.
- Traffic Signal Control.
- Vehicle Tracking by Loop Detectors.

Sensor Detection

- Strategic Highway Research Program (SHRP2).
- EAR Optical Sensor and Image Data Processing.

Pedestrian Accessibility

- Accessible Transportation Technologies Research Initiative (ATTRI).
- EAR Robotics.

Automation

CARMA[SM]

Traffic Management

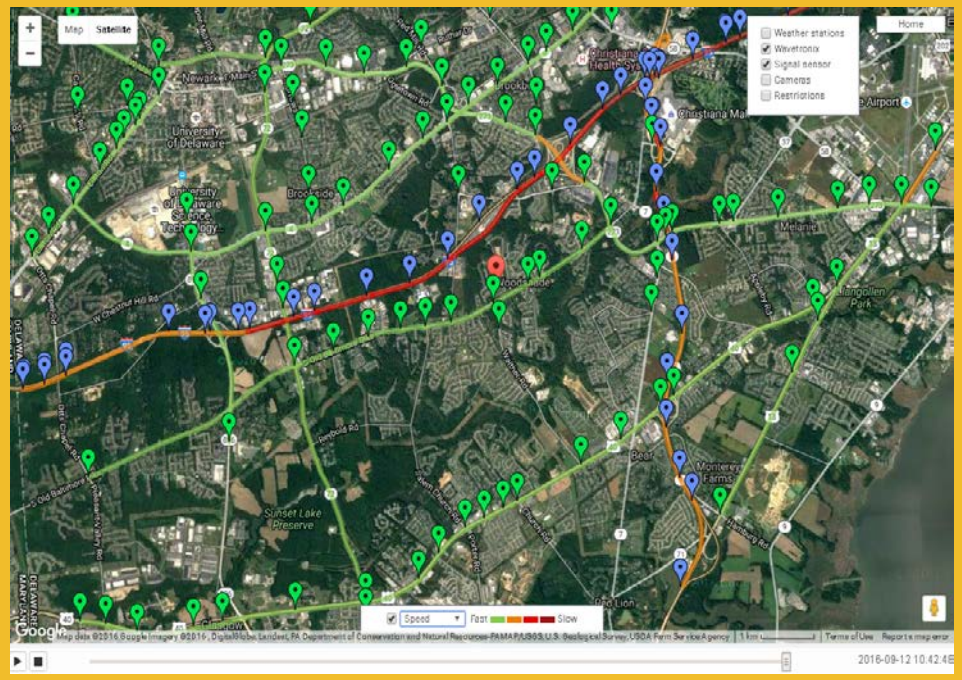
Projects

Delaware DOT

AI Integrate Transportation Management System (AIITMS) Deployment Program and EAR Program.

Research Topics:

- Develop an AI Tool to support Traffic Management Center (TMC) operations and arterial corridors by collecting information about better timing.
- Build a computer/AI-based tool to enhance TMC operations.
- Build a foundation which can support the automation or semi-automation of TMC operations in the near future.



Detection System

Blue: Digital Radar.

Green: Other Traffic Sensors.

AI Sensor Detection

Projects

Video Analytics

Safety Data Analysis Team

- SHRP2 datasets offer continuous video and sensor-reading data.
- These data allow better understanding as to how crashes happen.
- Machine Learning data from the Highway Safety Information System (HSIS) breaks down huge amounts of information into “bite-sized chunks.”

Pedestrian Accessibility
Projects

ATTRI

- Support independent travel through transportation hubs, cloud-based autonomy, and shared helper robots.

EAR Program

- Transform independent mobility for people with disabilities with machine intelligence.
- Research human-machine interfaces and novel mobility platforms (personal vehicles).

Source: FHWA.

Automation
Projects

CARMA[SM]

- Enables the testing and evaluation of cooperative automation concepts through open source software (OSS).
- Equips vehicles to interact and cooperate with infrastructure and informs vehicles about what's ahead and what to expect.
- Supports Transportation Systems Management and Operations (TSMO) strategies.
- Encourages collaboration between researchers.

Source: FHWA.

Cooperative Automation USE CASES

TSMO PROOF OF CONCEPT TESTING AND EVALUATION

1 Basic Travel

Example scenarios:

- Engage in a platoon defined by a geofence.
- Leader maintains safe time gap.
- Followers maintain interplatoon time gap.
- Platoon size in one lane reduced from 5 to 2 cars.
- Possible maneuvers with other cooperative ADS-equipped vehicles.

2 Traffic Incident Management

Example scenarios:

- Reduced command speed entering traffic incident event.
- Determined by infield geofence.
- Lane change to provide space for first responders.
- Possible maneuvers with other cooperative ADS-equipped vehicles.

3 Weather

Example scenarios:

- Reduced command speed entering an area with low visibility.
- Defined by a dynamic geofence.
- Engage in larger time gap.
- Maintain lane guidance.
- Possible maneuvers with other cooperative ADS-equipped vehicles.

4 Work Zones

Example scenarios:

- Reduced command speed entering work zone.
- Defined by a stationary geofence.
- Lane change assignment prior to entering work zone.
- Maintain safe time gap thought the work zone.
- Possible maneuvers with other cooperative ADS-equipped vehicles.

Source: FHWA.

Artificial Intelligence

Early Benefits

- Enables computers to collect and analyze large amounts of data and form conclusions.
- Improves traffic flow at intersections and specific routes.
- Supports human decision making at TMCs.
- Provides incident detection and management.
- Predicts traffic demand.
- Administers traffic signal control.
- Delivers real-time traffic and weather conditions.
- Assists with trip planning and increasing situational awareness while traveling.

Discussion

Issues and Challenges:

1. Early Deployment Opportunities.
2. Private Sector Innovation.
3. Work Force Training.
4. Transportation Legacy Systems.
5. Data and Computer Processing Power.
6. Security, Privacy, Ethics, Liability.
7. National Leadership.

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Contact Us!

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