



American Association of State Highway and Transportation Officials

Hot Topics in Artificial Intelligence and Example Applications



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Top 5 Hottest Technologies

What are the top five hottest technologies?

Here are the **top five hottest technologies of 2025**, based on recent expert reports and market momentum:

1. Agentic AI (Autonomous AI Agents)

These smarter-than-ever AI systems can plan, execute, and adapt to complex tasks with minimal human oversight—think AI project managers, research assistants, or autonomous decision systems. Governance and trust frameworks are key concerns as these systems grow more capable. [Source](#) [+13](#)

2. Generative AI & Synthetic Media

From advanced text, image, and video generation to real-time interactive content, generative AI is reshaping creative industries and user experiences. This includes synthetic data—AI-generated datasets for privacy-safe and unbiased model training. [Source](#)

3. Quantum Computing & Quantum Technologies

Quantum is moving beyond theory. Companies like Google and IBM are pushing toward practical application in logistics, materials science, cryptography, and drug discovery. Quantum communication and sensing are also coming into maturity. [Wikipedia](#)
Additionally, major initiatives like the EU's funding plans and India's Quantum Valley and tech hubs reflect growing global investment. [Bloomberg](#) [+1](#)

4. Spatial Computing & Next-Gen Connectivity (5G/6G)

Blurring physical and digital realities, spatial computing (including XR and mixed reality) is becoming mainstream. Ultra-fast, low-latency 5G is widespread, while early 6G prototypes promise terabit-per-second speeds and terahertz communications. [TechCrunch](#)

5. Living Intelligence (AI + Biotech + Sensors)

A rising concept involving systems that sense, learn, adapt, and evolve in real time by converging AI, biotechnology, and sensor networks. These systems could revolutionize health monitoring, environmental sensing, and autonomous adaptation. [Wikipedia](#)

- **Agentic AI (Autonomous AI Agents)**
- **Generative AI & Synthetic Media**
- **Quantum Computing and Quantum Technologies**
- **Spatial Computing & Next-Gen Connectivity (5G/6G)**
- **Living Intelligence (AI + Biotech + Sensors)**

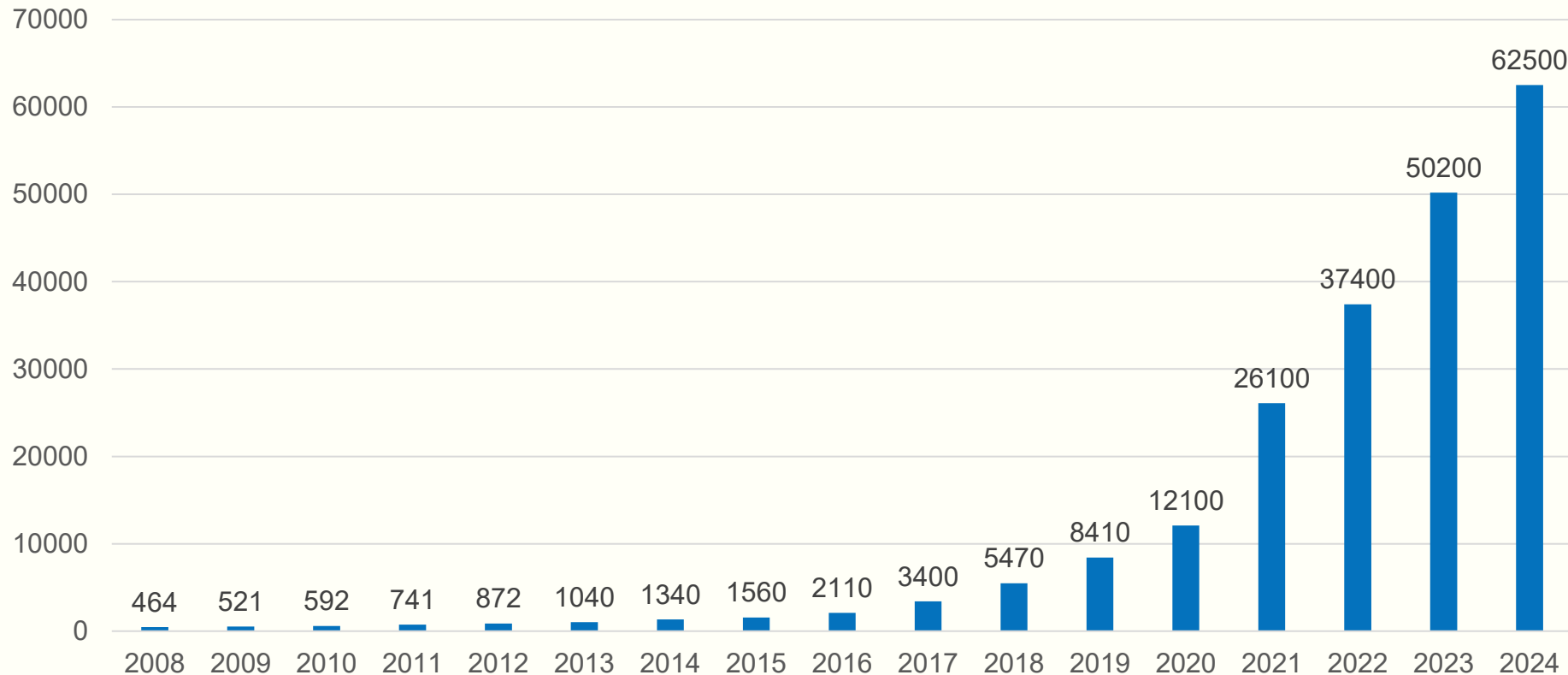


AI Is Hot in Transportation Research

Published papers on AI research and applications in transportation

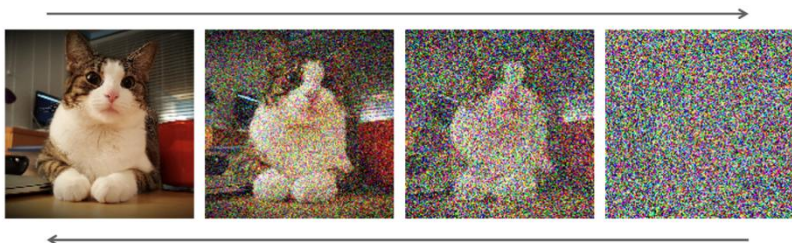
Data source: Google Scholar

Paper Publication related with AI & Transportation

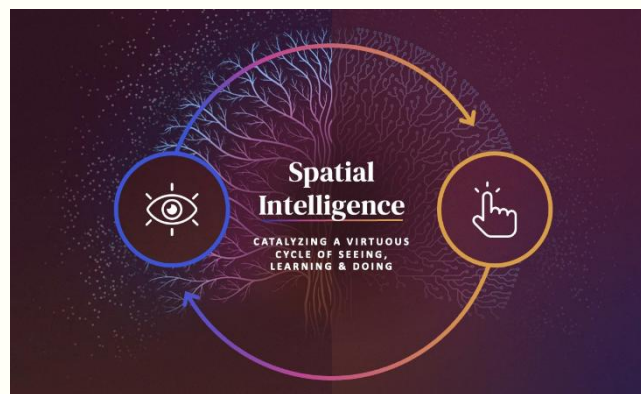


Hot Topics in AI for Transportation

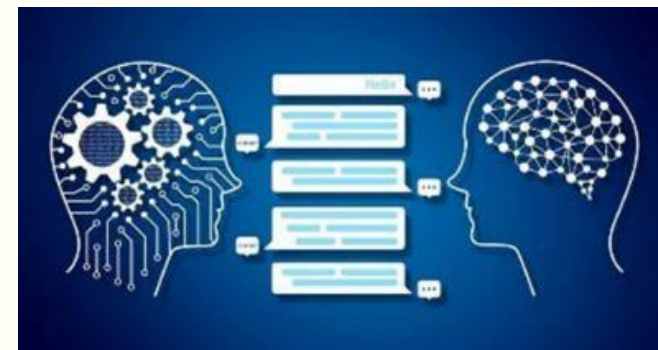
Diffusion Model



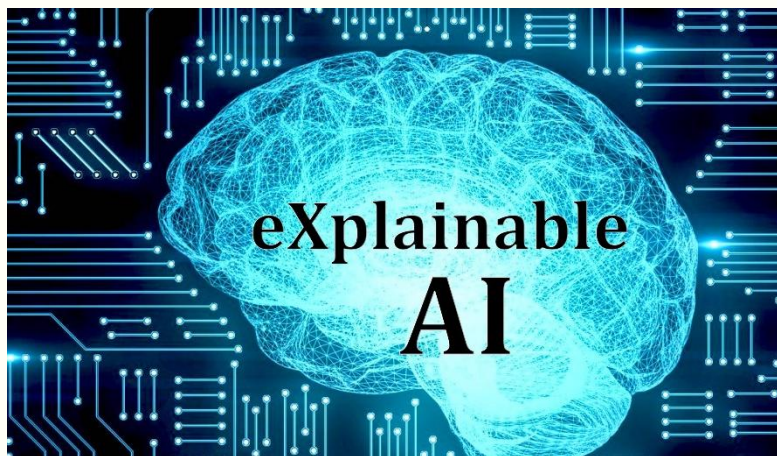
Spatial Intelligence



Large Language Model

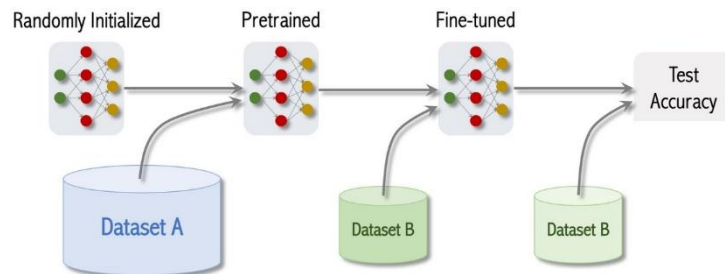


Explainable AI



Vision Transformer

Vision Transformer



Edge AI



Diffusion Models

Text-to-Image (Dalle-2)



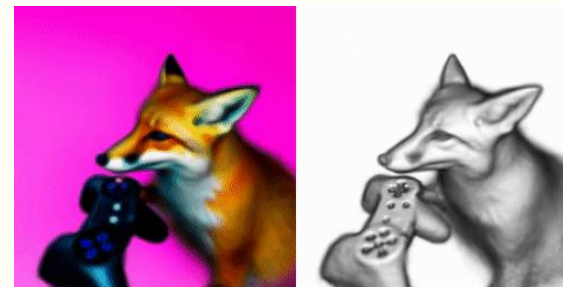
Teddy bears mixing sparkling chemicals as mad scientists

Text-to-Video (Make-A-Video)

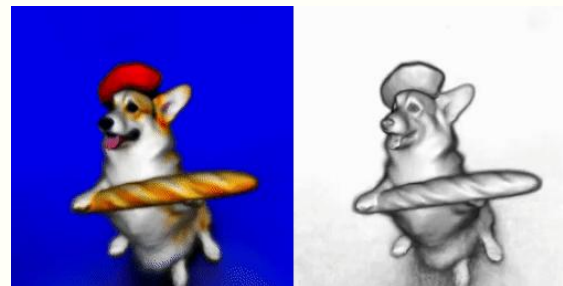


A confused grizzly bear in a calculus class

Text-to-3D (DreamFusion)



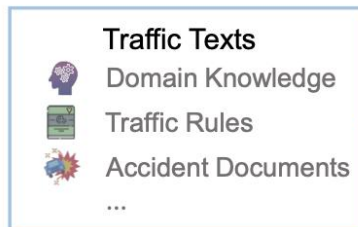
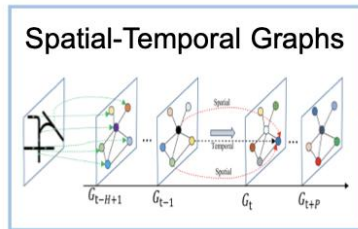
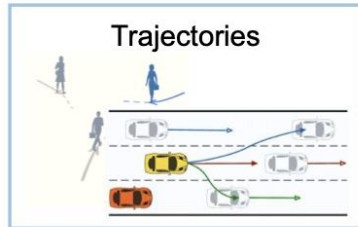
a fox holding a video game controller



a corgi wearing a beret and holding a baguette, standing up on two hind legs

Diffusion Models in Transportation

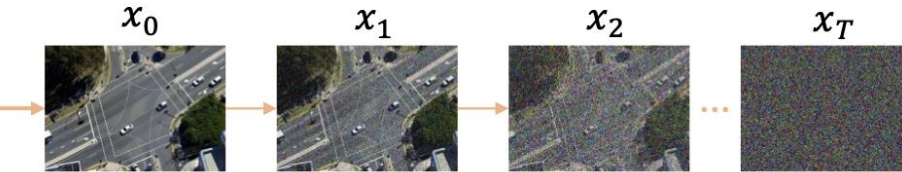
Traffic Data



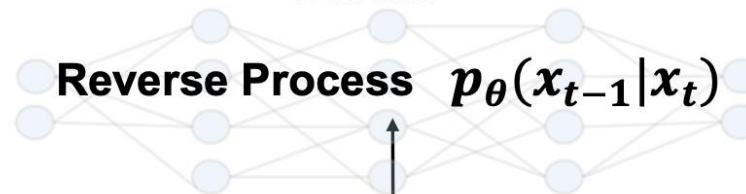
Diffusion Model

Forward Process $q(x_t|x_{t-1})$

Add Noise



Denoise

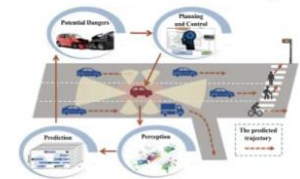


Reverse Process $p_\theta(x_{t-1}|x_t)$

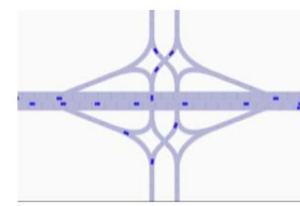
Various conditions or unconditional

Traffic Tasks

Autonomous Driving



Traffic Simulation



Traffic Forecasting



Traffic Safety



Spatial Intelligence

Spatial intelligence refers to the cognitive ability to understand and manipulate visual information in three dimensions

Autonomous Driving and Vehicle-to-Everything

- 3D Map-Based Autonomous Navigation:
- Autonomous Driving Decisions in Complex Environments
- Bidirectional Data Exchange Between Vehicles and Infrastructure

Smart Traffic Management and Infrastructure Optimization

- Real-Time 3D Mapping and Navigation
- Traffic Flow Optimization Using Spatial Intelligence
- Infrastructure Monitoring and Maintenance

Special Needs Travel Support/Personalized Services

- Navigation and contextual prompts for the Visually/Hearing/Cognitively impaired

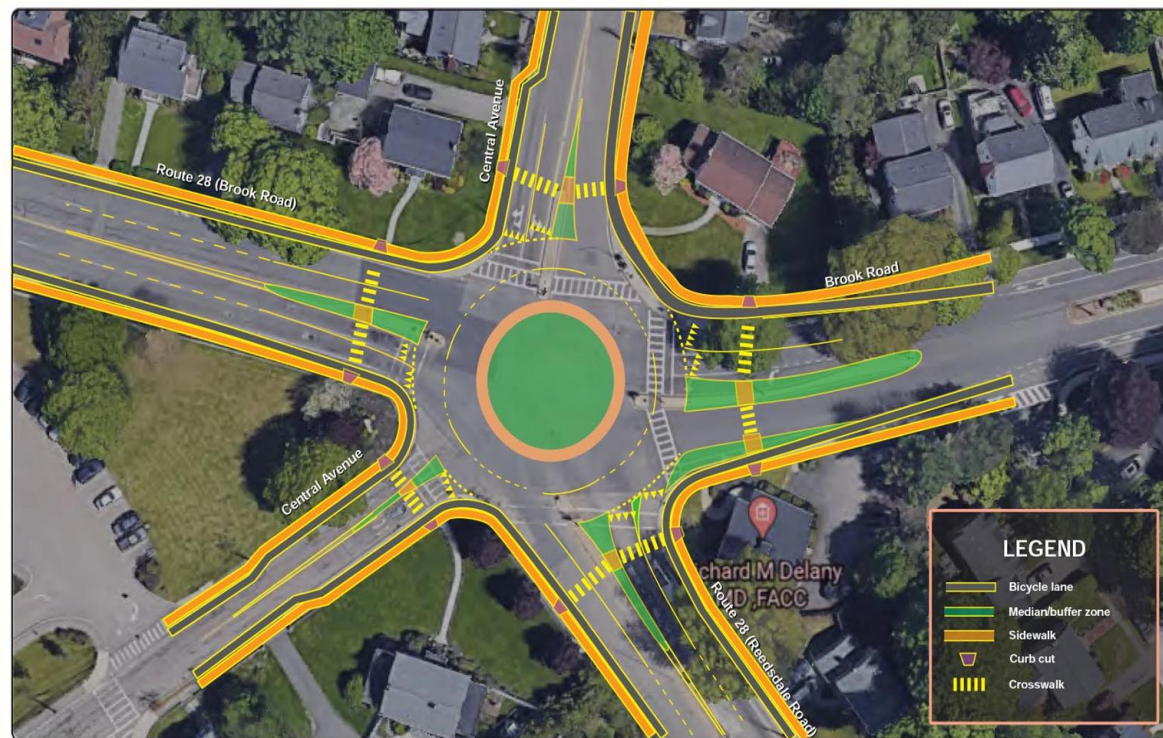


Spatial Intelligence

Crash Reconstruction



2D to 3D Design Plans



BOSTON
REGION
MPO

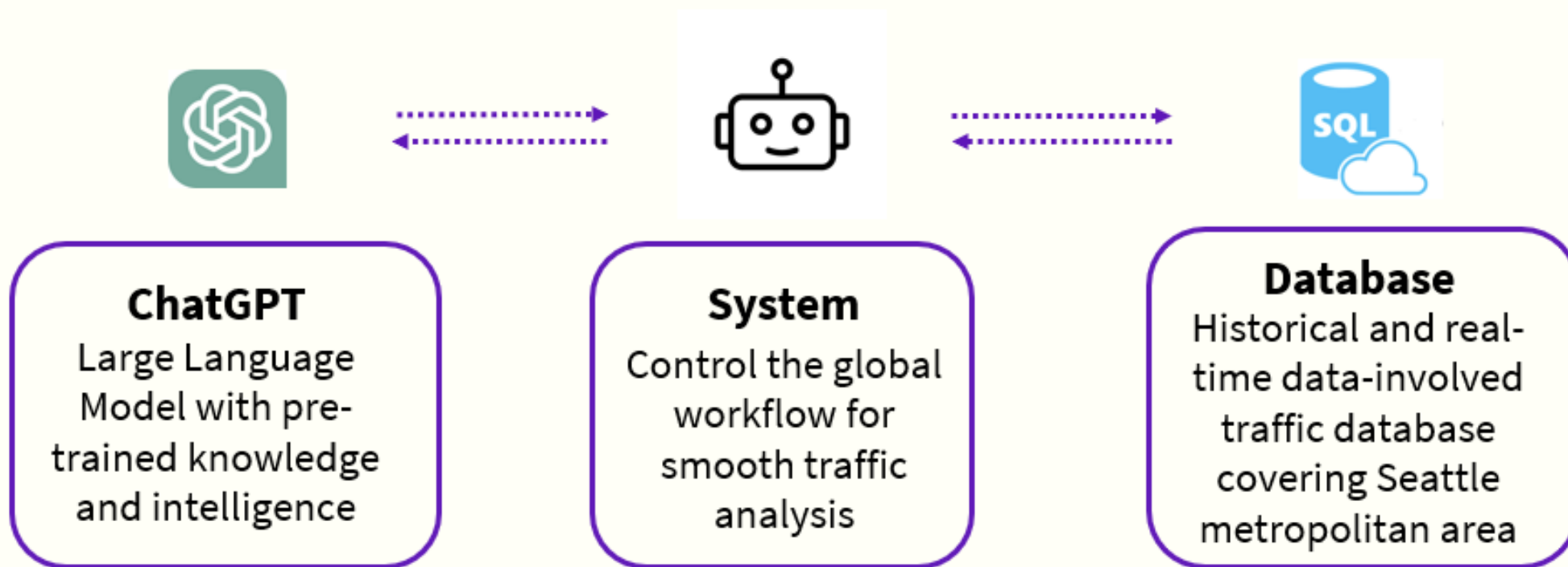


Figure 19
Roundabout Retrofit at Brook Road and Reedsdale Road Intersection

Addressing Priority Corridors from
the LRTP Needs Assessment: Route 28 Priority
Corridor Study: Milton, Massachusetts

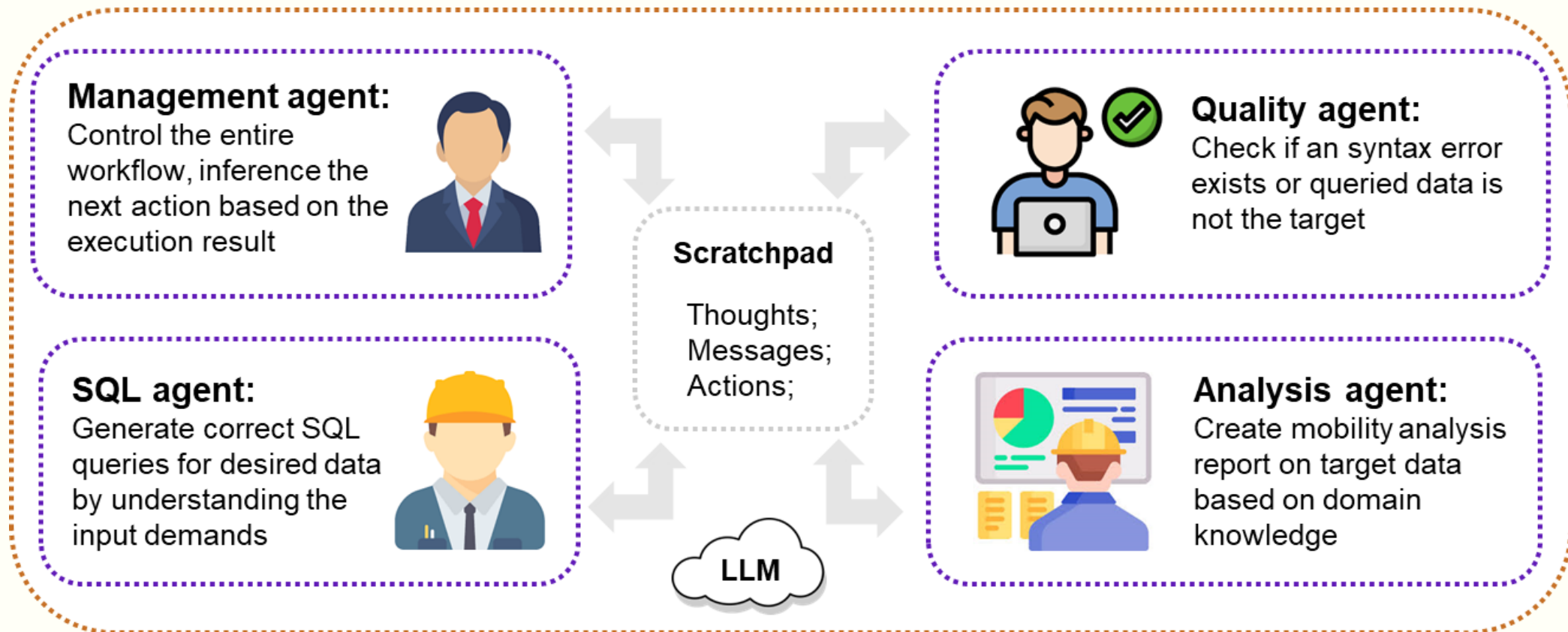
Traffic Management with LLM

- Conceptual overview of traffic management with LLM

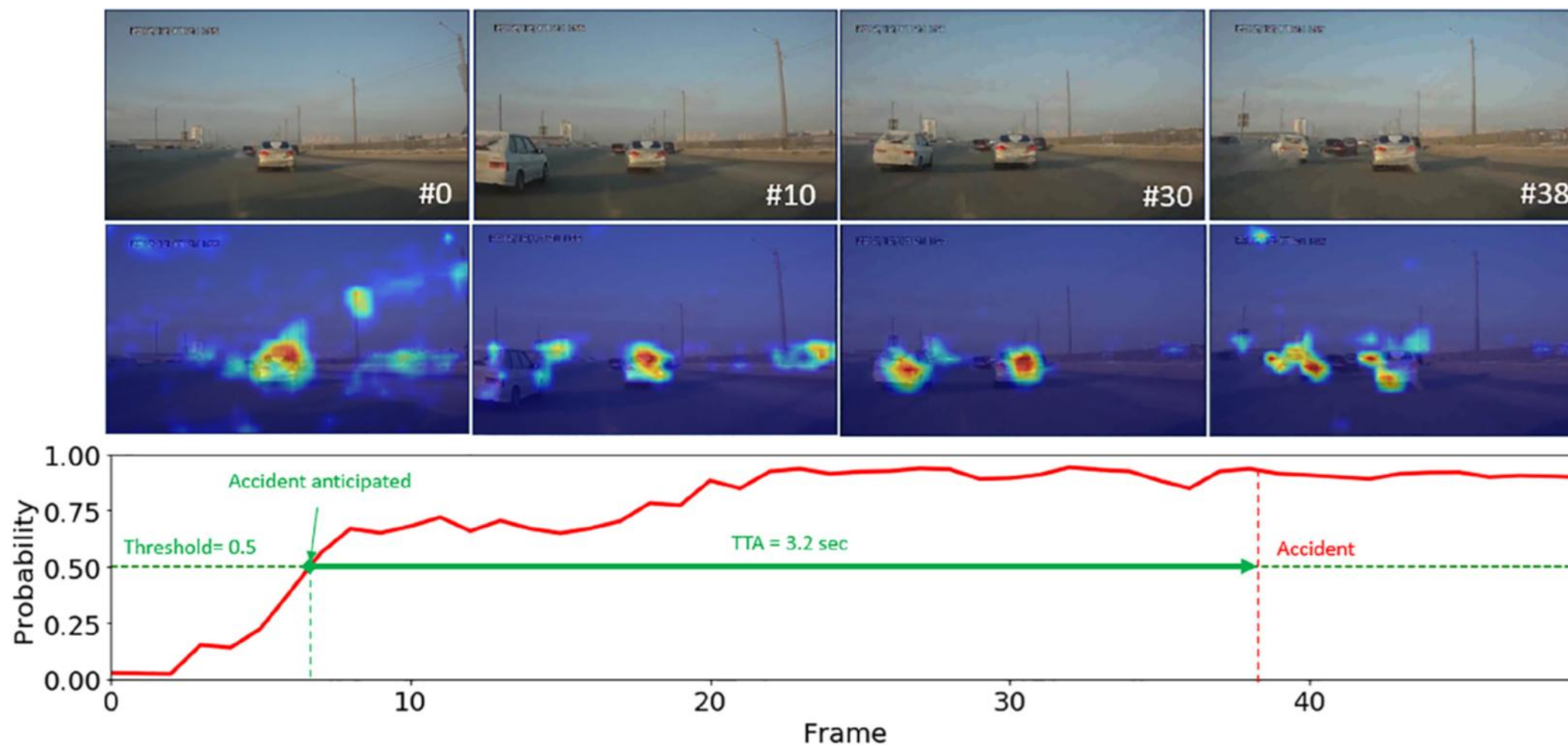


Traffic Performance GPT

An intelligent online chatbot, STAR-GPT, for efficient customized transportation surveillance and management empowered by a large real-time traffic database.

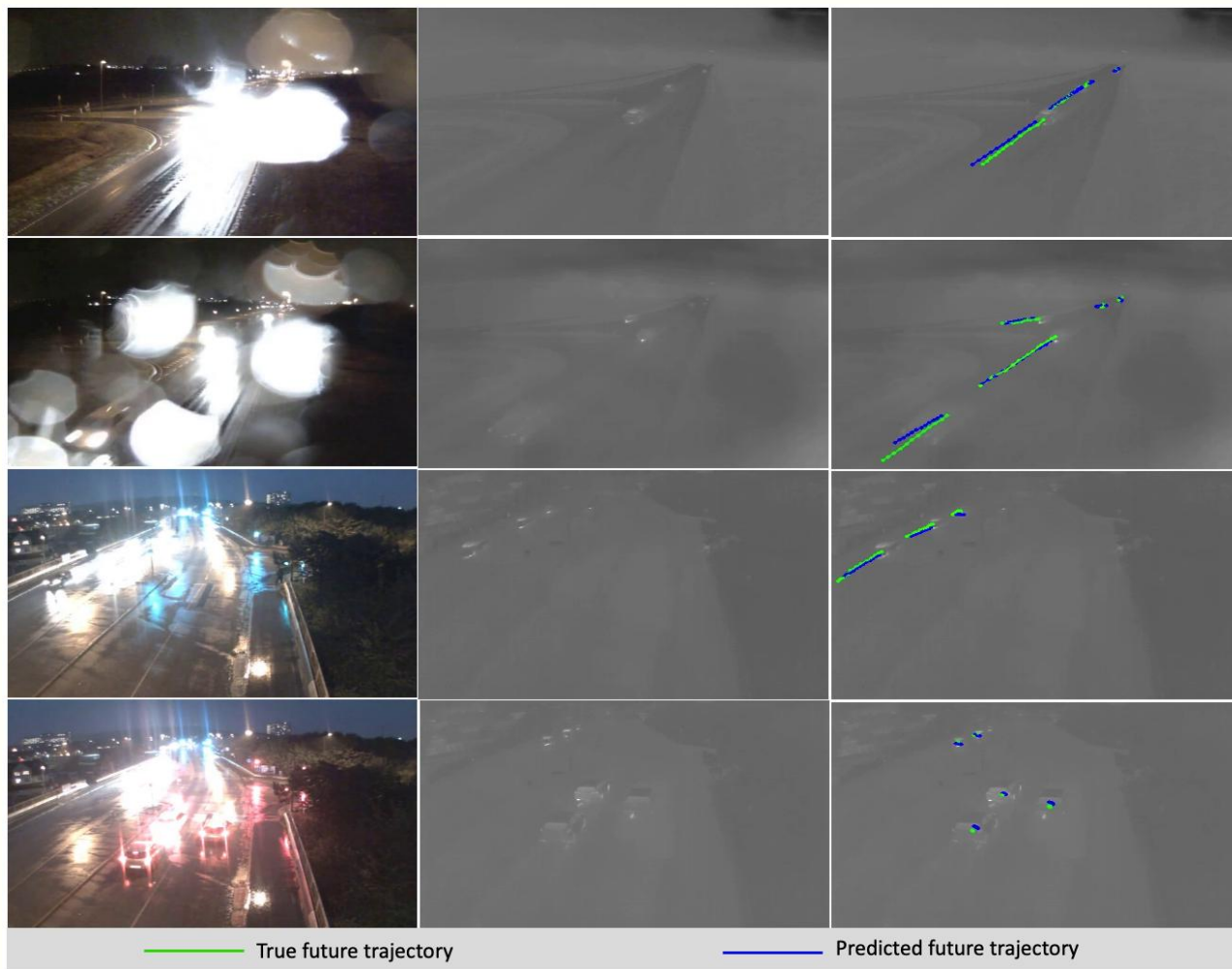


XAI for Traffic Crash Risk Assessment



Vision Transformer

Thermal-Forecast: Traffic Trajectory Prediction in Challenging Nighttime Conditions Using Thermal Imaging



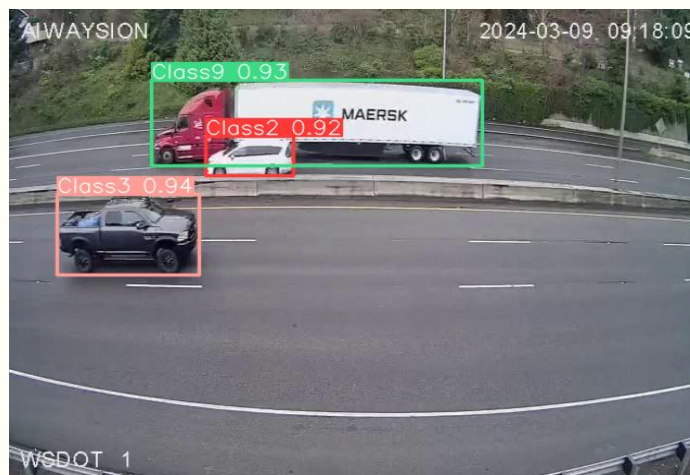
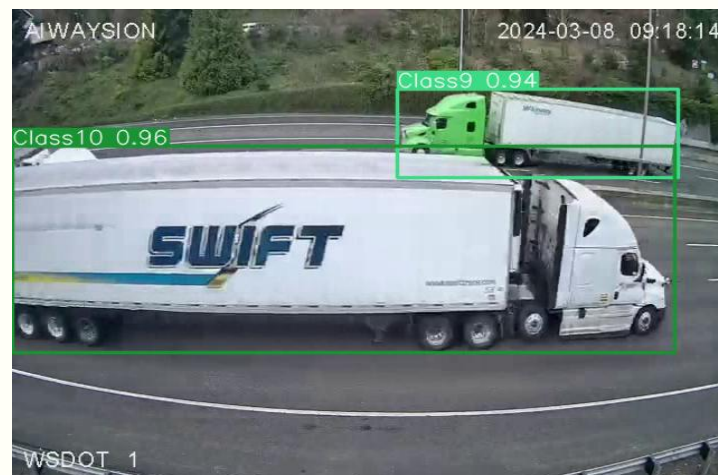
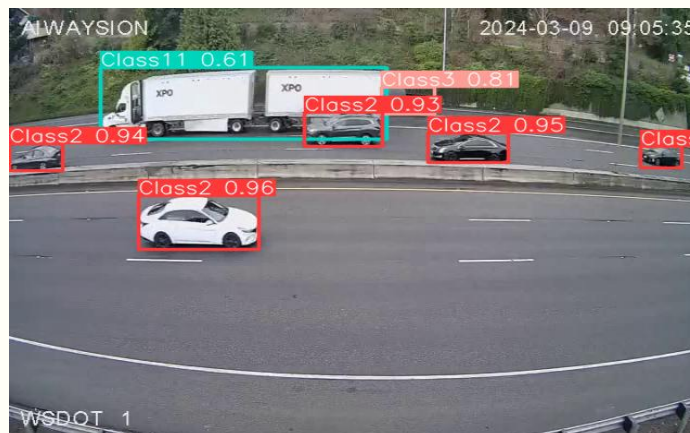
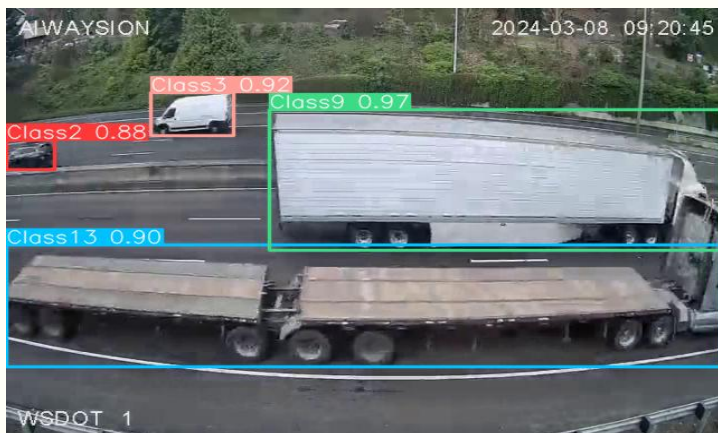
Prediction horizon: 1.2 sec, 1.5 sec and 2 sec

Model	Method	FDE _{1.2} (pxl)	FDE _{1.5} (pxl)	FDE _{2.0} (pxl)
1	Single GRU	16.99	19.21	19.92
2	Single LSTM	17.23	17.26	22.17
3	Transformers	20.78	48.52	86.37
4	Fusion-GRU (5)	17.31	18.77	20.29
5	ViT-DGRU	14.12	14.83	16.52



Edge-AI for Vehicle Classification

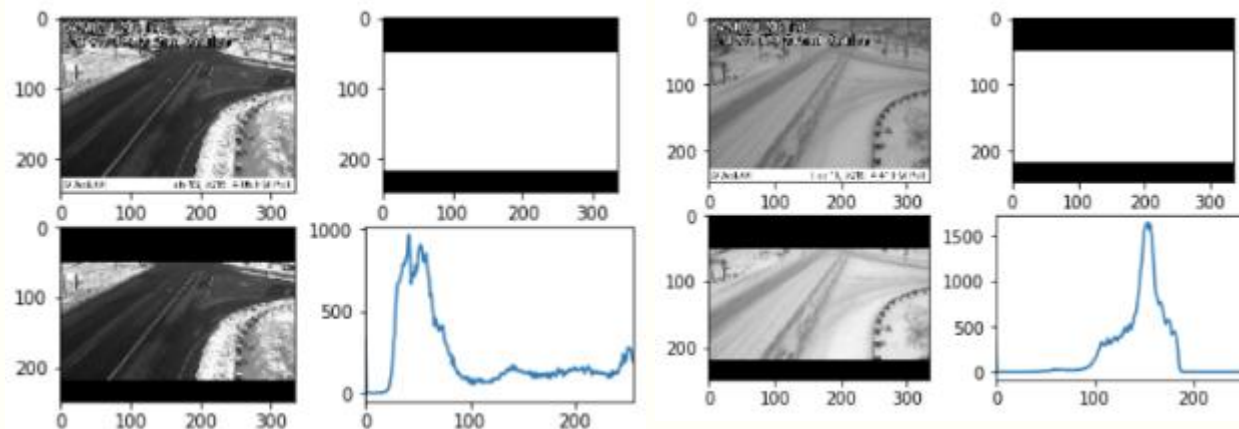
Object Detection and Classification



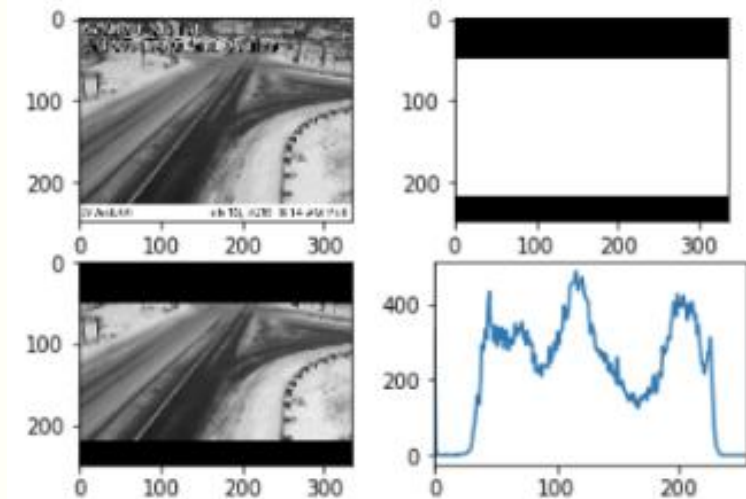
Class	Detection Accuracy
Class1	0.995
Class2	0.981
Class3	0.982
Class4	0.946
Class5	0.991
Class6	0.958
Class7	0.942
Class8	0.968
Class9	0.964
Class10	0.961
Class11	0.995
Class12	0.995
Class13	0.995
Our Accuracy for All Classes	0.976
Market Leader	0.96

Edge-AI for Traffic Sensing

Road Surface Condition Monitoring



	Dry	Snowy	Icy	Wet
Dry	97.5%	0.4%	0.7%	1.4%
Snowy	0.2%	97.9%	1.8%	0.1%
Icy	1.6%	1.6%	93.6%	3.2%
Wet	0.6%	1.7%	2.4%	95.3%





Edge-AI for Environment Sensing

Image Dehaze for Visibility Detection



Original Image



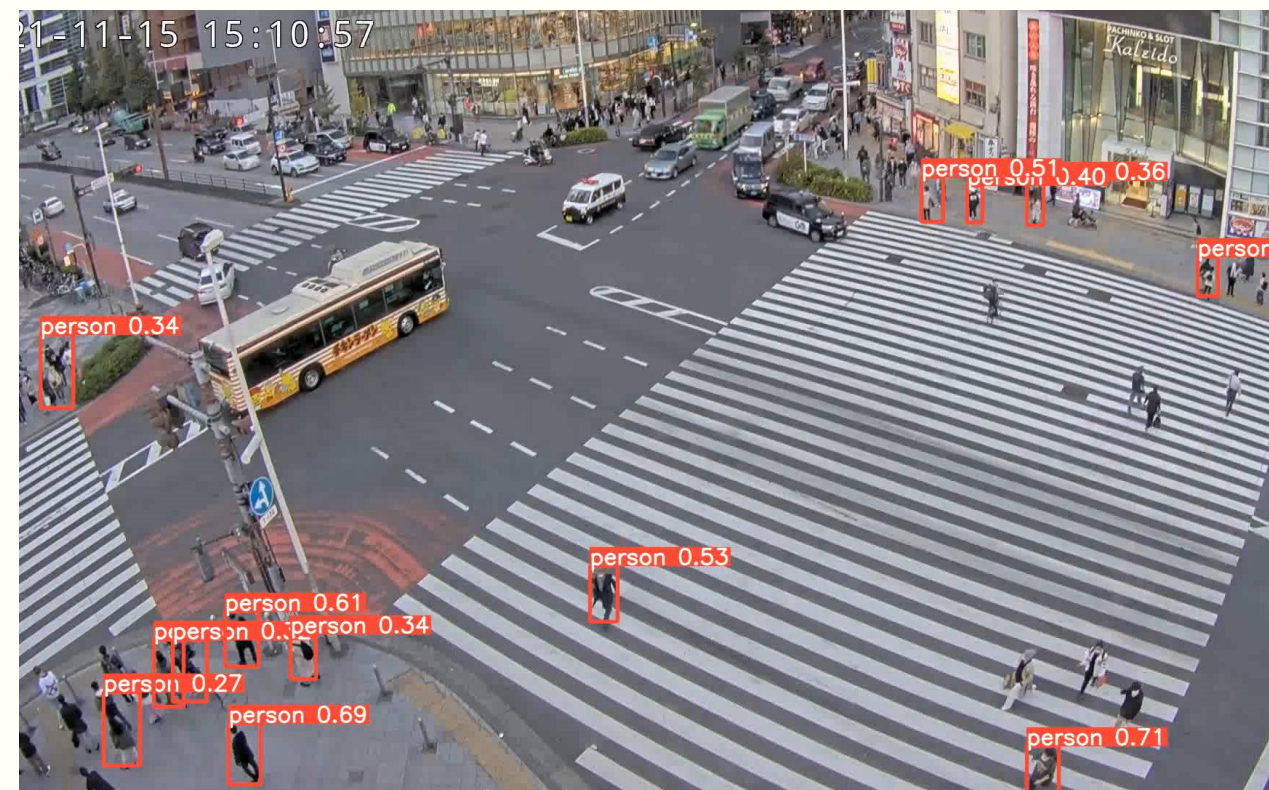
Scattering Map



De-hazed Image

Threshold	$\pm 5\%$	$\pm 10\%$	$\pm 20\%$
Visibility			
$V_s < 500$ m	85.29%	89.14%	93.18%
$500\text{m} \leq V_s < 1000$ m	88.17%	90.25%	95.42%
$1000\text{m} \leq V_s < 2000$ m	90.36%	93.22%	97.03%
$V_s \geq 2000$ m	91.23%	95.78%	98.75%
Overall	89.27%	92.15%	96.61%

Edge-AI for ATU Detection



YOLO V11 Object Detection Model



STAR Lab SARLES System

Edge AI for Vehicle Re-ID





Traffic Sign Data Collection

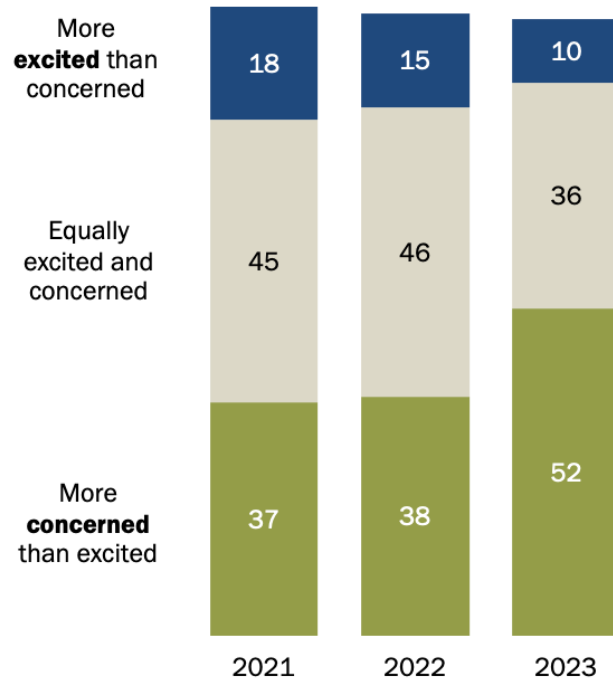


SR-520 Detection Results

People's Opinions Are Different

Concern about artificial intelligence in daily life far outweighs excitement

% of U.S. adults who say the increased use of artificial intelligence in daily life makes them feel ...



Note: Respondents who did not give an answer are not shown.

Source: Survey conducted July 31-Aug. 6, 2023.

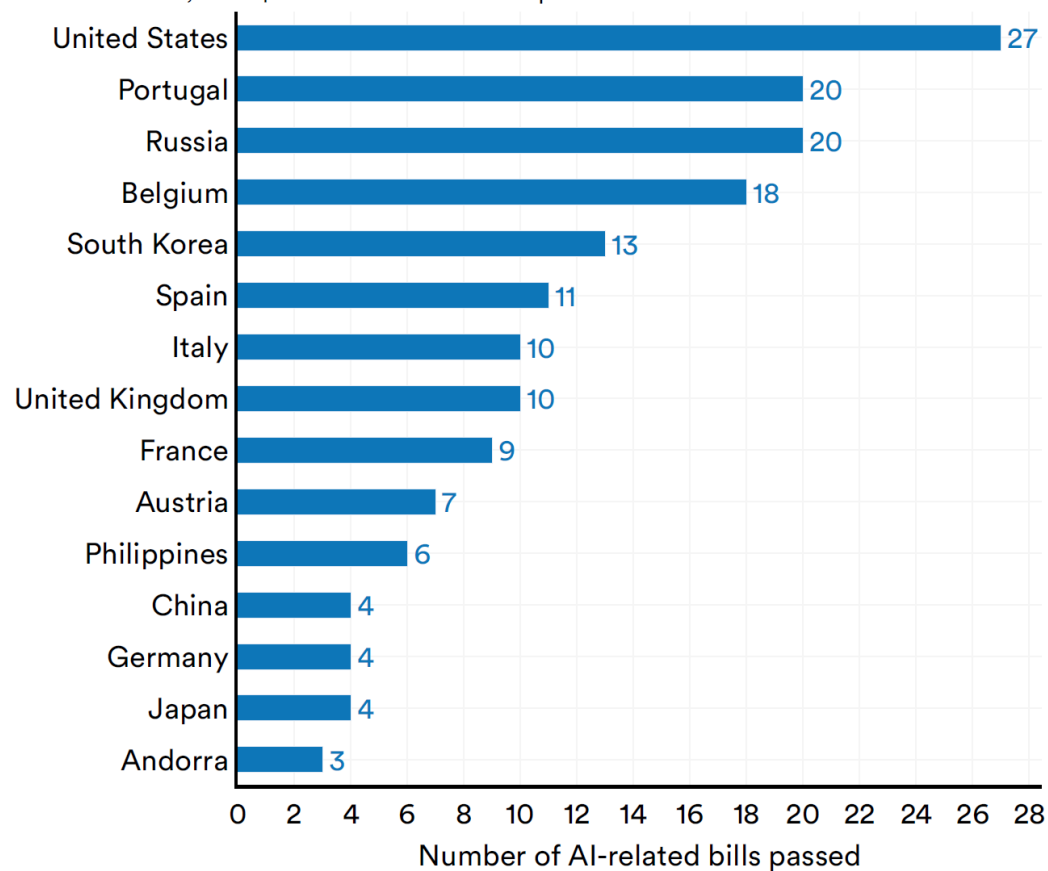
PEW RESEARCH CENTER

1. Ethical Concerns
2. Job Displacement
3. Safety and Reliability
4. Transparency and Accountability
5. Misinformation and Manipulation
6. Security Risks
7. Economic Inequality

AI Is Increasingly Regulated

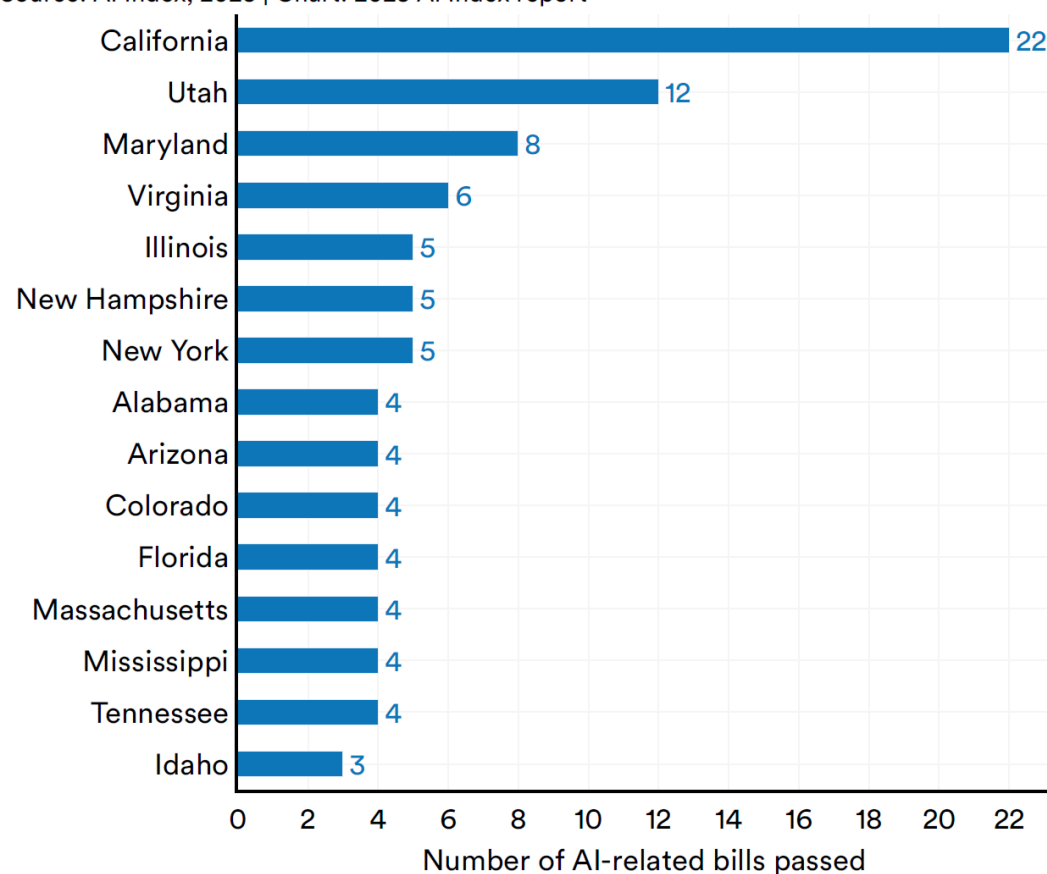
Number of AI-related bills passed into law in select geographic areas, 2016–24 (sum)

Source: AI Index, 2025 | Chart: 2025 AI Index report



Number of AI-related bills passed into law in select US states, 2024

Source: AI Index, 2025 | Chart: 2025 AI Index report



AI That Makes Images

Y

You

Please generate an image showing Professor Yinhai Wang is presenting to the Research and Technology Coordination Committee of the National Academies.



DALL-E

I'm sorry, but I can't generate images of real people, including specific individuals like Professor Yinhai Wang. If you'd like, I can create an image of a generic professor presenting to a research and technology committee in an academic setting. Would you like me to proceed with this?

Y

You

Yes, please proceed. There are thirteen members on the committee.



AI That Makes Images

Y

You

I do not like them. Please generate again.

Y

You

This is ridiculous. How could the podium be on the meeting table?



DALL-E

I apologize for the oversight in the image composition. Let's try again with a corrected scene where the podium is appropriately placed in front of the committee members, not on the meeting table.



Thanks for Your Attention!

We look forward to
collaborating with you all!

My contacts:

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PacTrans Website:

<http://depts.washington.edu/pactrans/>

