United States
Department of Energy
National Nuclear Security Administration
International Nuclear Security

Artificial Intelligence

Applications to and Implications for Nuclear Security

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- Introduction to the Role of Artificial Intelligence in Strengthening the Security of Nuclear Facilities| February 6-8, 2024 | Vienna, Austria

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Goals

Data fusion

What is it?

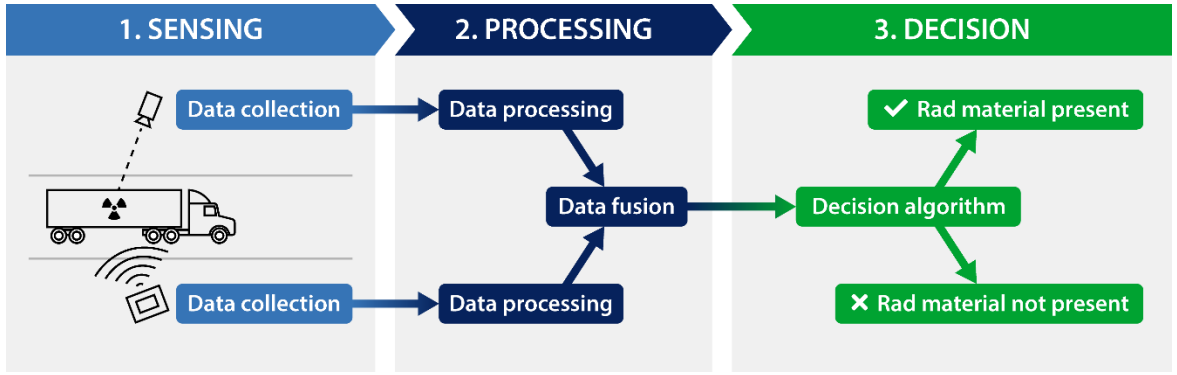
Artificial intelligence-driven data fusion

Why data fusion?

What benefits data fusion may provide for nuclear security?

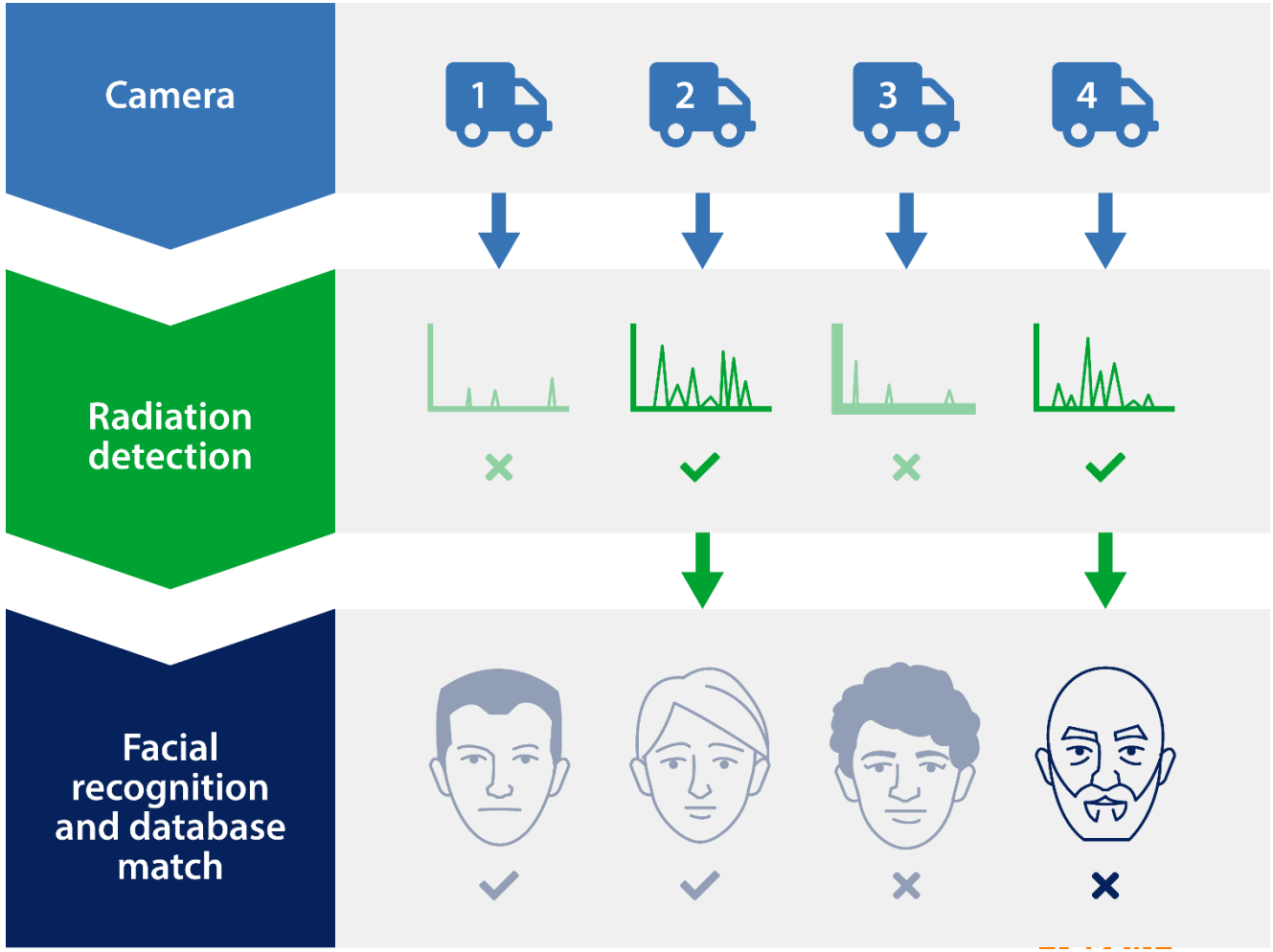
1. What is data fusion?

Discovering and exploiting complex relationships among data collected by multiple sensors



Which of these is a threat?

- Q: What type of information would you need to make this determination?



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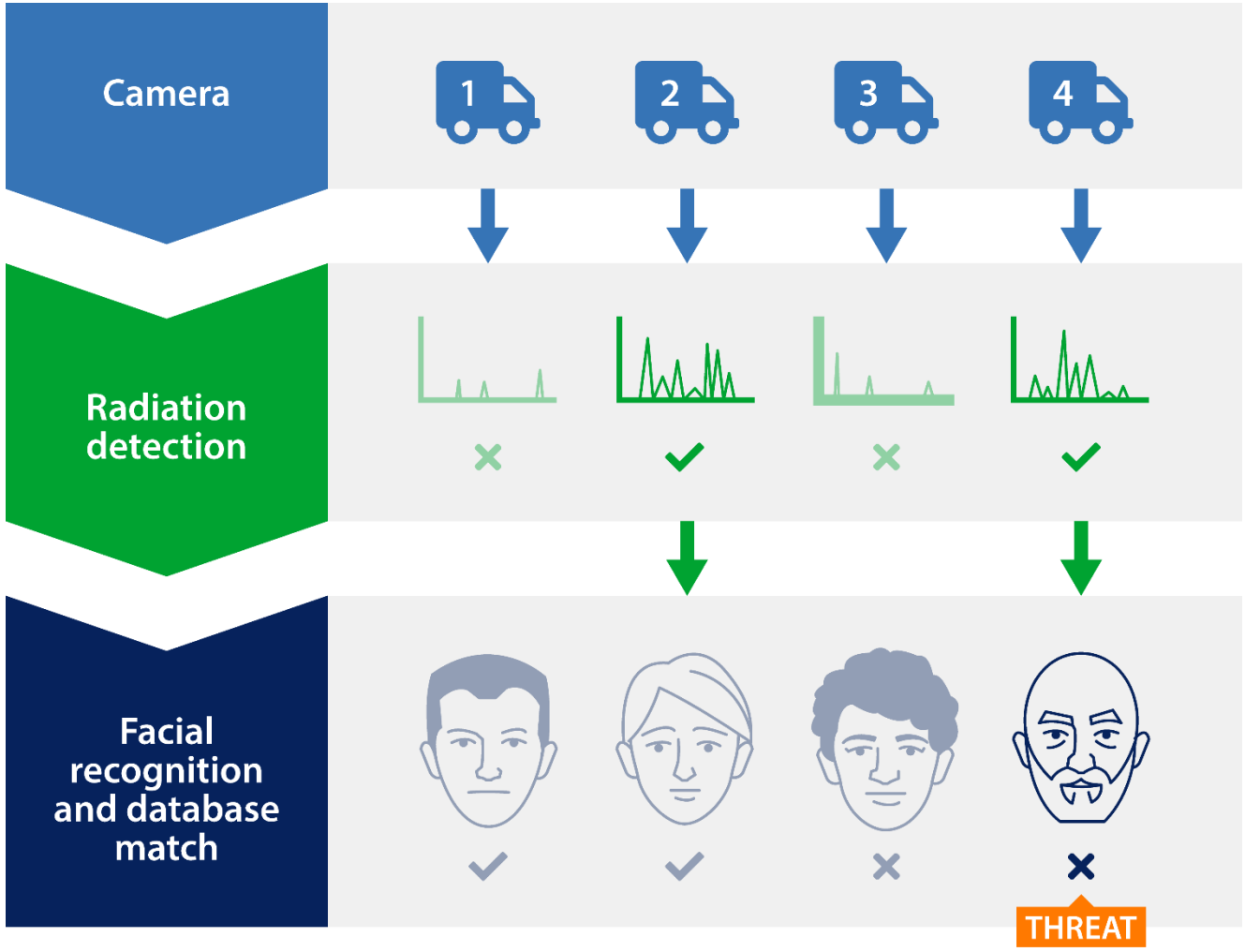
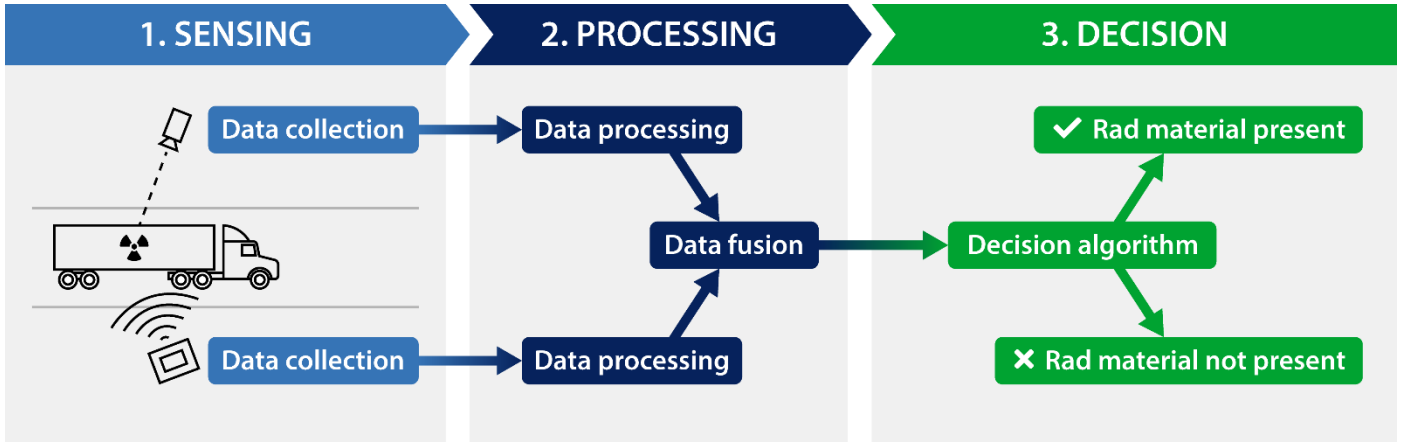


What is a data fusion system?

1. Sensors produce data
2. Data processors produce features
3. Decision algorithms produce labels



What is driving data fusion?

- Lighter, less expensive, more portable sensors
- Smaller computing systems
- Larger computing power

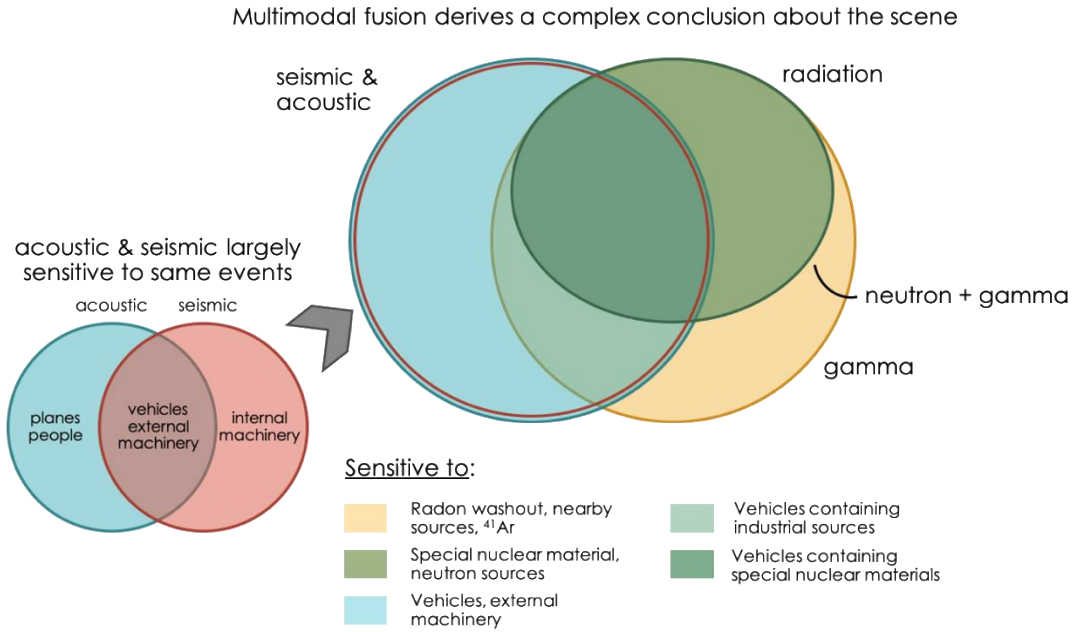
What are the added challenges?

- System maintenance
- System security
- Verification and Validation

2. How can data fusion alter the performance of a protection system or decision support system?

Improves confidence and resilience

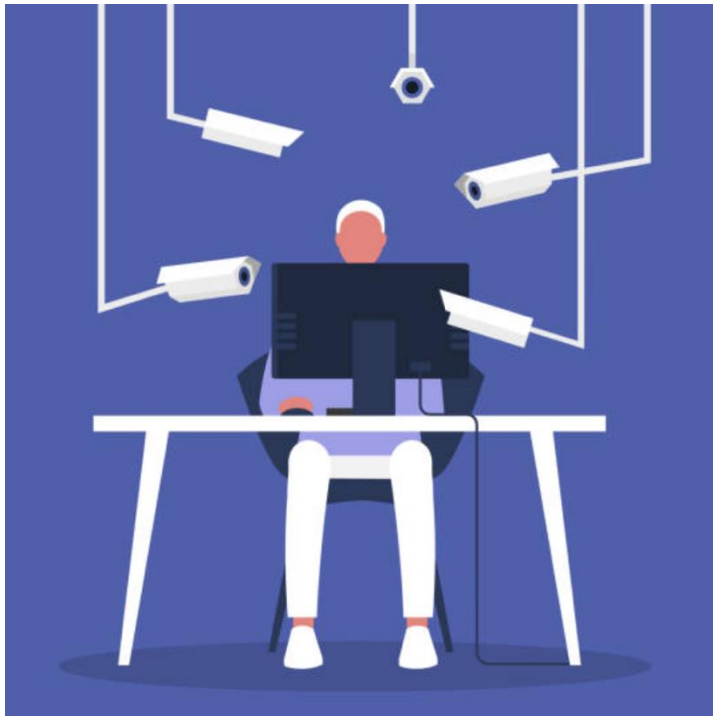
Enables sophisticated conclusions



Data fusion can …

- Build in redundancies

Multiview

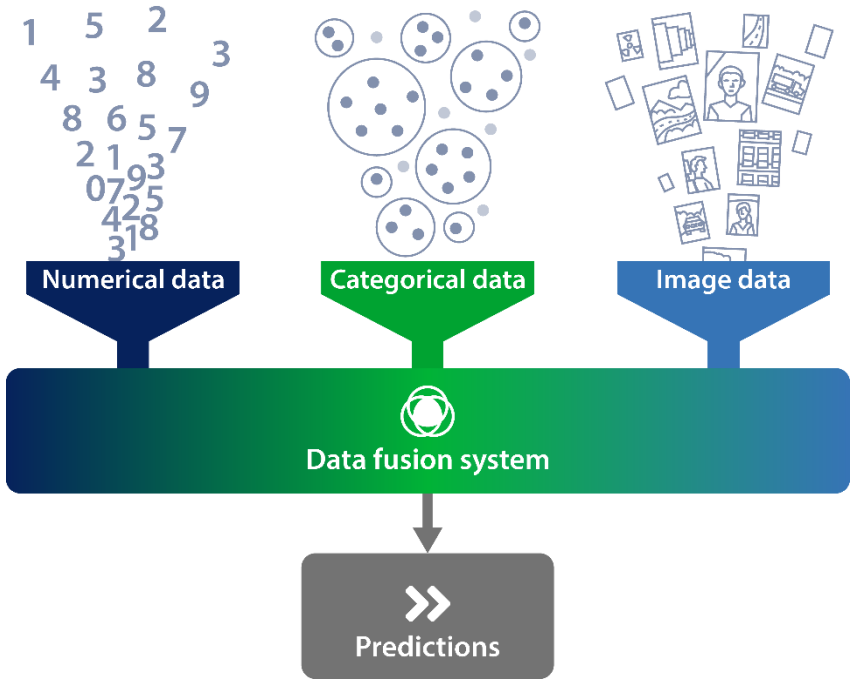


Working from Home

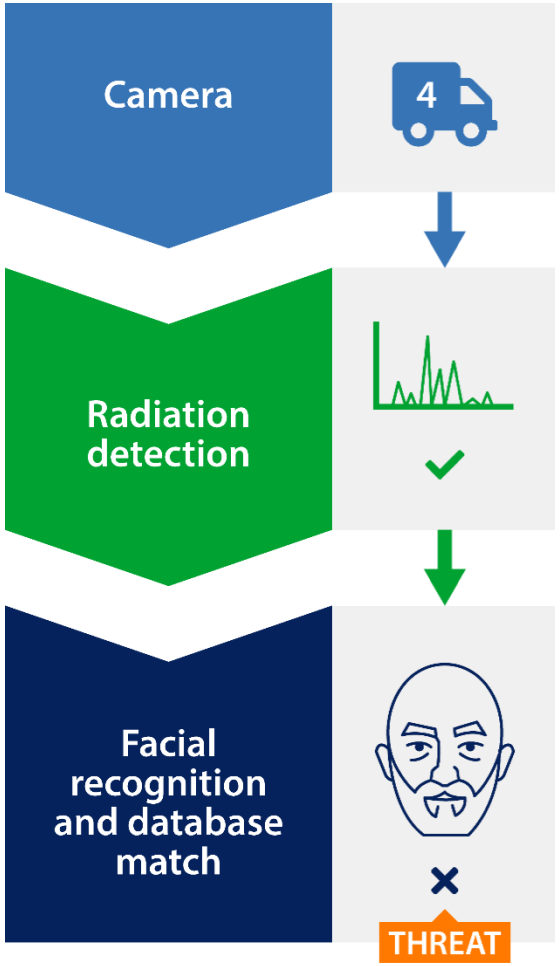
Improves confidence and resilience in decision-making capabilities

Data fusion can …

- Build in redundancies
- Handle large amounts of different types of data when enabled by AI



Multimodal



Improves complexity in derived decisions

Data fusion can draw sophisticated solutions

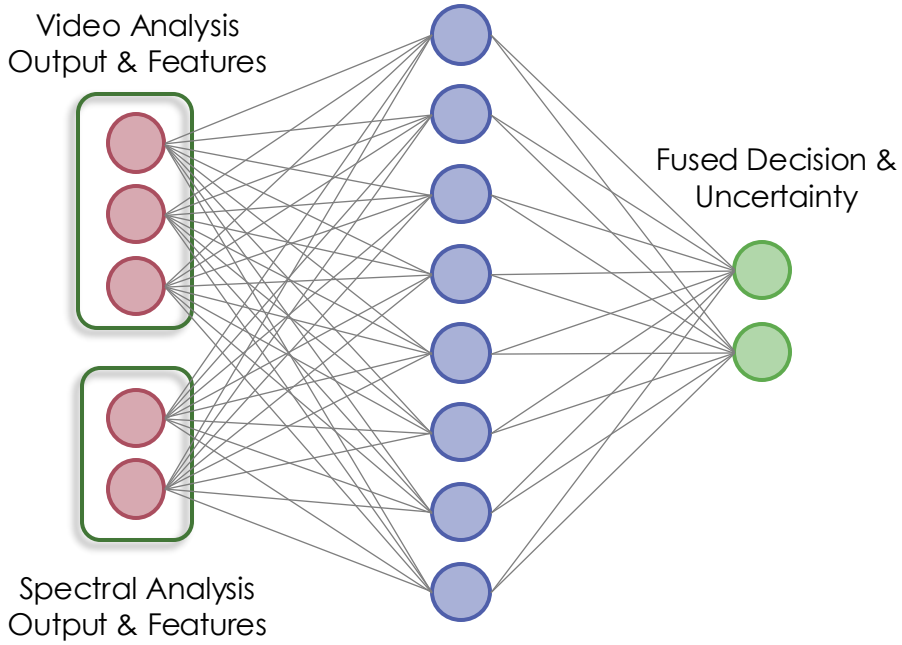
Manually Designed Fusion

AND Truth Table

Radiation Present?	Object Present? Yes	Object Present? No
No	Decision (rad shipment not present) ✗	Decision (rad shipment not present) ✗
Yes	Decision (rad shipment present) ✓	Decision (rad shipment not present) ✗

Relies on experts to encode decision rules

AI-Based Fusion



Complex relationships are learned

Summary

- Ubiquity of sensors and widespread computing power make AI-driven data fusion possible
- Fusion systems may be designed to be more robust than single-sensor systems and draw more complex conclusions about the scene

Questions