

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

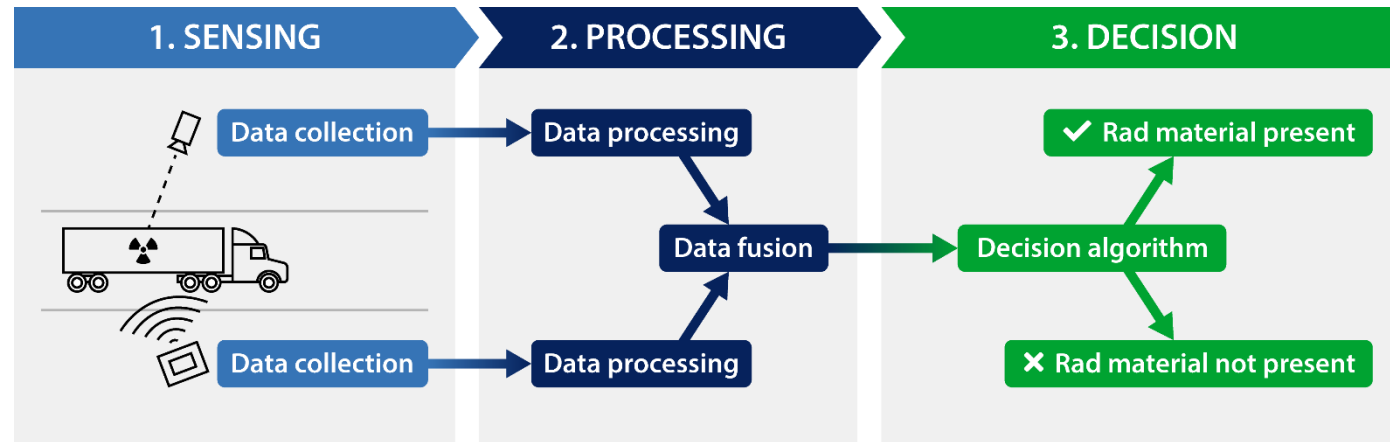
# Artificial Intelligence

## Applications to and Implications for Nuclear Security



# What is a data fusion system?

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



# Which of these is a threat?

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



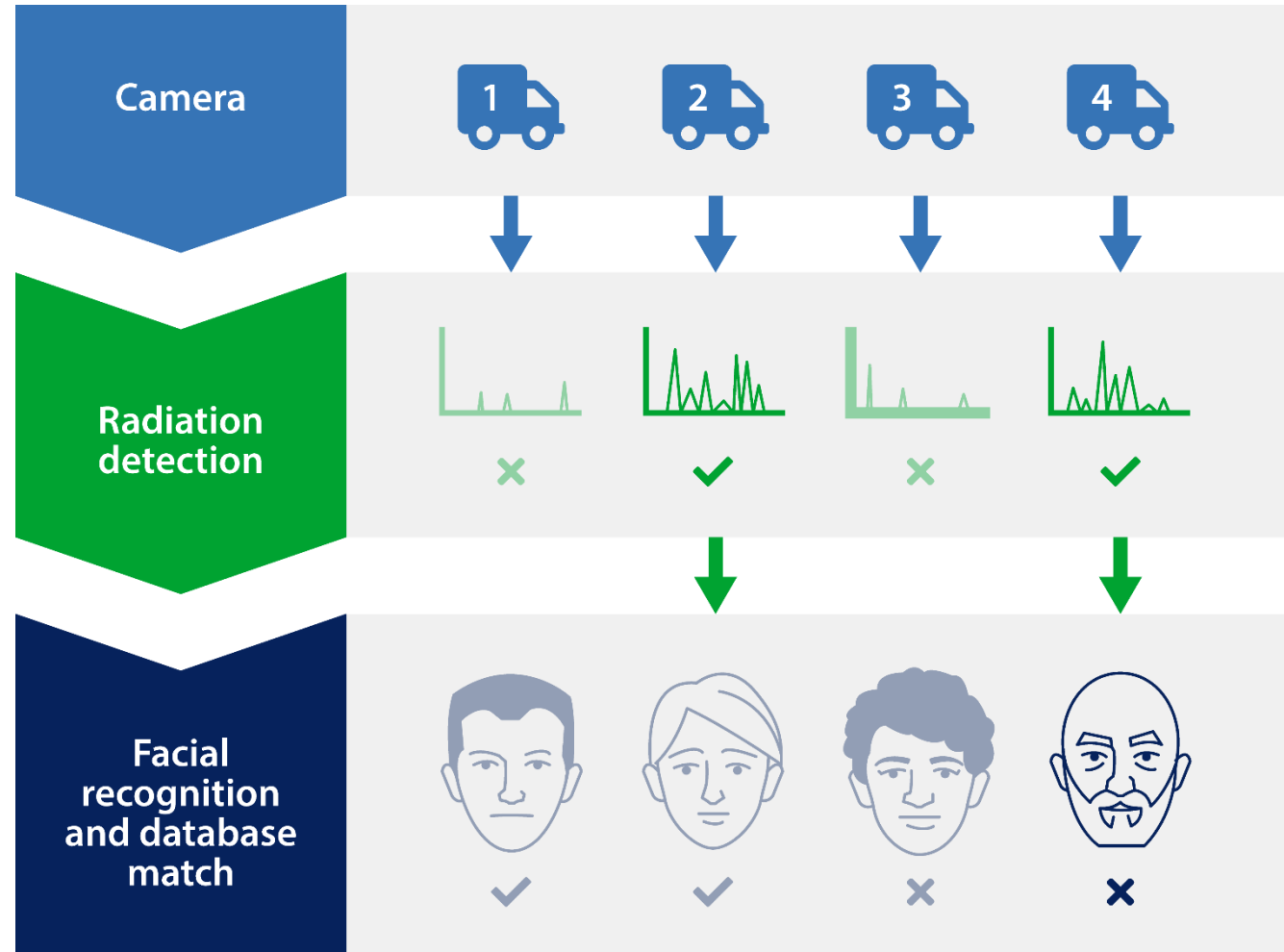
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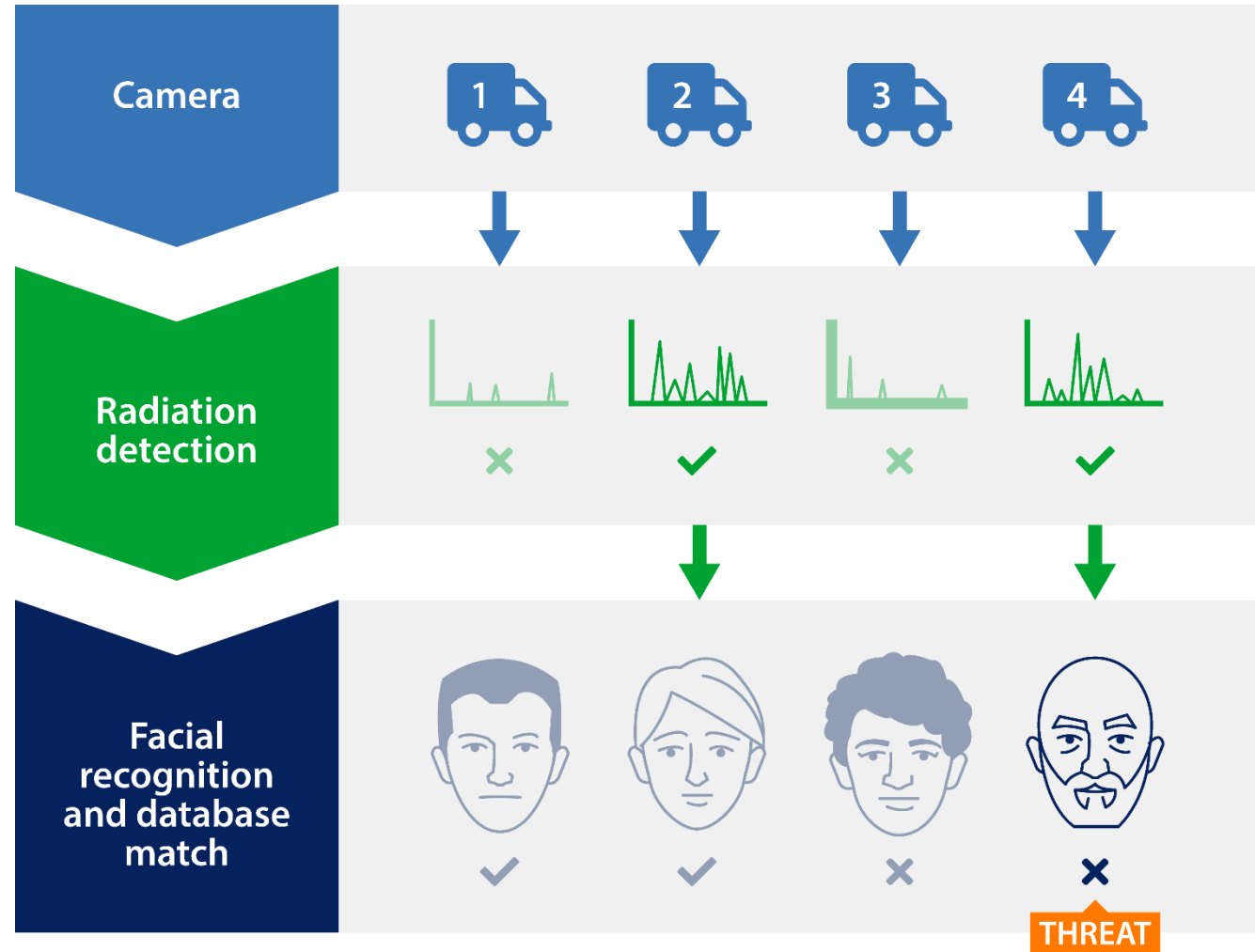
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## What is driving data fusion?

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

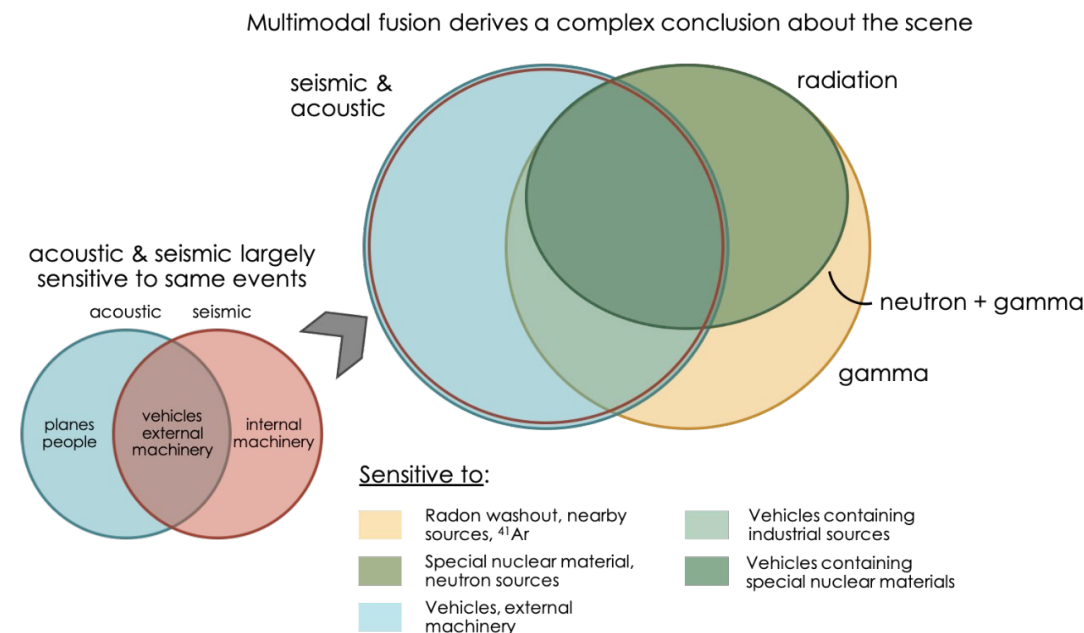
## What are the added challenges?

- 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*



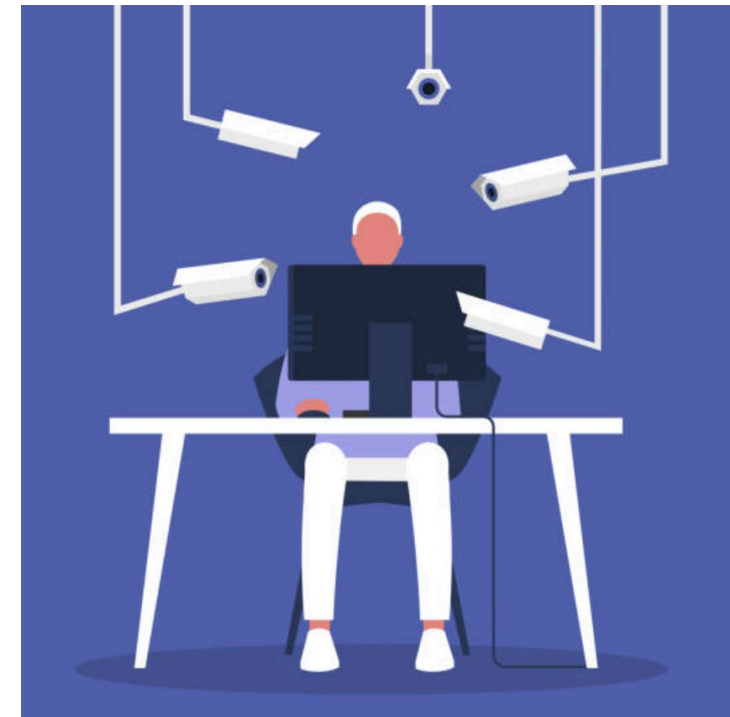


# Data fusion can ...

- Build in redundancies



## Multiview

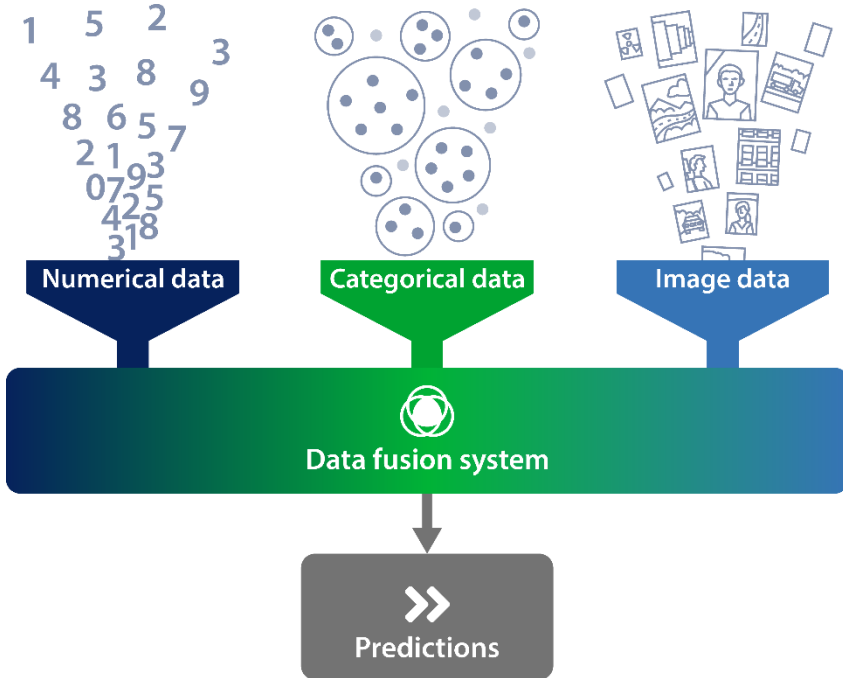


Working from Home

**Improves confidence and resilience in decision-making capabilities**

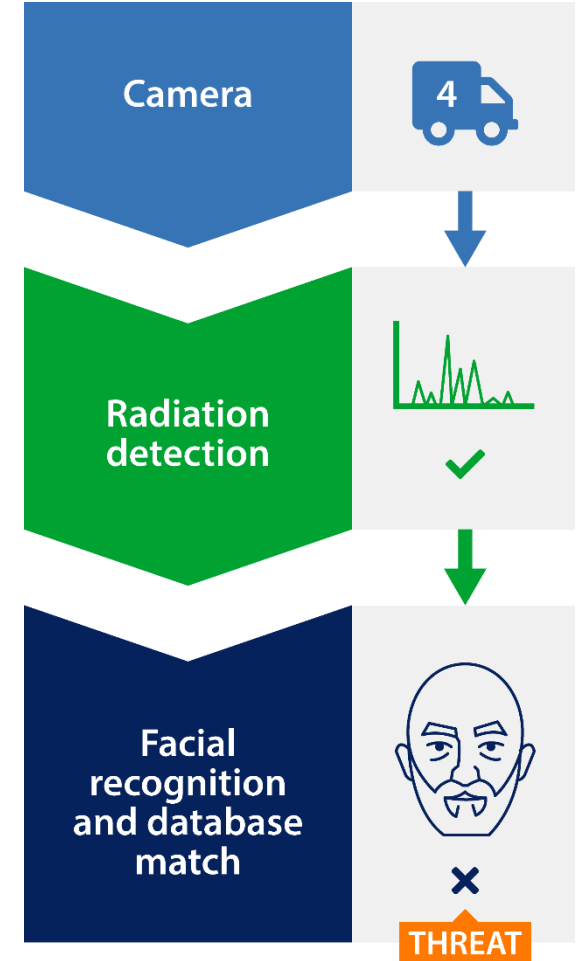
# Data fusion can ...

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



**Improves complexity in derived decisions**

## Multimodal



# Data fusion can draw sophisticated solutions

## Manually Designed Fusion

AND Truth Table

Radiation Present?	No	Decision (rad shipment not present) <b>X</b>	Decision (rad shipment not present) <b>X</b>
	Yes	Decision (rad shipment present) <b>✓</b>	Decision (rad shipment not present) <b>X</b>
		Yes	No

Object Present?

**Relies on experts to  
encode decision rules**

# Data fusion can draw sophisticated solutions

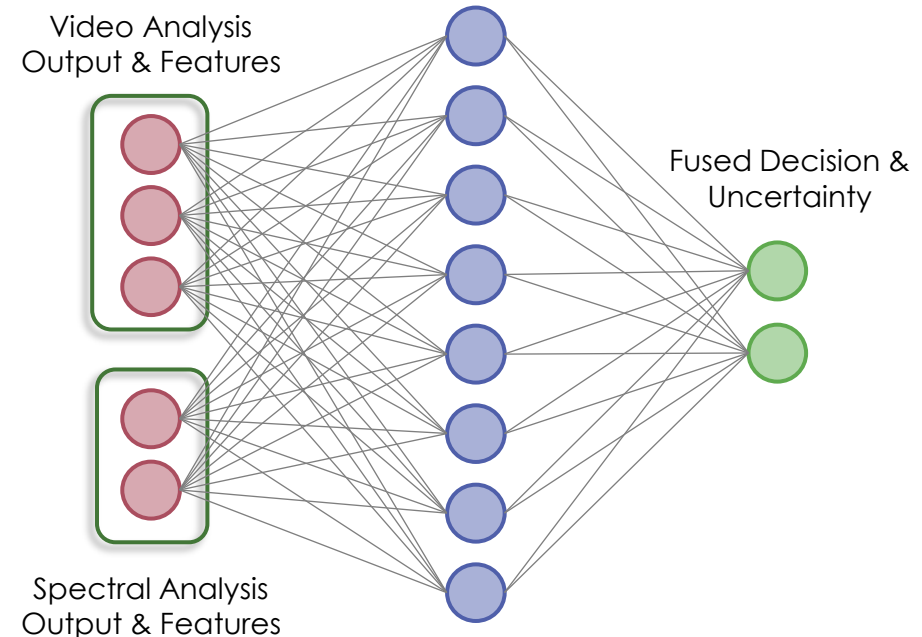
## Manually Designed Fusion

AND Truth Table

Radiation Present?	No	Decision (rad shipment not present) <b>X</b>	Decision (rad shipment not present) <b>X</b>
	Yes	Decision (rad shipment present) <b>✓</b>	Decision (rad shipment not present) <b>X</b>
		Yes	No
		Object 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