



ARTIFICIAL INTELLIGENCE

developed by VMI Security



TYPES OF MACHINE LEARNING



Supervised learning
(deep learning)

Technique used
by VMI

Unsupervised learning

Reinforcement learning



IMAGE COLLECTION



**Images are scanned using the
built-in X-ray scanner**

IMAGE ANNOTATION

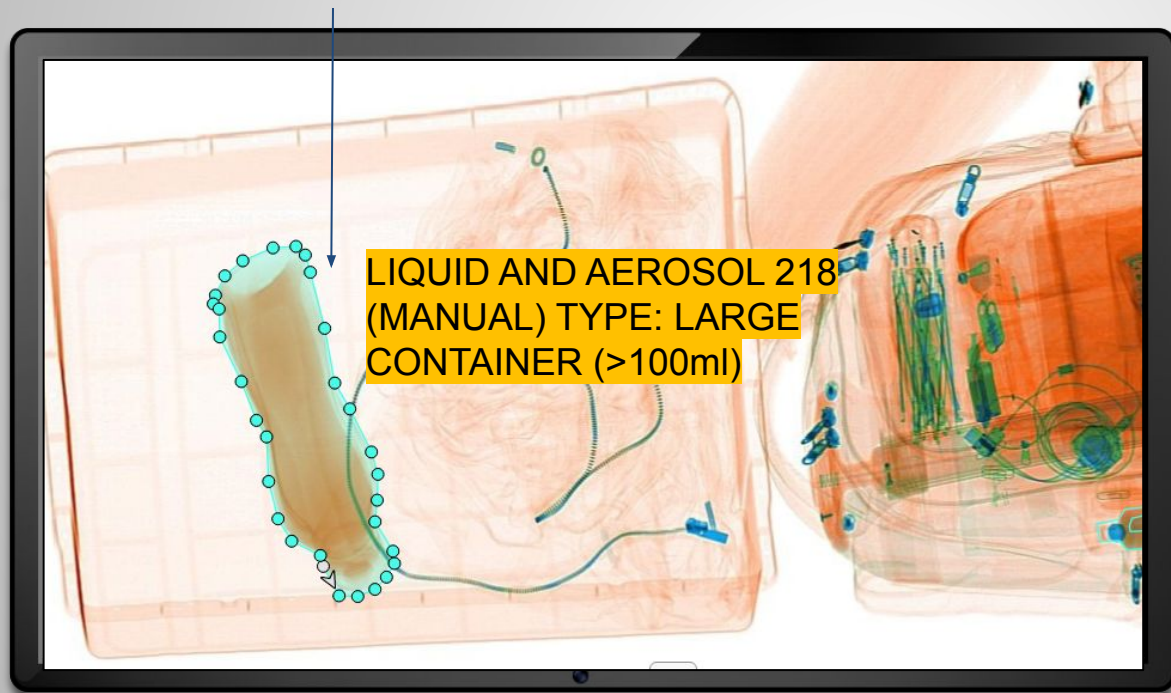


Experienced professionals annotate potentially dangerous or illicit objects.

IMAGE ANNOTATION



Manual image labeling

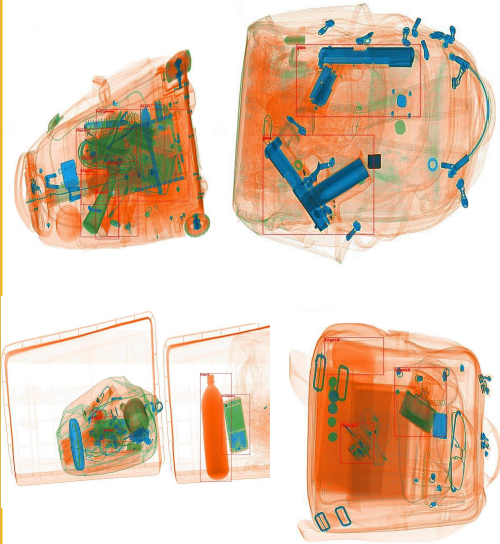


Experienced professionals annotate potentially dangerous or illicit objects.

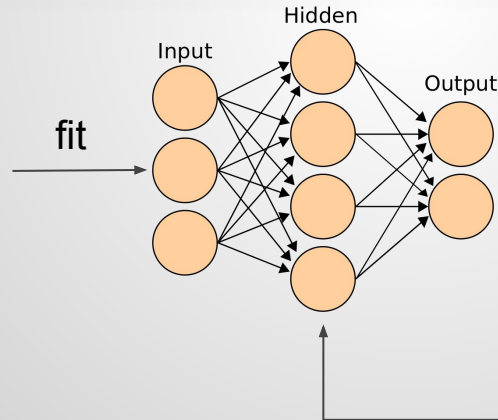
MODEL TRAINING



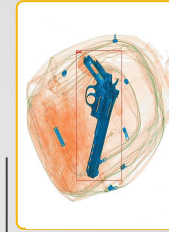
Training set



Neural Network
(Convolutional
Neural Network)



Test images
("unknown" by
the model)



Model evaluation

Release

high score



Score

low score



Model
fine-tuning



ARTIFICIAL INTELLIGENCE FOR LUGGAGE SCANNERS





BAGGAGE AI INFERENCE

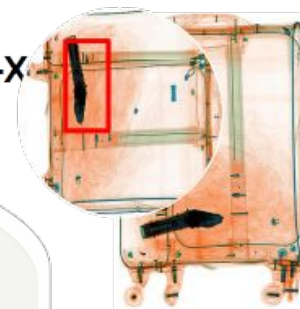


Luggage



Real-time image

RAIOS-X



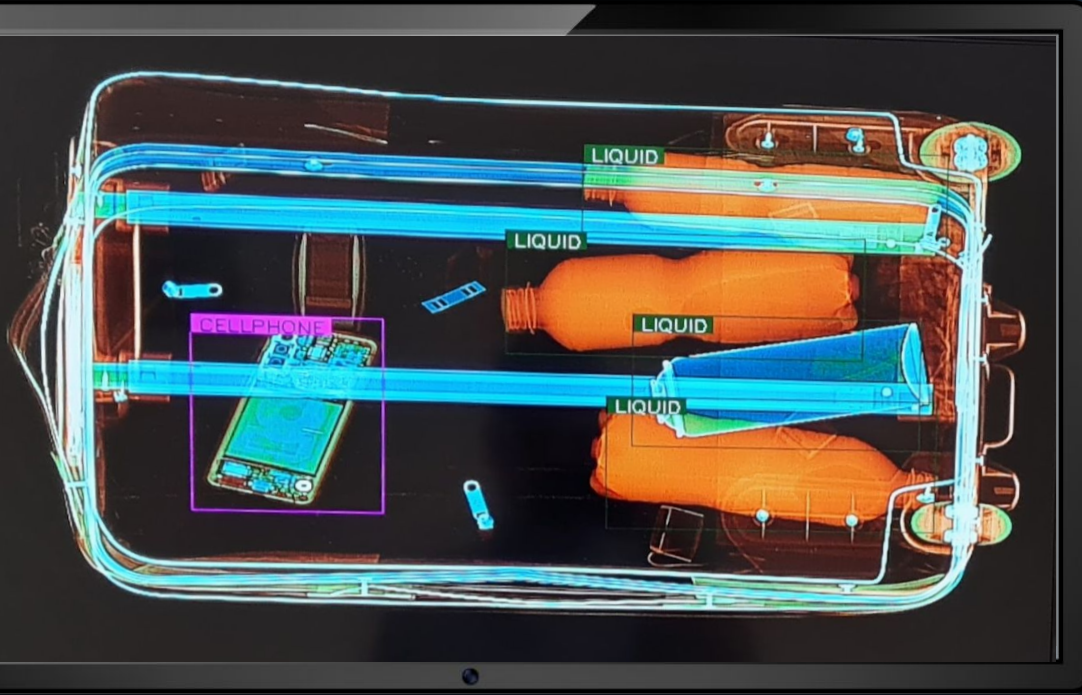
Inference:
object (weapon)
detected



Artificial
intelligence
program

ADVANTAGES OF AI FOR BAGGAGE INSPECTION

- AI can detect potentially dangerous or prohibited objects in real-time (in less than 1 second).
- It detects prohibited objects that are difficult to be detected by human analysis.
- Can detect multiple objects (of various sizes and positions) at the same time.





ADVANTAGES OF AI FOR BAGGAGE INSPECTION

In these more complex scenarios, AI can help:

In the agility of the inspection

- reducing queuing time,
- reducing the need for manual inspection by opening bags in security

In security

- Support in detecting prohibited objects that are difficult to identify

ADVANTAGES OF OUR AI COMPARED WITH COMPETITORS

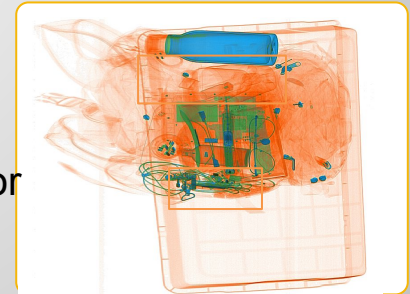
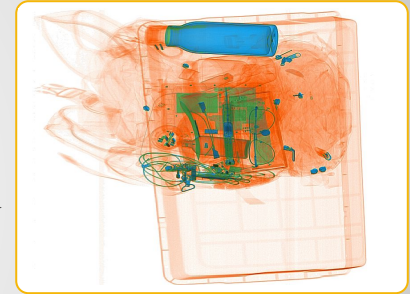
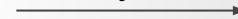


Imagen RAW
(Low + High
Energy)



Software AI

Atomic
number (Z) +
Geometry +
Density



AI inference
on the operator
screen

The RAW image contains information
about the atomic number of each object

ADVANTAGES OF OUR AI COMPARED WITH COMPETITORS

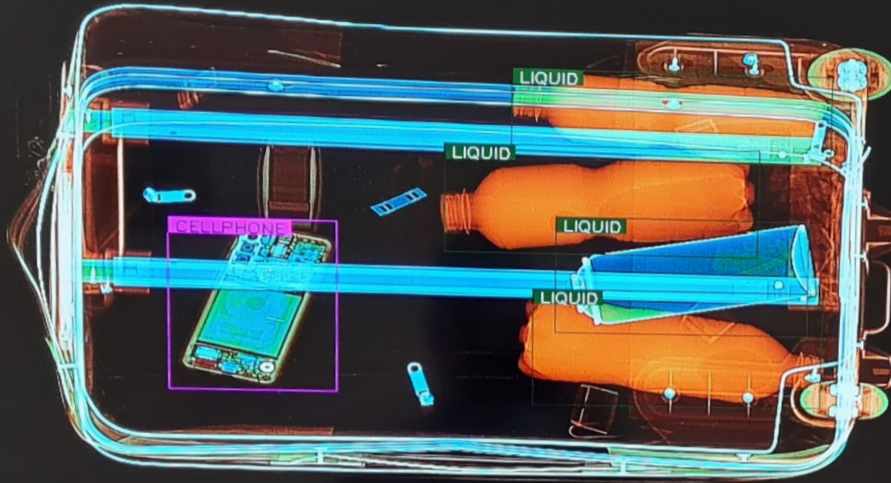


Advantages of acting on the RAW image:

Our AI solution works directly on the RAW image (which contains the atomic number of the objects in the image) and not on a print of the operator's screen (a traditional solution used by many competitors)

- Higher accuracy on each pixel of the image (direct impact on the model's precision)
- No loss of information (screen print image is generated by the machine's Operating System, applies compression and much information is lost)
- Filter applications on the operator's screen do not affect the AI's inference (since the AI works on the RAW image and not on the image processed by the filters)

ADVANTAGES OF OUR AI COMPARED WITH COMPETITORS

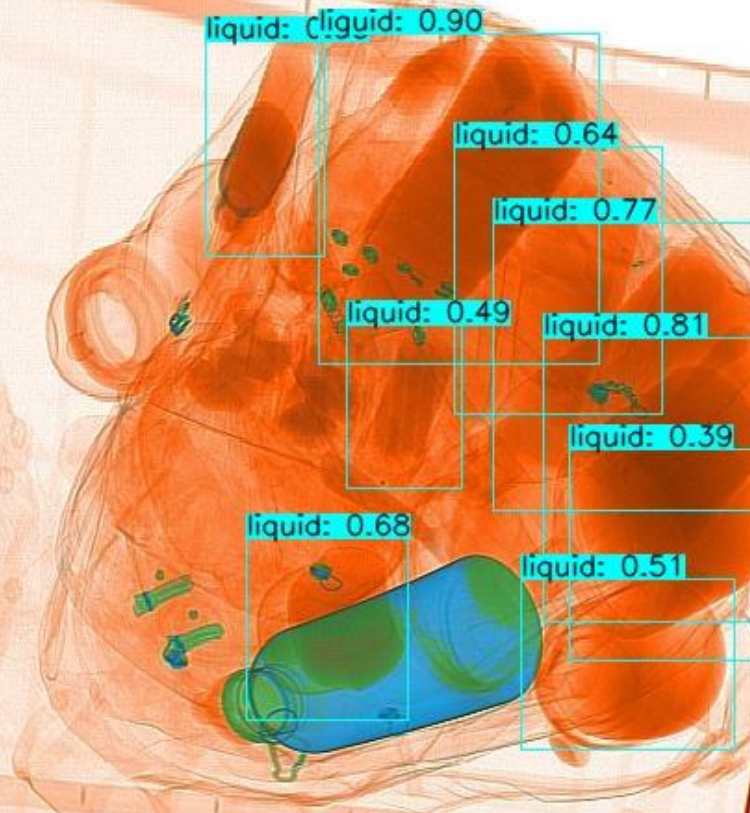


Applications of filters on the operator screen (image processing functions of the software) do not affect AI inference

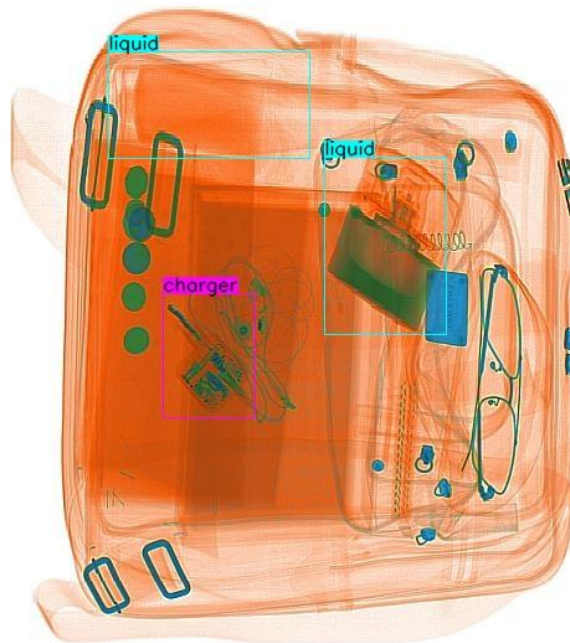
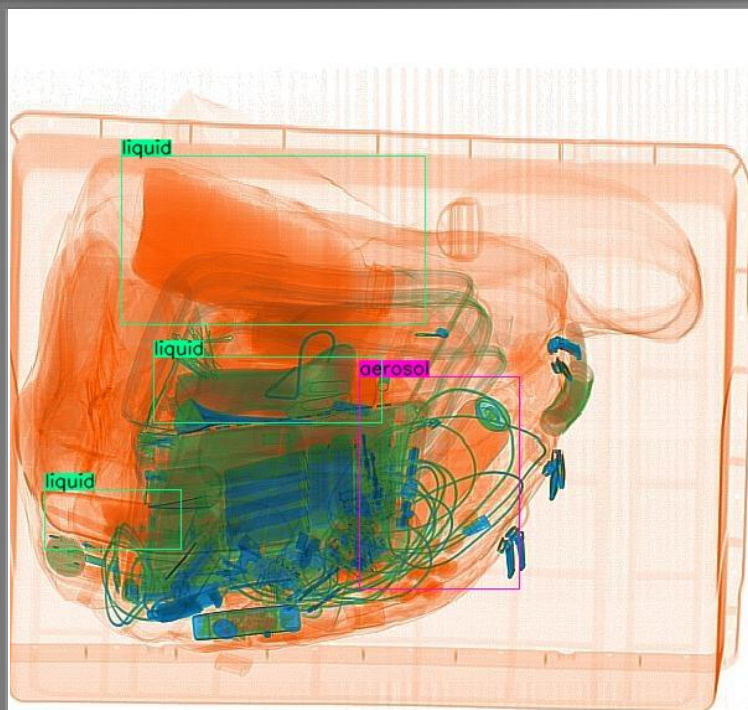


OBJECTS IDENTIFIED AUTOMATICALLY

- | | |
|--------------|-------------------|
| → Liquid | → Fire gun |
| → Aerosol | → Knives |
| → Cell phone | → Lithium battery |
| → Laptop | → Keys |
| → Charger | → Lighter |



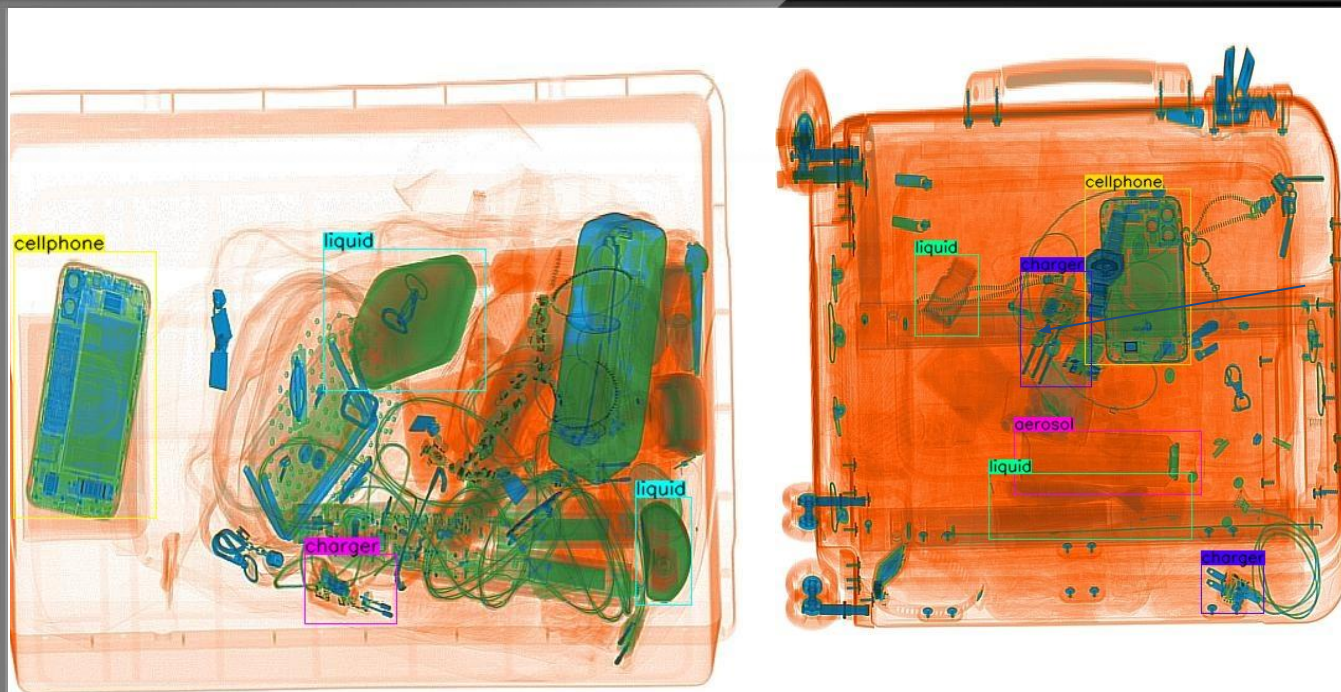
EXAMPLES OF INFERENCE



**Prohibited items
in carry-on
luggage:**

- flammable liquids
- aerosols

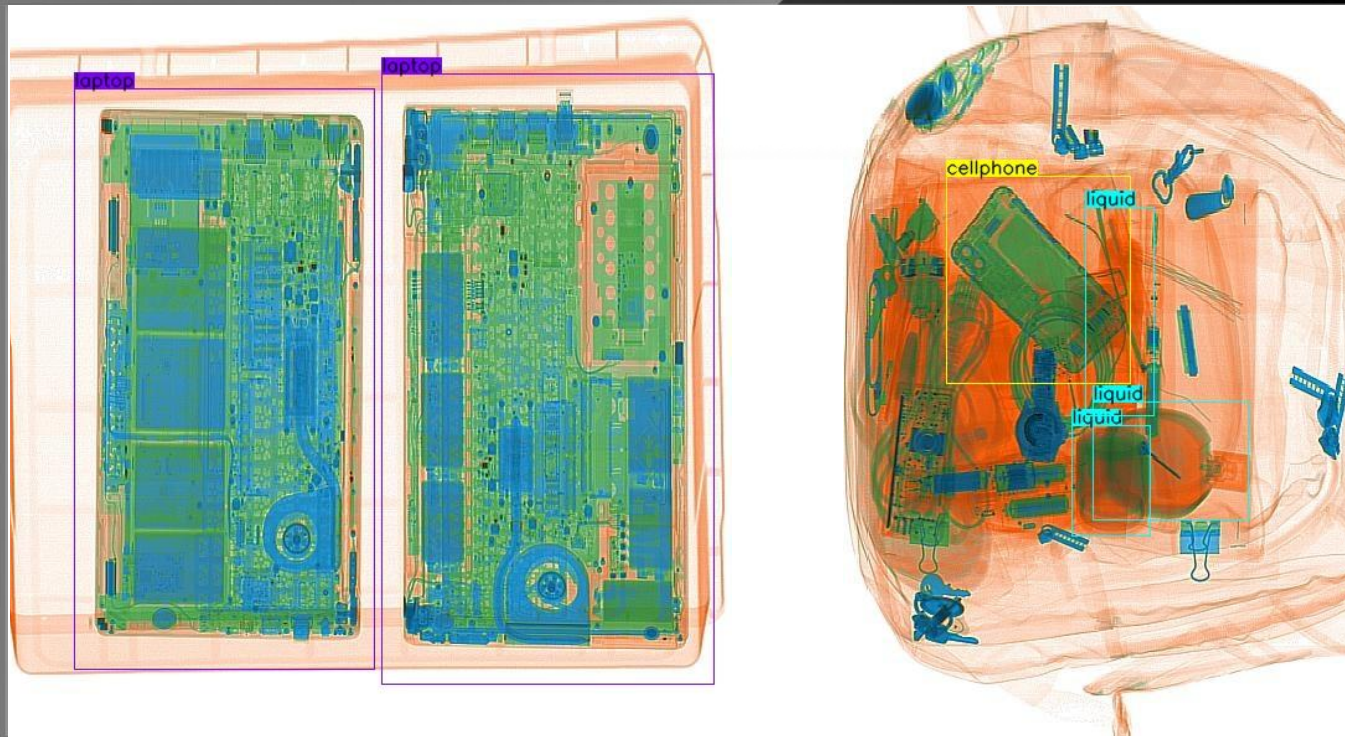
EXAMPLES OF INFERENCE



Prohibited items
in carry-on
luggage:

- flammable liquids
- aerosols

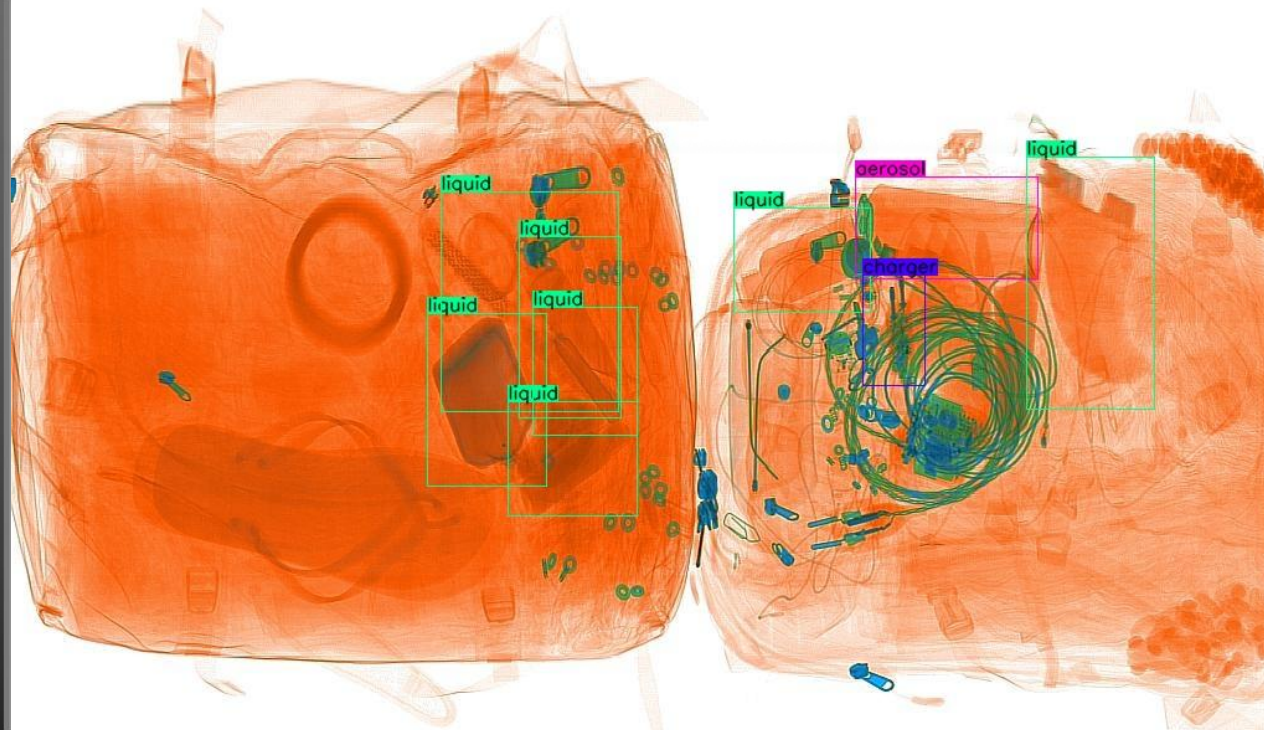
EXAMPLES OF INFERENCE



Prohibited items
in carry-on
luggage:

- flammable liquids
- aerosols

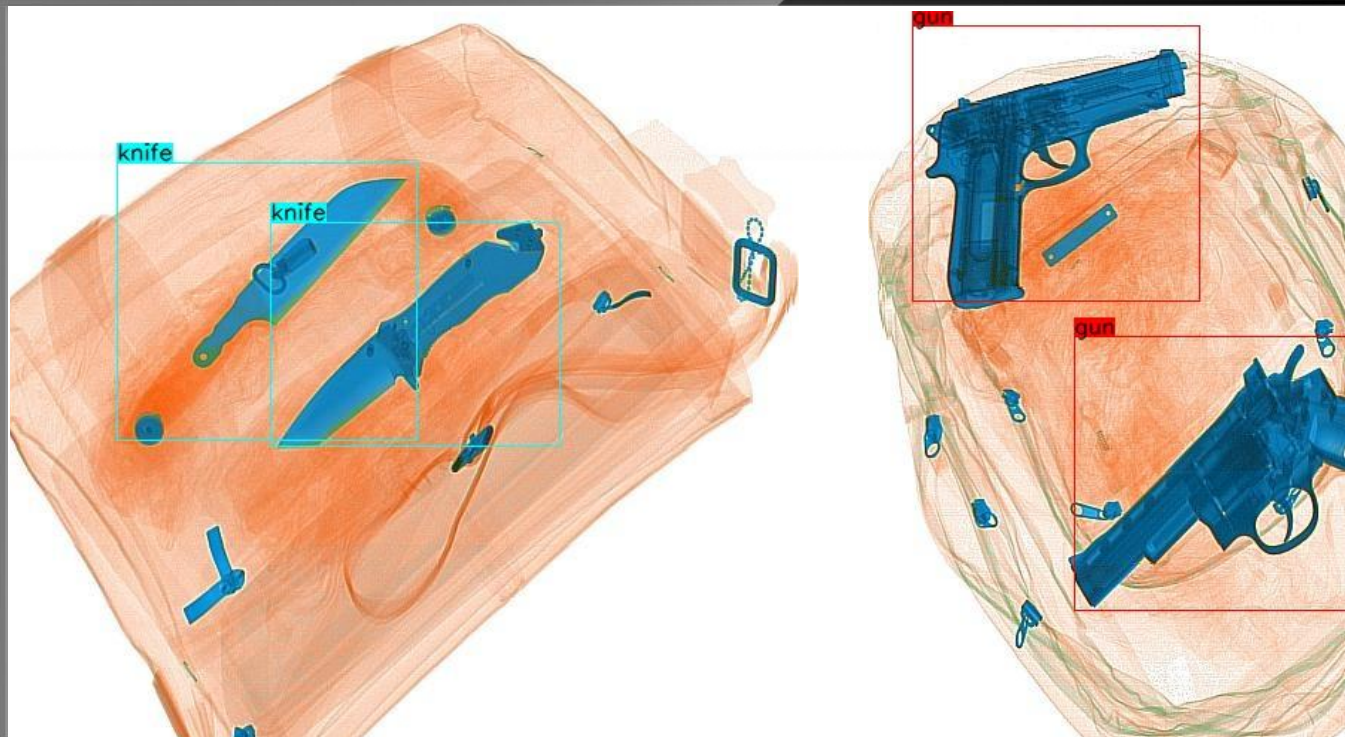
EXAMPLES OF INFERENCE



Prohibited items
in carry-on
luggage:

- flammable liquids
- aerosols

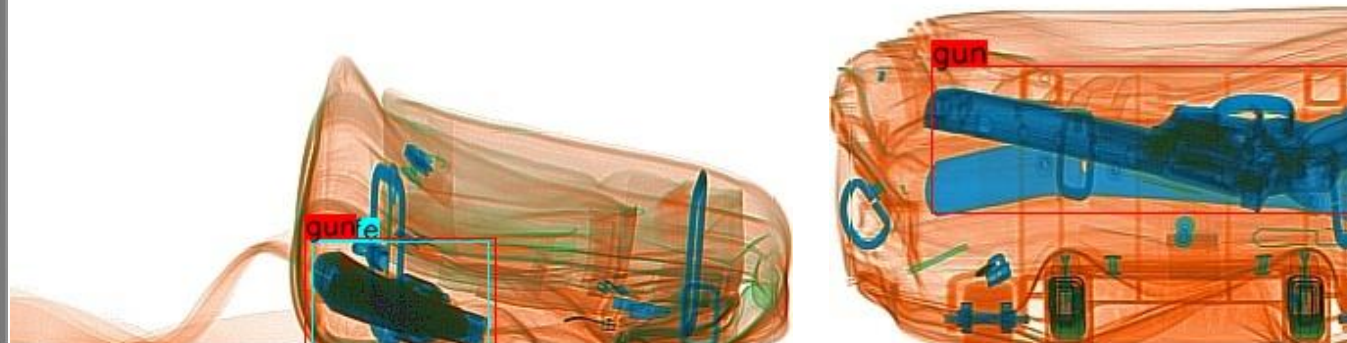
EXAMPLES OF INFERENCE



Prohibited items in
carry-on luggage:

- Knives 6mm
- Fire gun

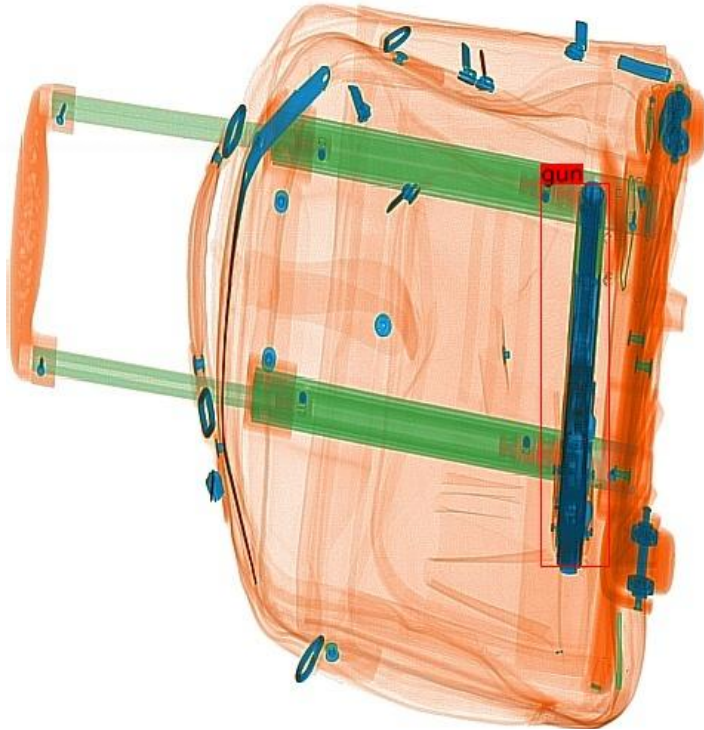
EXAMPLES OF INFERENCE



Prohibited items in
carry-on luggage:

- Fire gun

EXAMPLES OF INFERENCE



Prohibited items in
carry-on luggage:

- Fire gun

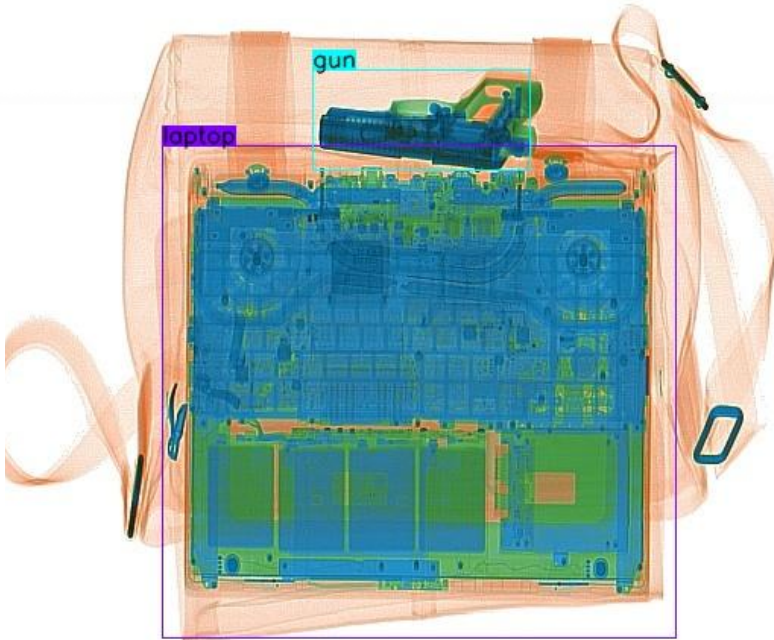
EXAMPLES OF INFERENCE



Prohibited items in
carry-on luggage:

- Fire gun

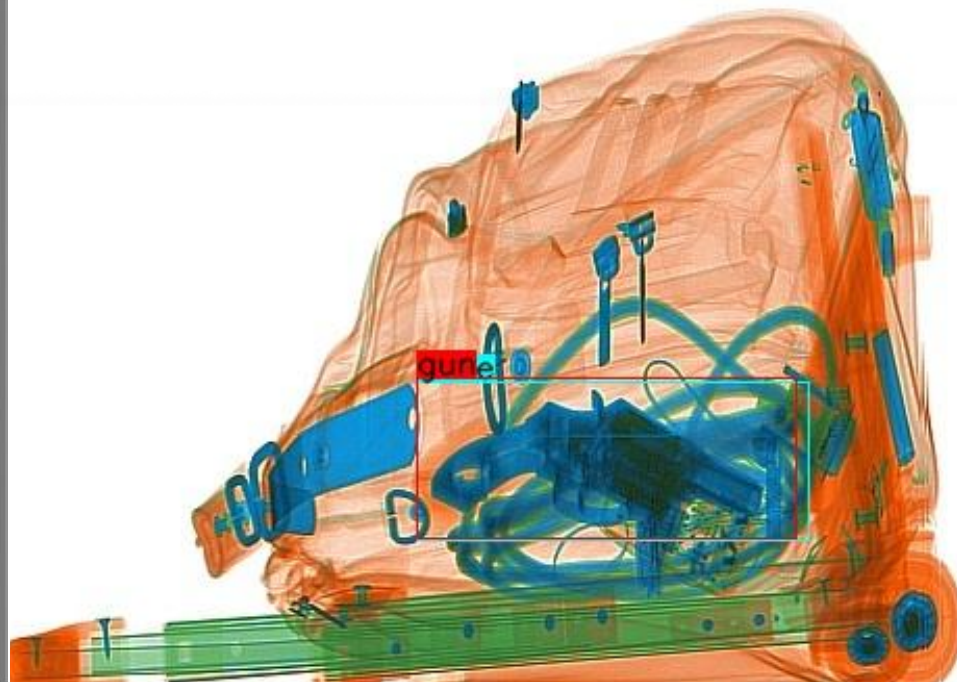
EXAMPLES OF INFERENCE



Prohibited items in
carry-on luggage:

- Fire gun

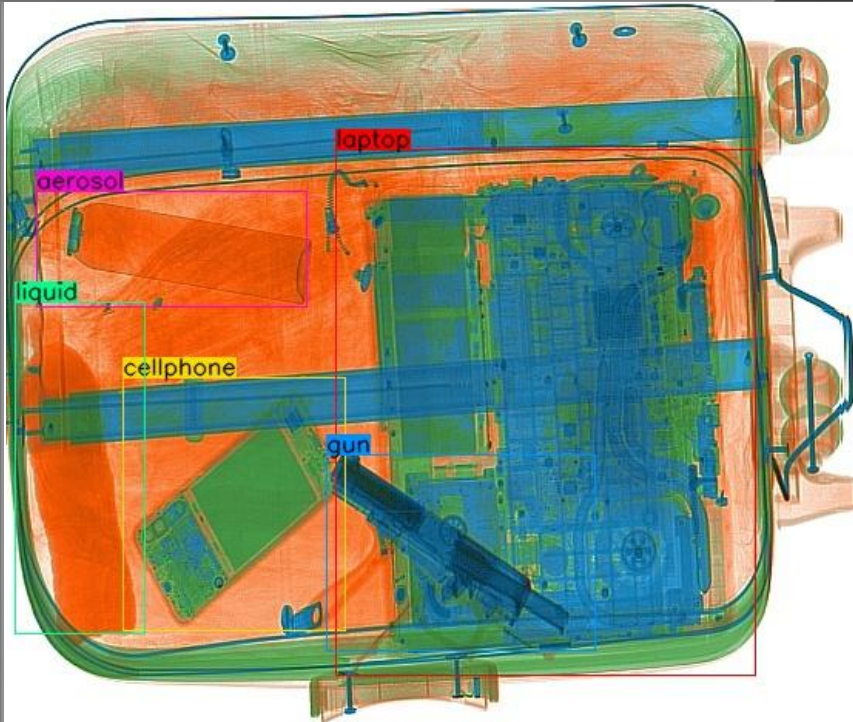
EXAMPLES OF INFERENCE



Prohibited items in
carry-on luggage:

- Fire gun

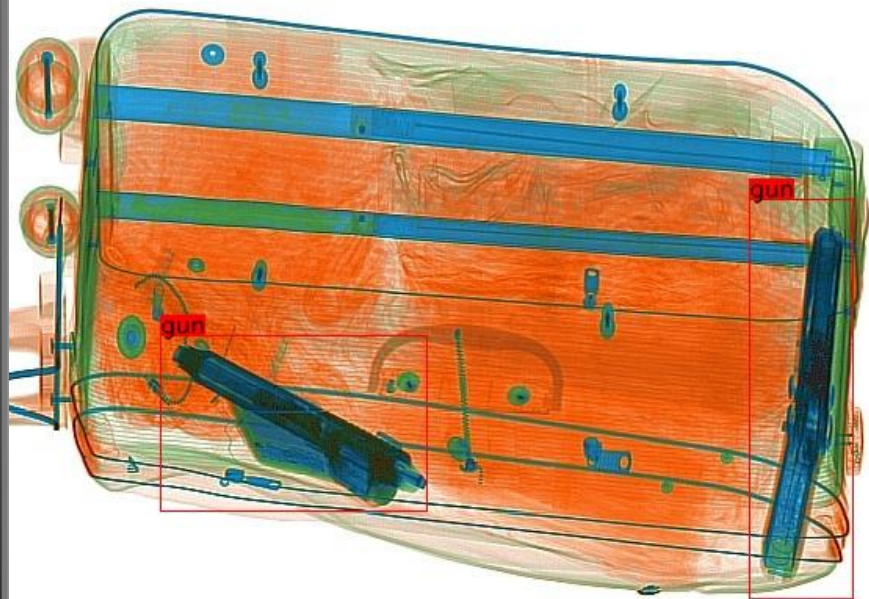
EXAMPLES OF INFERENCE



Prohibited items in carry-on luggage:

- flammable liquids
- aerosols
- fire gun

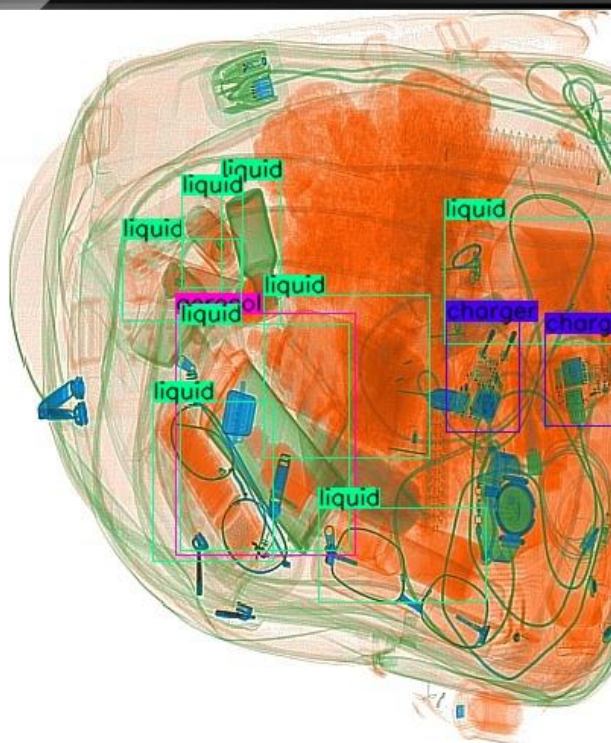
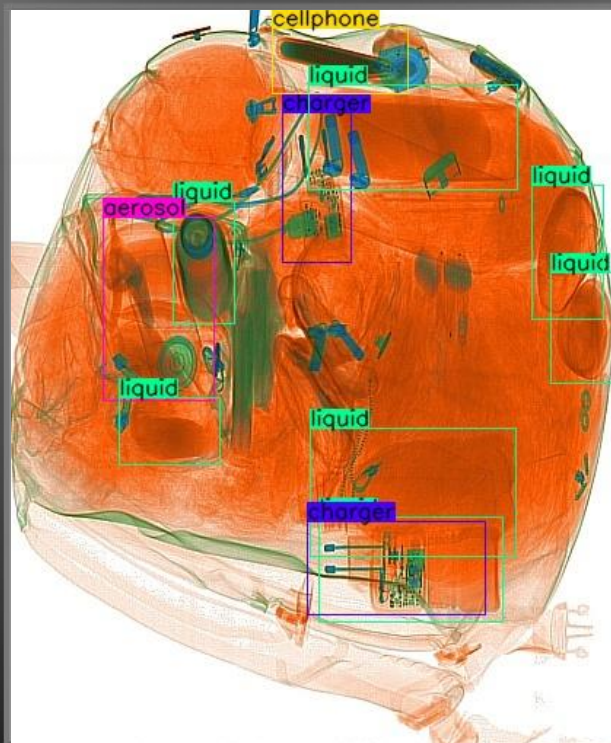
EXEMPLOS DE INFERÊNCIA



Prohibited items in
carry-on luggage:

- Fire gun

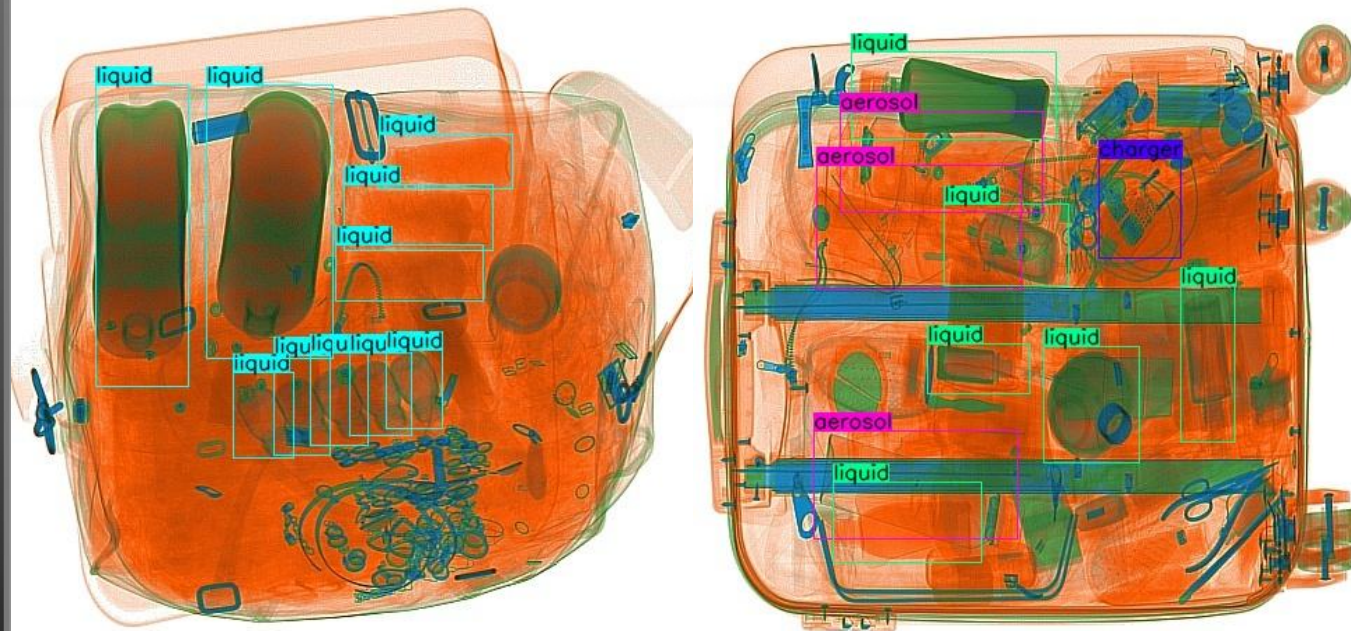
EXAMPLES OF INFERENCE



Prohibited items
in carry-on
luggage:

- flammable liquids
- aerosols

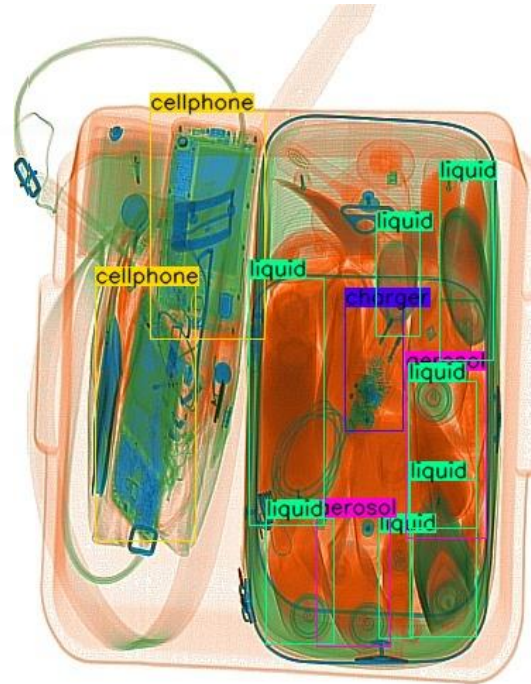
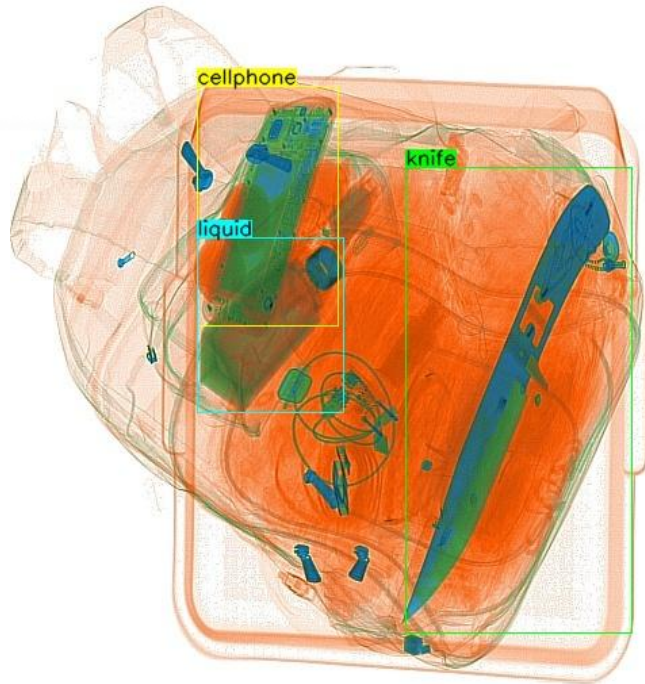
EXAMPLES OF INFERENCE



Prohibited items
in carry-on
luggage:

- flammable liquids
- aerosols

EXAMPLES OF INFERENCE

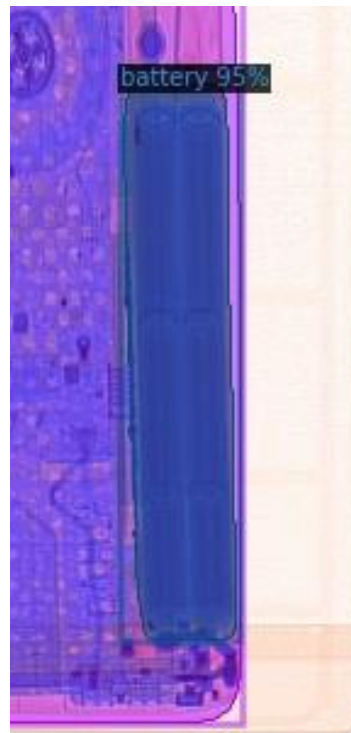


Prohibited items in carry-on luggage:

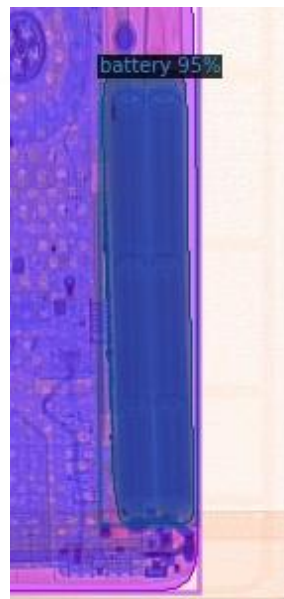
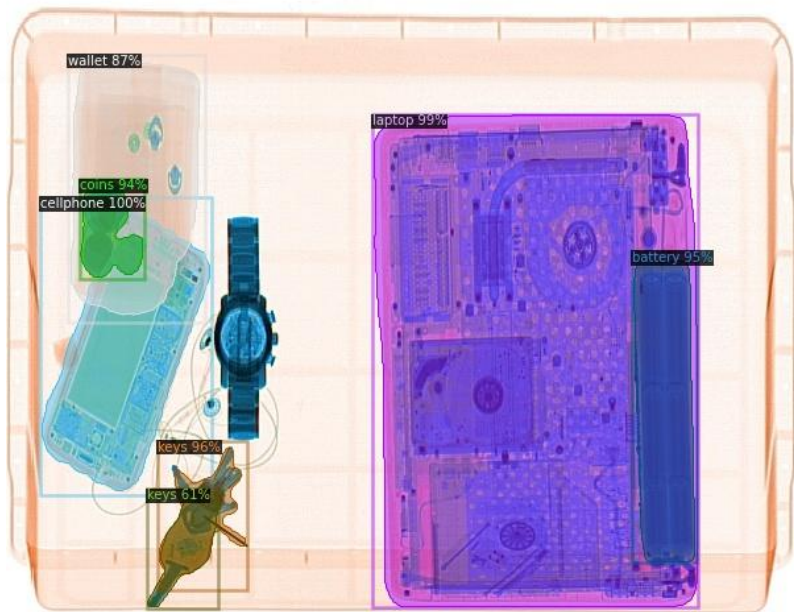
- flammable liquids
- aerosols
- knives



BATTERY LITHIUM



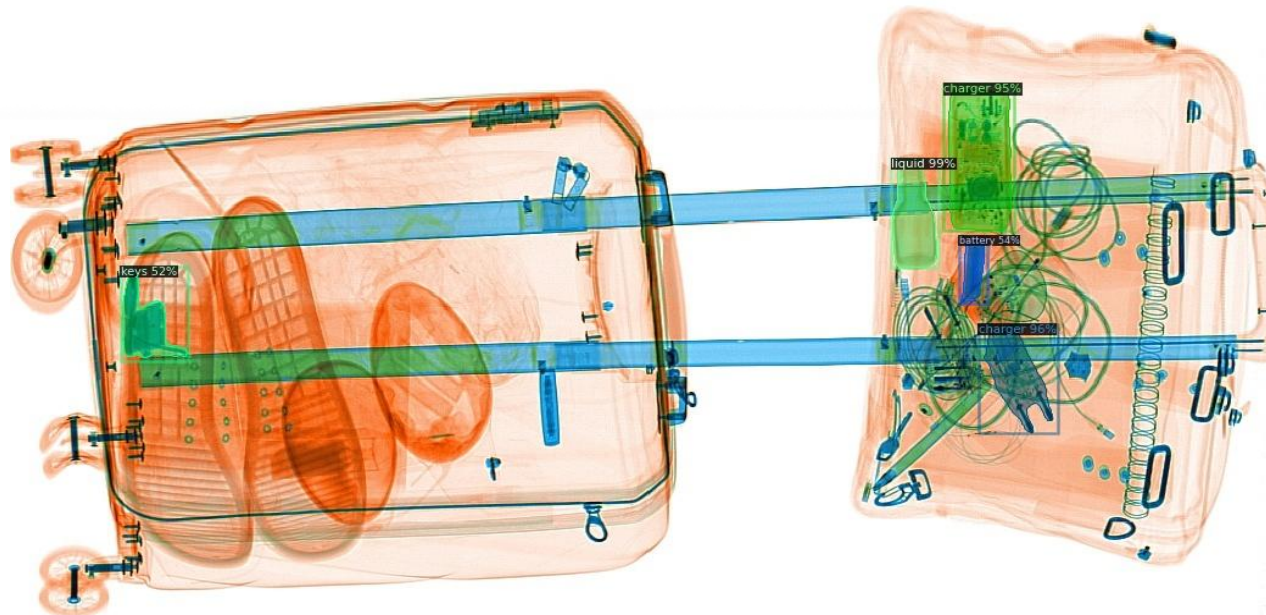
EXAMPLES OF INFERENCE



Prohibited items in carry-on luggage:

- battery lithium

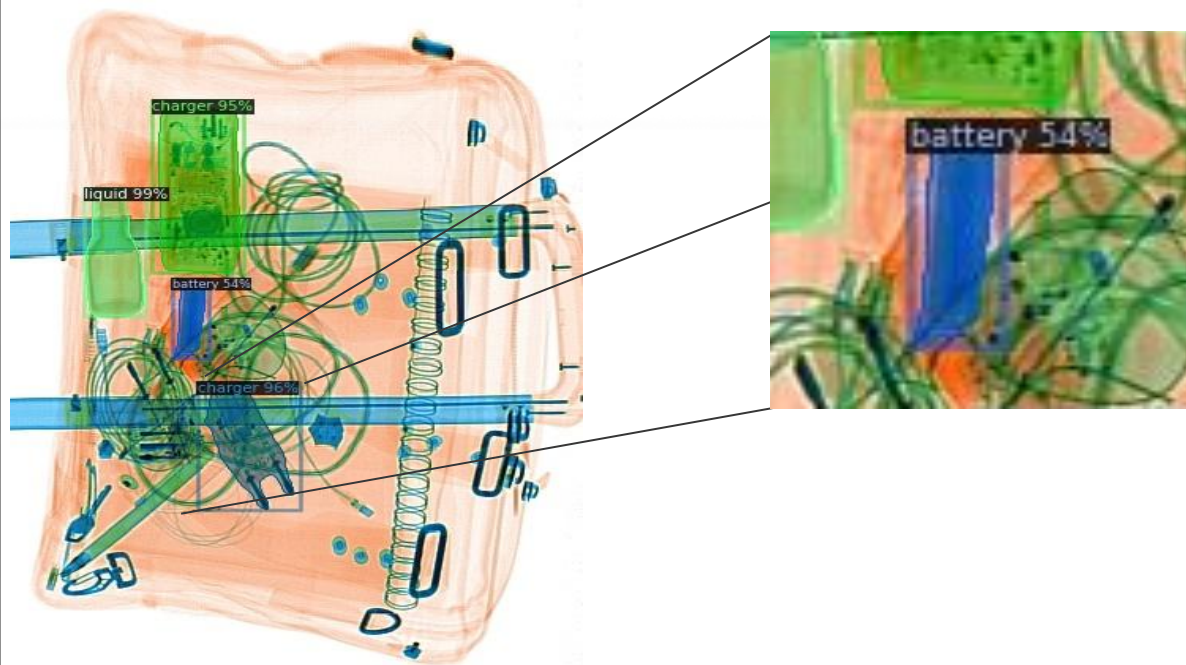
EXAMPLES OF INFERENCE



Prohibited items in carry-on luggage:

- battery lithium

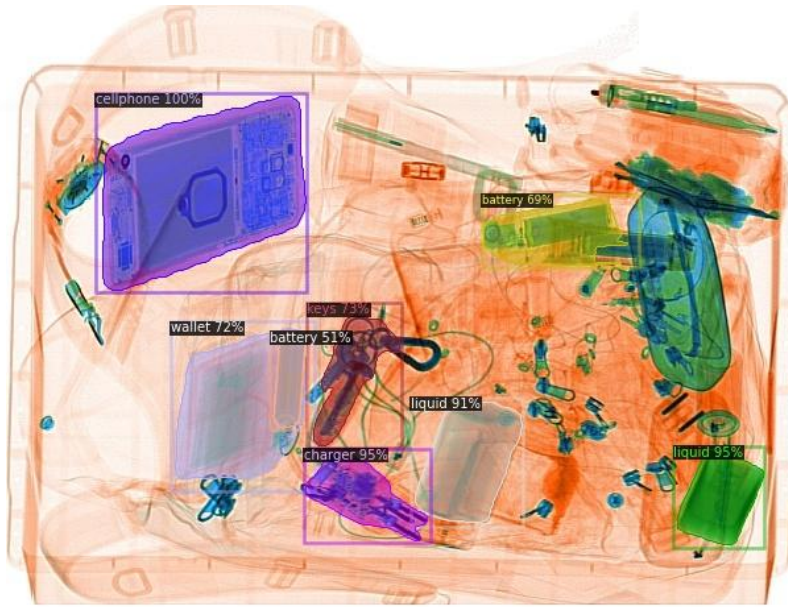
EXAMPLES OF INFERENCE



**Prohibited items in
carry-on luggage:**

- battery lithium

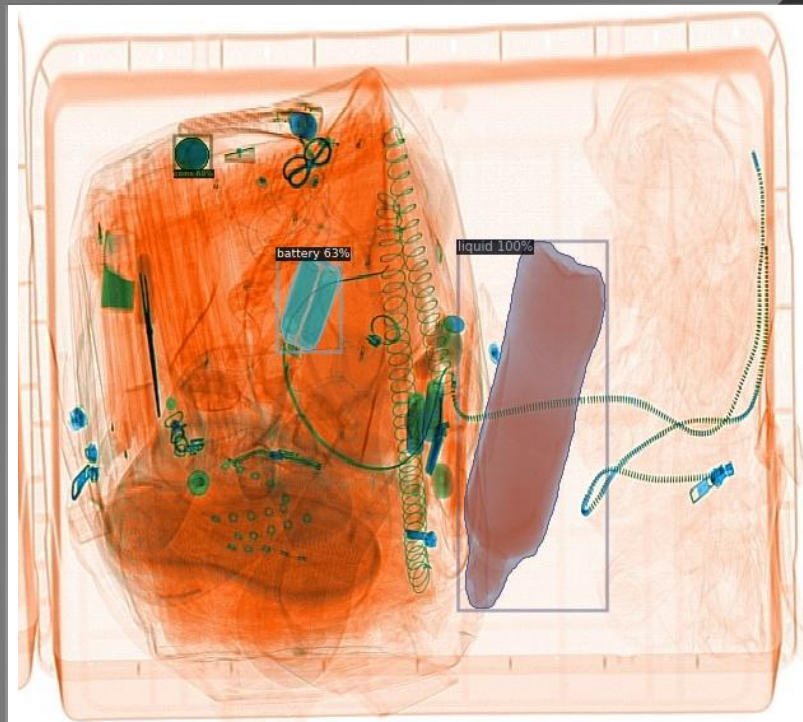
EXAMPLES OF INFERENCE



Prohibited items in carry-on luggage:

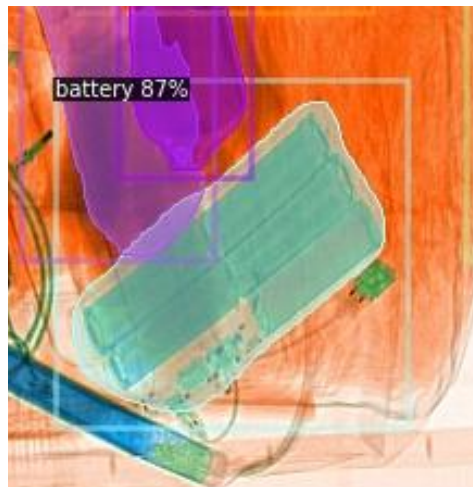
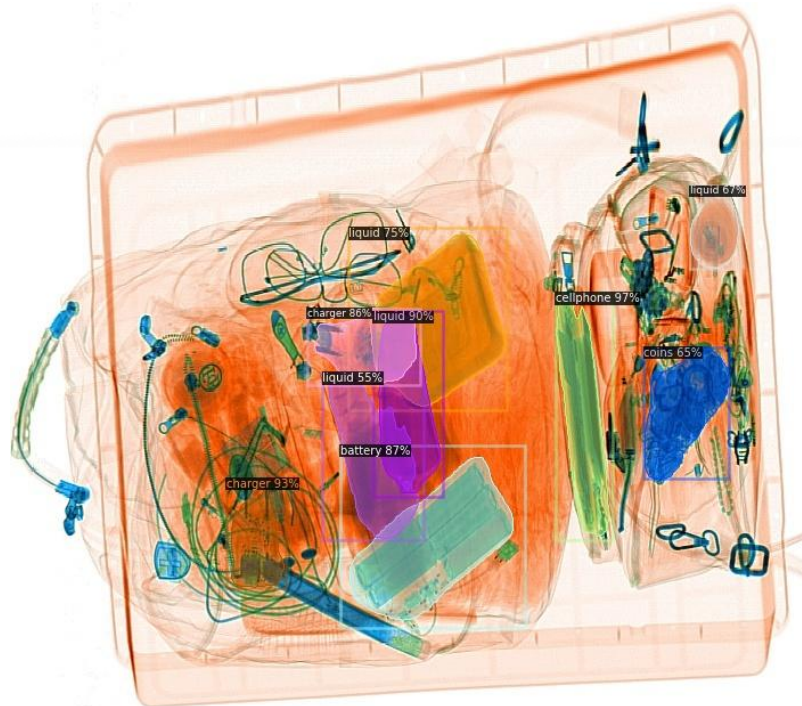
- battery lithium

EXAMPLES OF INFERENCE



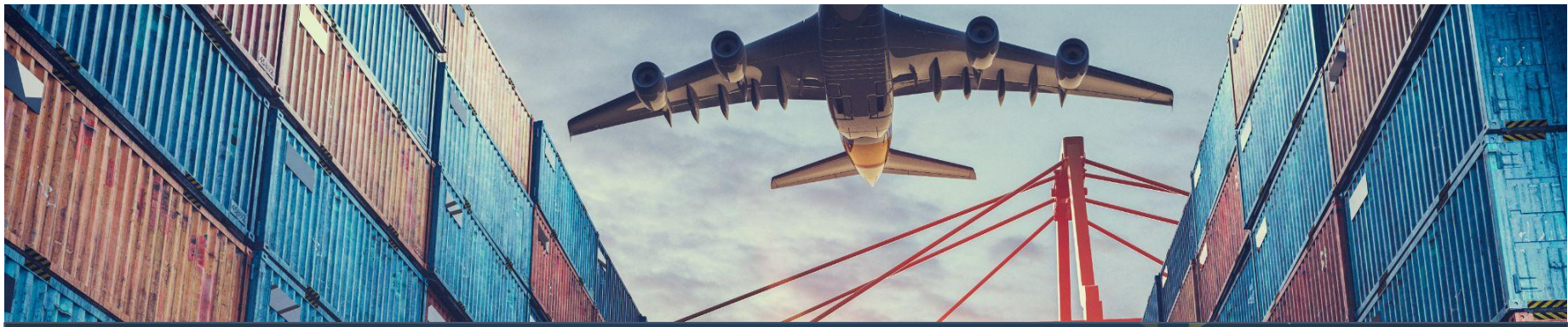
Prohibited items in
carry-on luggage:
- battery lithium

EXAMPLES OF INFERENCE



Prohibited items in carry-on luggage:

- battery lithium



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