AMANDA

The world in your hands

AutonoMous self powered miniAturized iNtelligent sensor for environmental sensing anD asset tracking in smArt IoT environments

AMANDA Project – Webinar
Custom AI methods for low power systems

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CERTH
CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

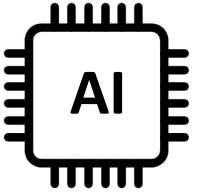
iti Information Technologies Institute

AMANDA project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 825464.

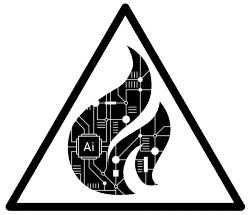
Agenda

We will briefly discuss the following:

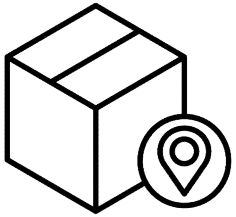
- The Edge Intelligence core of the AMANDA card



- Low power machine learning algorithm for fire monitoring and detection

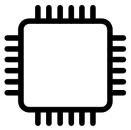


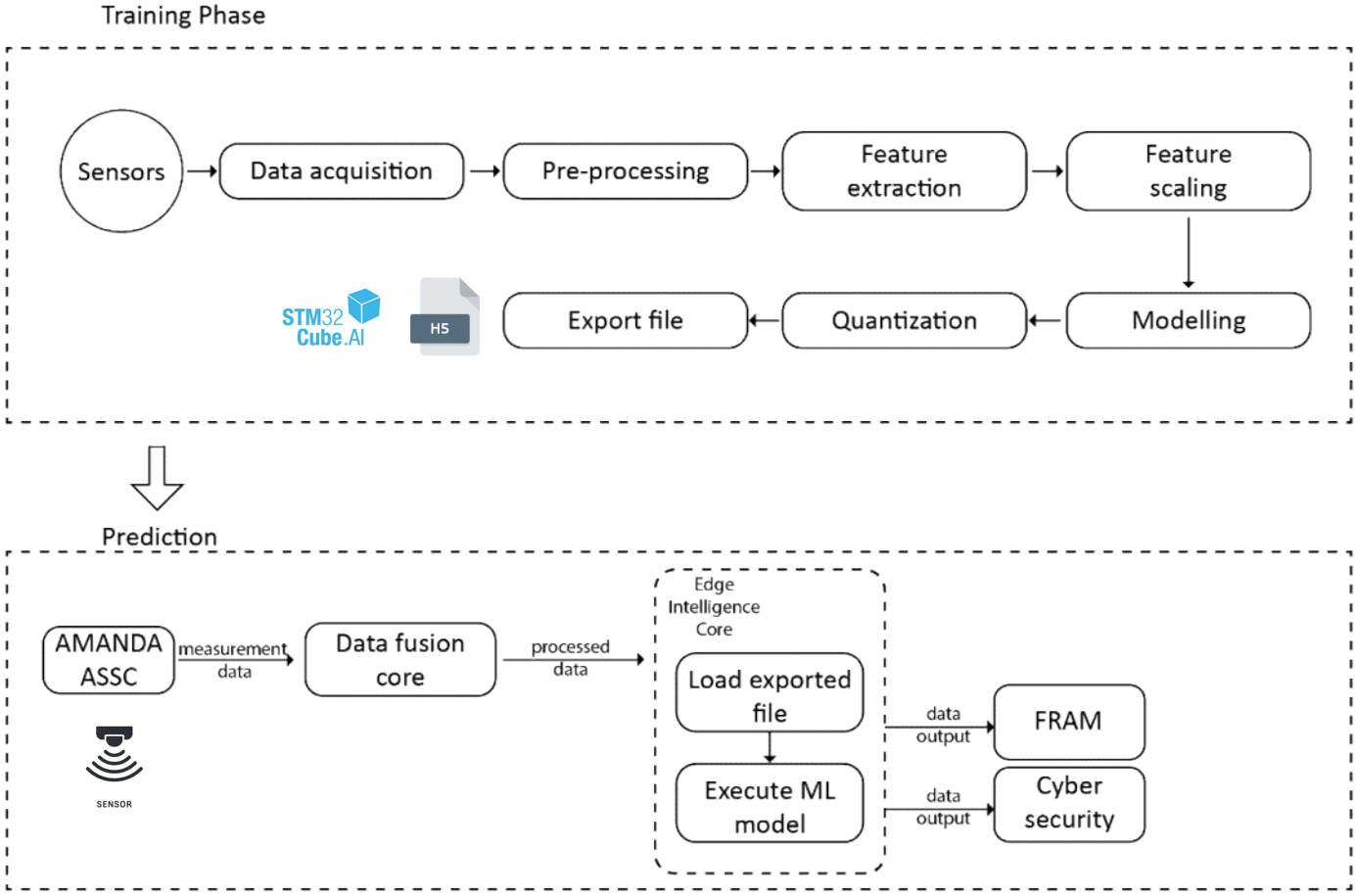
- Two machine learning methods to monitoring the transportation conditions of medicines/vaccines



- A low power object detection algorithm for crowd counting

AMANDA: Edge Intelligence Architecture

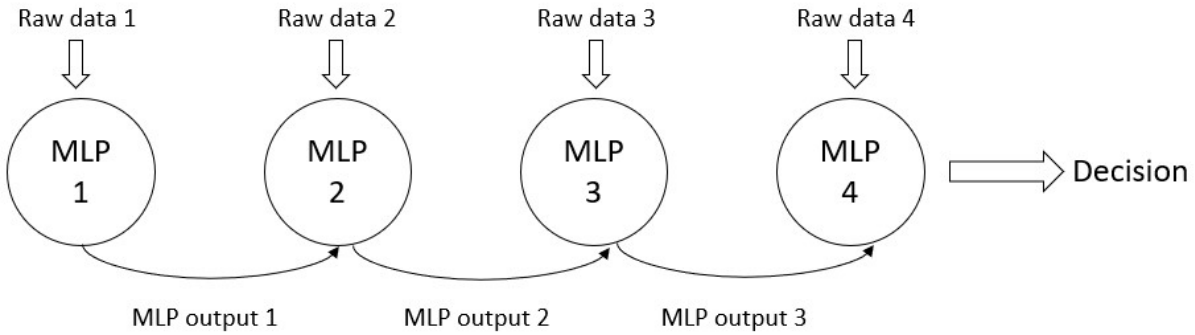




SC02: Fire monitoring

Input Data	ML algorithm	Optimized version of ML	Accuracy (initial/optimized)
Temperature, Humidity, CO2, VOC	MLP model	Chain of MLP models	94.2% / 97.05%

- Binary Classification problem - outputs (0, 1)
- 5 Input Data (T, H, CO2, VOC, Previous State)
- Chain of MLP models



SC02: Fire monitoring

- 4500 data points from the temperature, humidity, eCO2 and TVOC sensors
- Quantization of 8 bit is applied
- A standardization method was applied, shifting the distribution of each attribute to have a mean of 0 and a standard deviation of 1

Metrics	Value
Accuracy	97.05%
F1 score	97%
Sensitivity	97.1%
Specificity	96.5%

Papers	Accuracy	Environmental Sensors
[1]	85%	temperature, smoke, gas sensor
[2]	90%	temperature, flame, smoke sensor
[3]	95.3%	temperature, humidity, flame sensor
Own work	**97.05%**	**temperature, humidity, TVOC, CO2 sensor**

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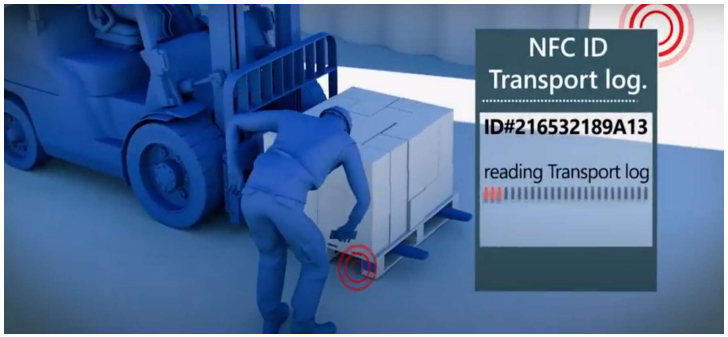
SC05: Monitor transportation conditions of medicines/vaccines

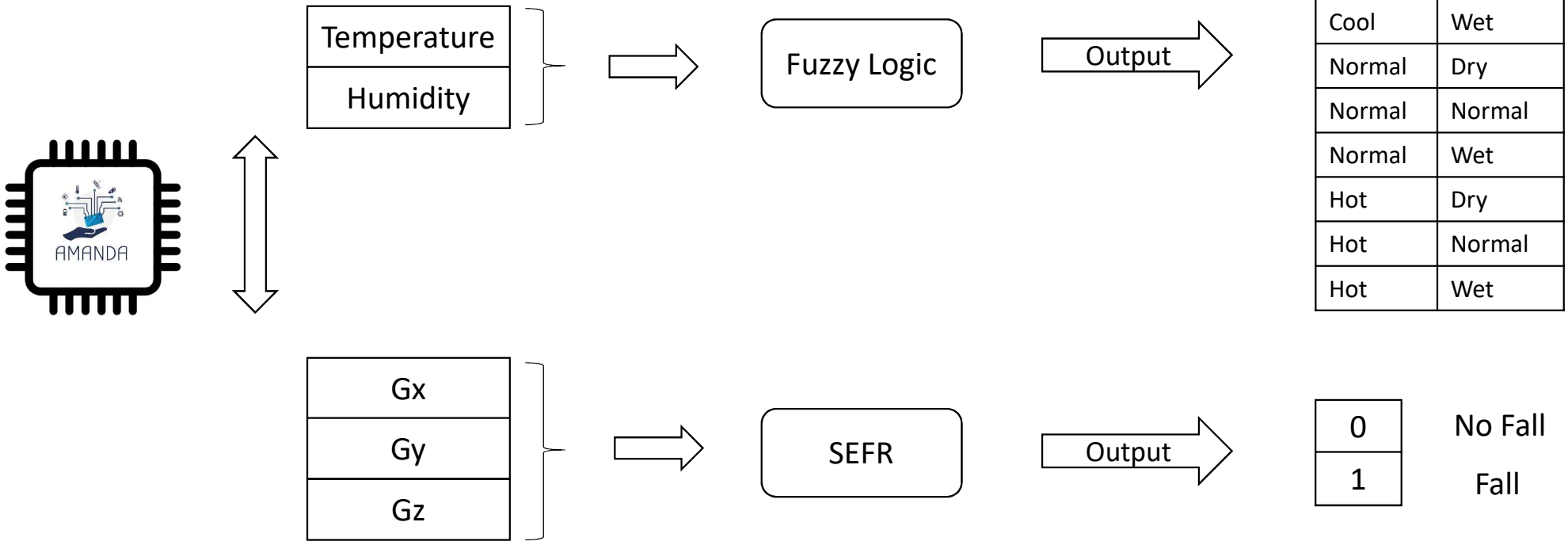
Input Data	ML algorithm	Optimized version of ML	Accuracy (initial/optimized)
Temperature, Humidity, Accelerometer	MLP model	Fuzzy Logic + SEFR	95.2% / 96.4%

- Fuzzy Logic
  - 2 Inputs (Temperature, Humidity)
  - 9 outputs
    - 3 conditions for Temperature
    - 3 conditions for Humidity

- SEFR
  - 3 Inputs (Gx, Gy, Gz)
  - Binary output (Fall, no Fall)



SC05: Monitor transportation conditions of medicines/vaccines

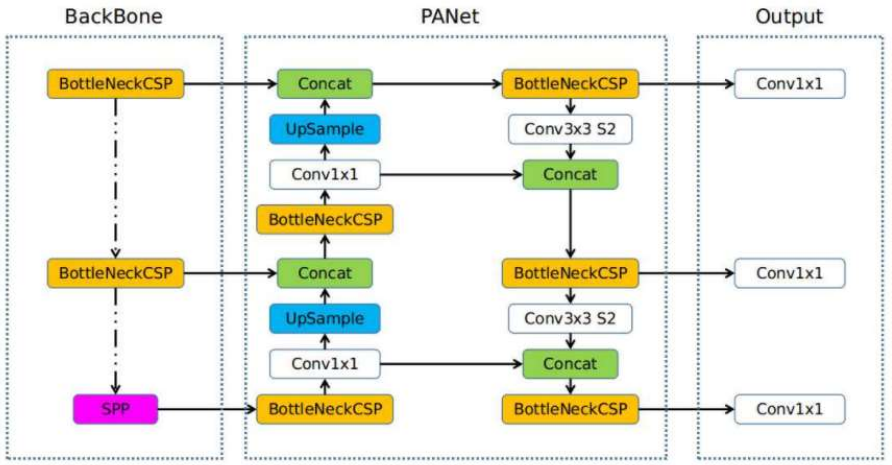


Temper.	Humidity
Cool	Dry
Cool	Normal
Cool	Wet
Normal	Dry
Normal	Normal
Normal	Wet
Hot	Dry
Hot	Normal
Hot	Wet

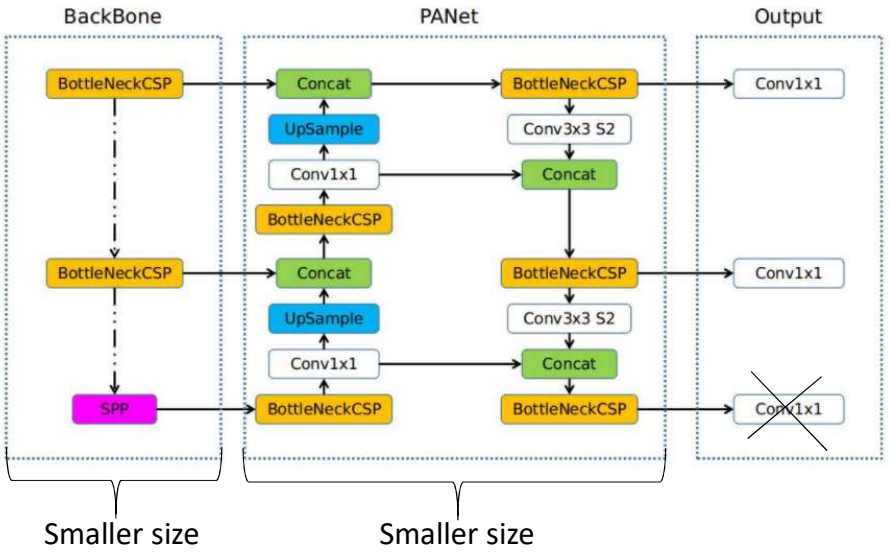
SC06: Crowd counting for social distancing

Input Data	ML algorithm	Optimized version of ML	Accuracy (initial/optimized)
Image	CNN	YoloV5	94.2% / mAP (0.5): 97.04% mAP (0.5-0.95): 61.9%

Yolov5



Yolov5 Lite (71 sec)



SC06: Crowd counting for social distancing

Yolov5 Ultra Lite

- Replace Backbone with the ShuffleNetV2
- Reduce the size of PANet layer
- Create a custom non maximum suppression method
- Reduce the number of outputs (from 3 to 2)
- Quantization to 8bit
- Accuracy:
    - mAP(0.5): 97,04%
    - mAP(0.5-0.95): 61,9%
- Model size: 0.2 Mb
- Execution time: 21 sec

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Thank you
Q&A

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