EDGE IMPULSE

Edge Impulse's FOMO Technology & Sony's Computer Vision Platform: A Compelling Combination

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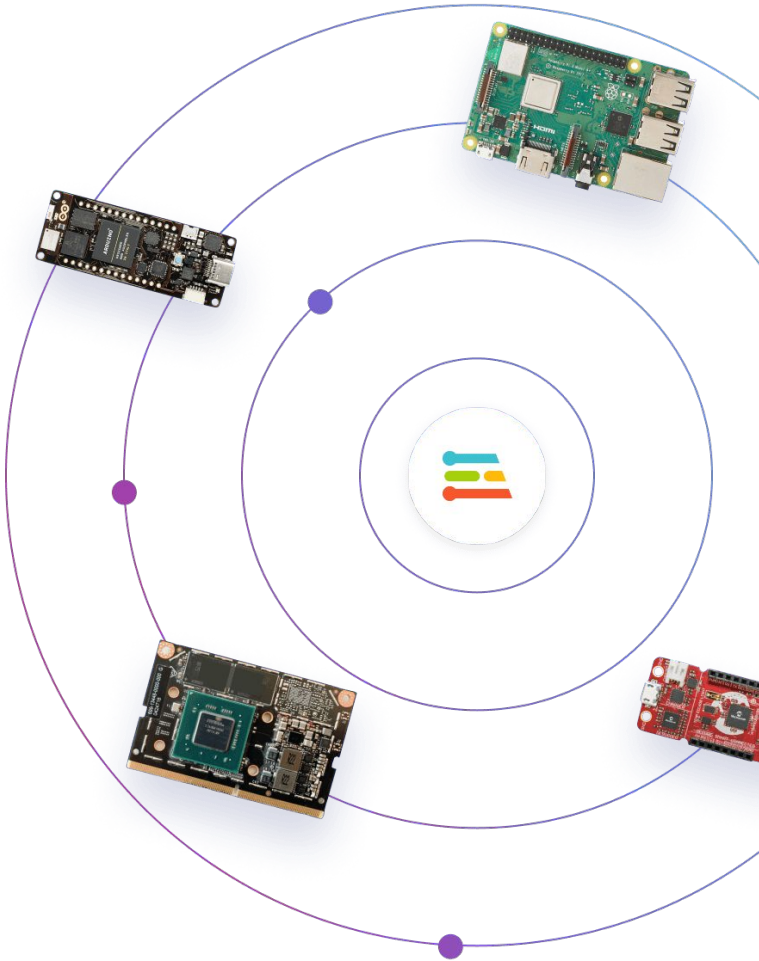
Agenda

- What is Edge Impulse?
- Image Processing Approaches
- Constrained Object Detection
- Use Cases and Limitations
- Demo 🚀



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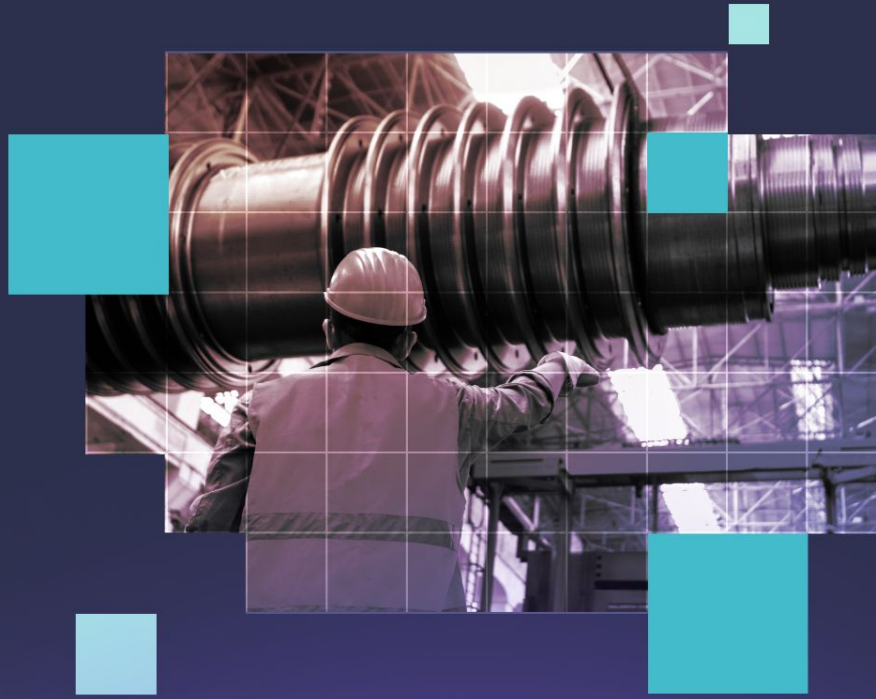
Edge Impulse



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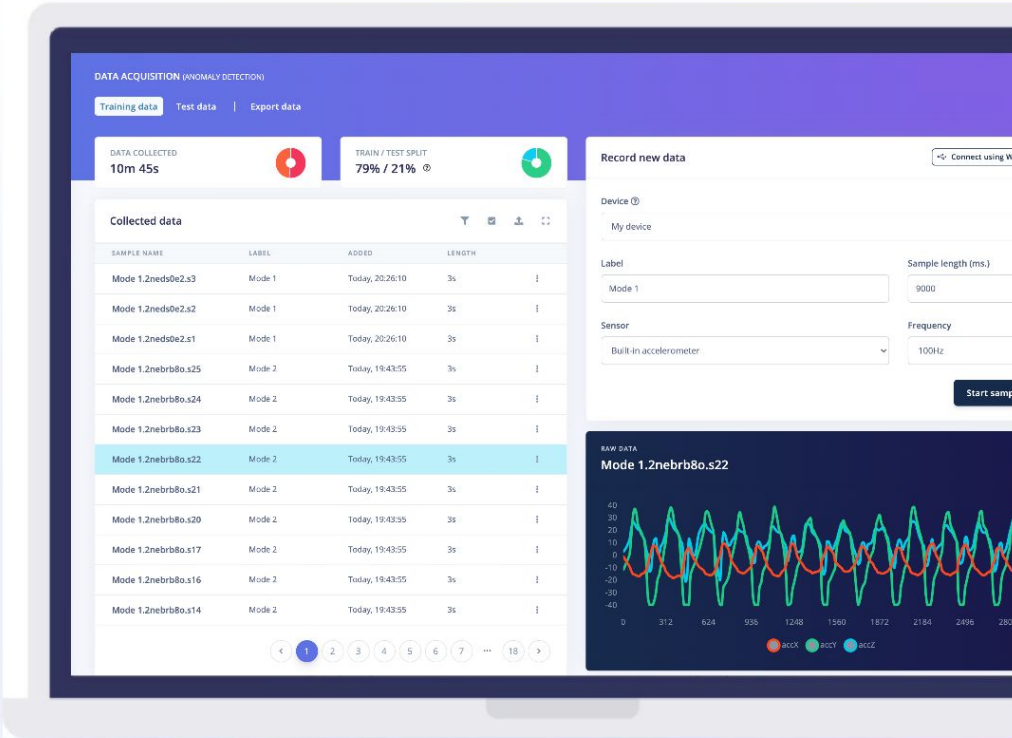
The developer-first edge ML platform

- Any data, any device
- No royalty, no impact on BOM
- Your IP, stays your IP
- Total explainability, no black boxes



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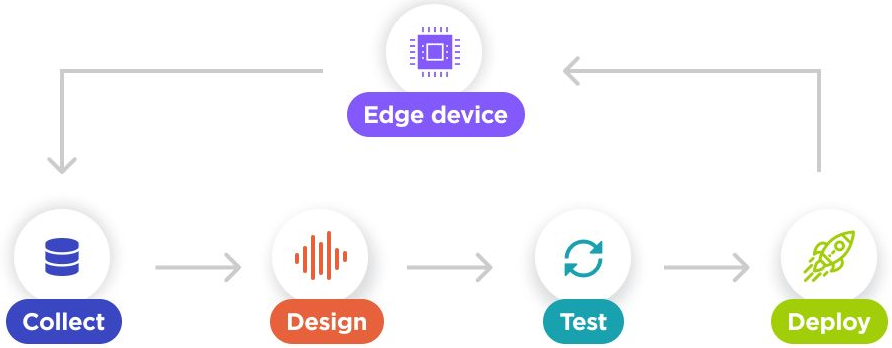
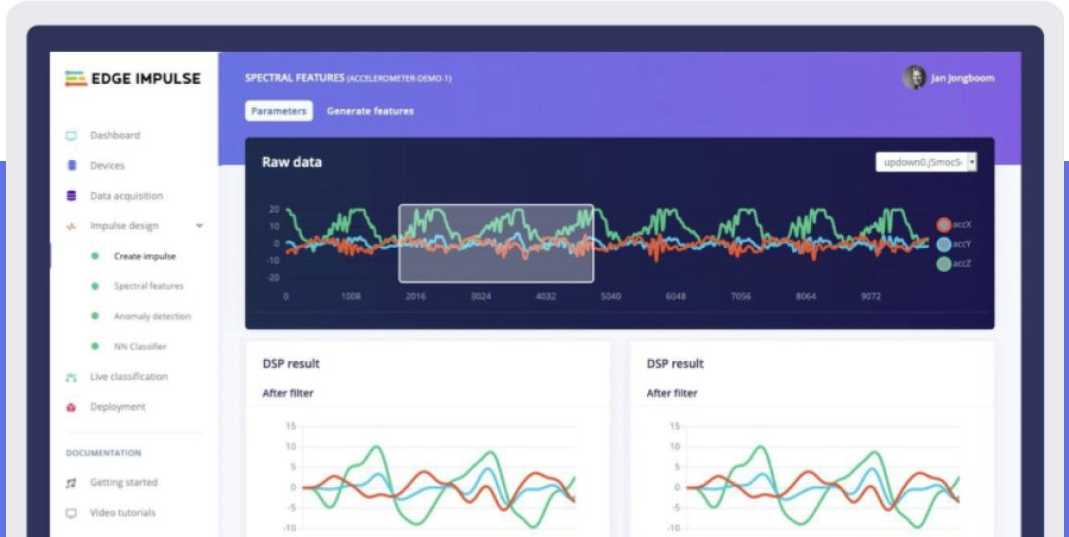
Go to market faster with confidence





Deploy to any edge device with ease

- The largest silicon ecosystem
- Award-winning compiler
- Access to device source code
- Full firmware integration for a number of devices

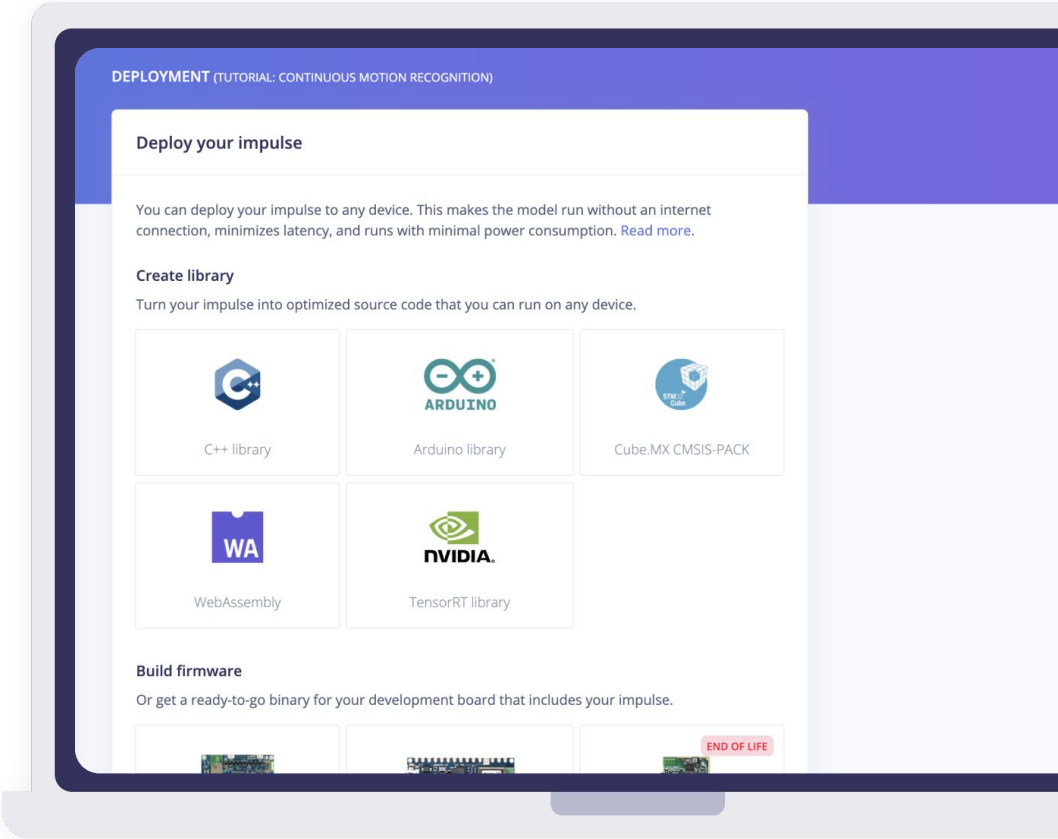


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Image Processing Approaches

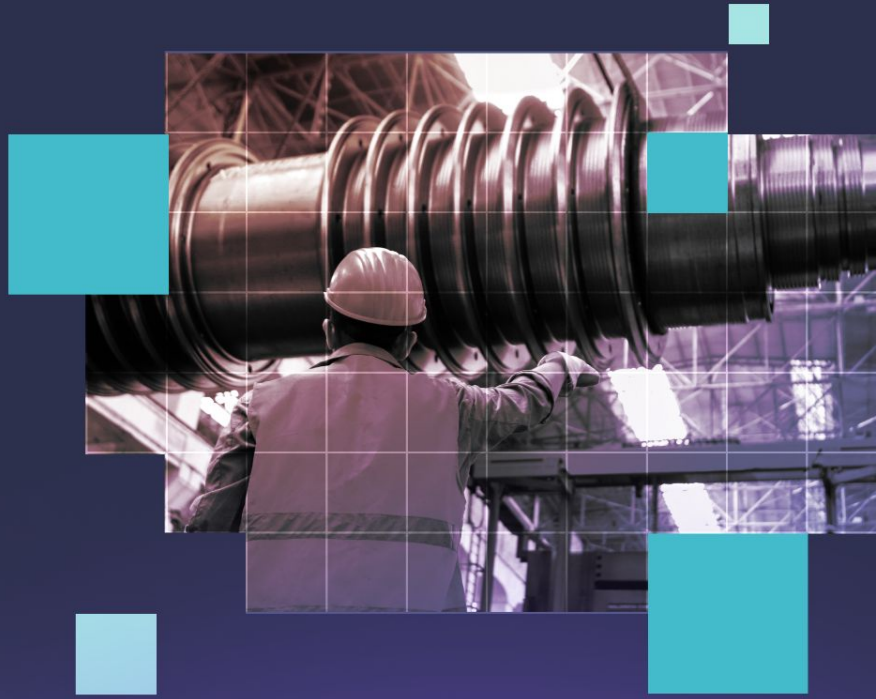
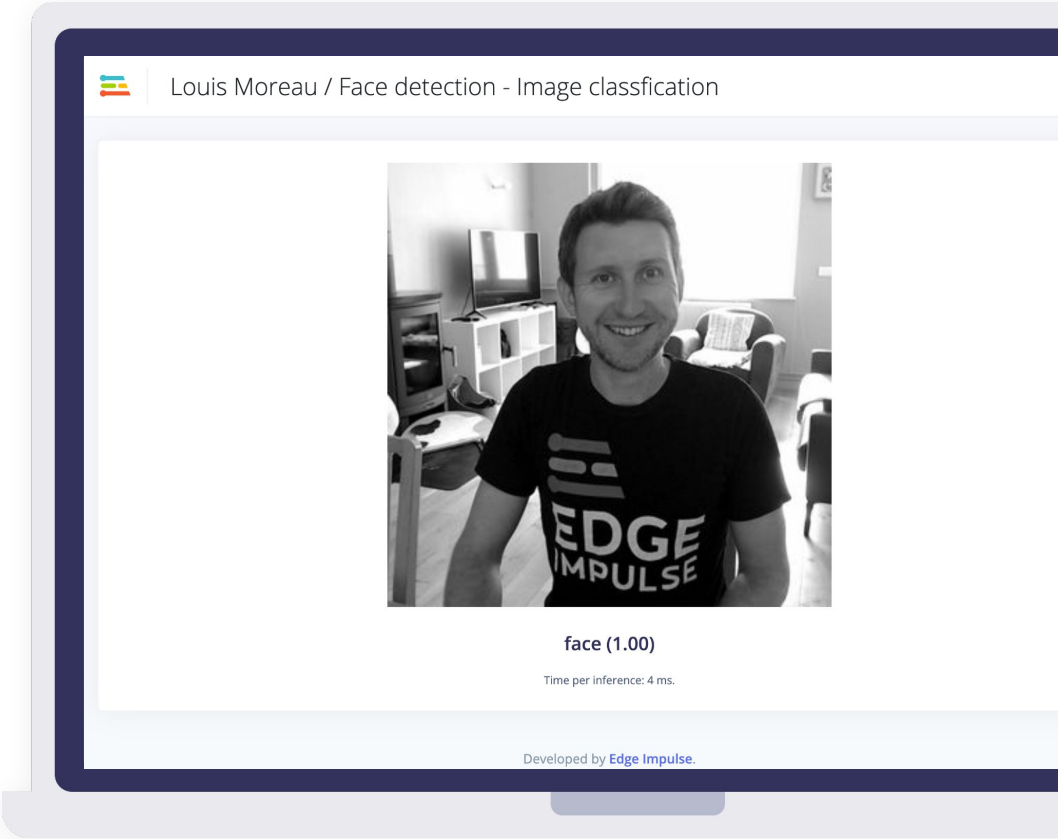


Image classification

The question the model is trying to answer is:

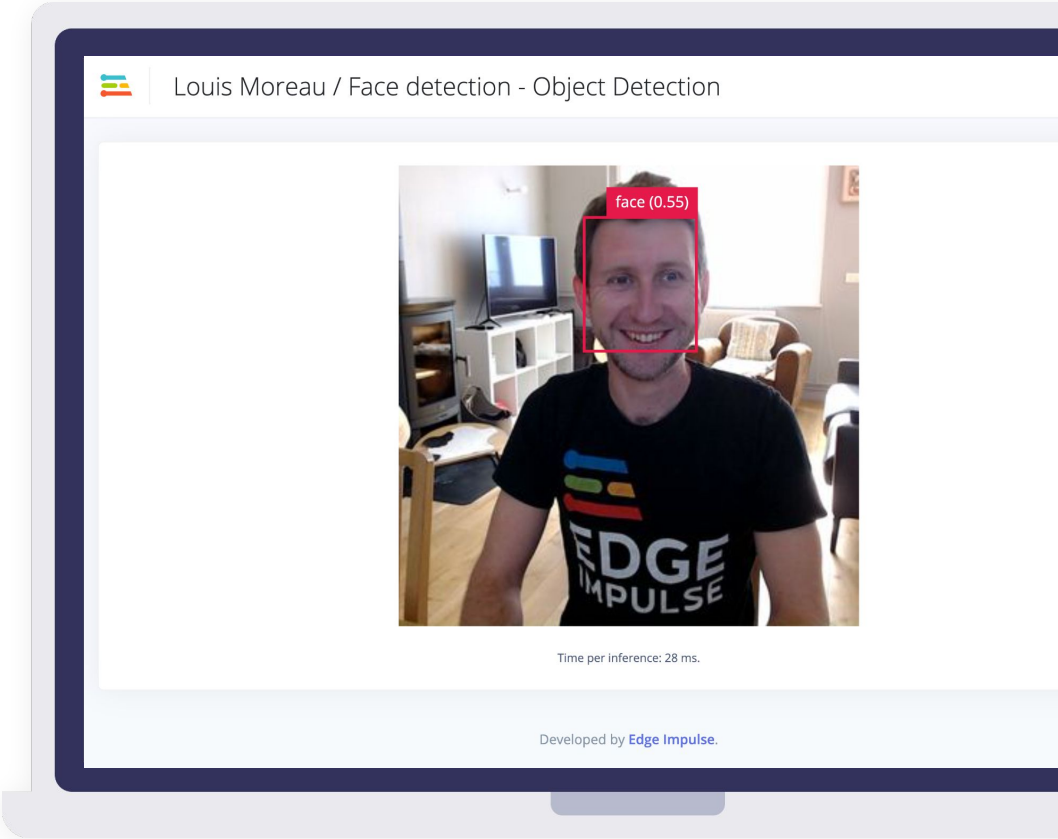
“Is there a face or not in the image?”



Object Detection using Bounding Boxes

The question the model is trying to answer is:

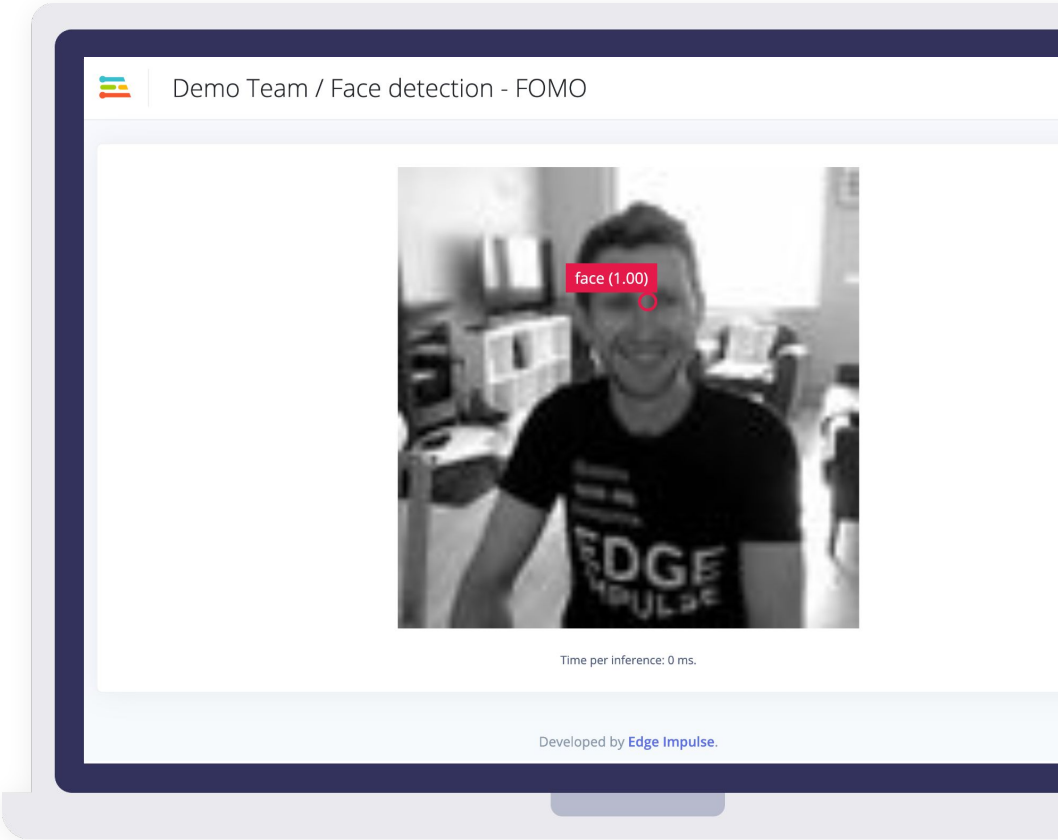
“Are there faces in the image, where and what size are they?”



Object Detection using Centroids

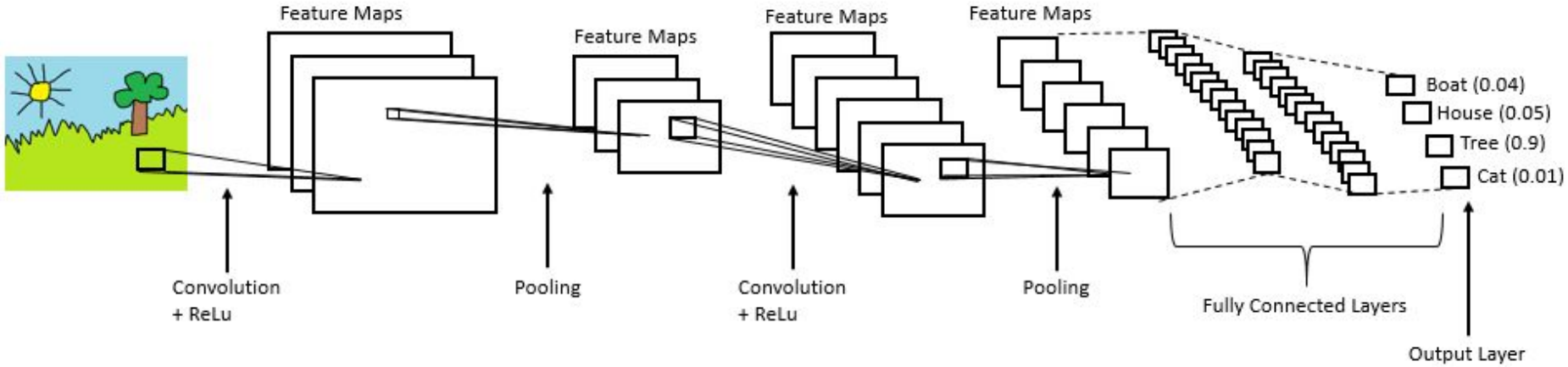
The question the model is trying to answer is:

“Are there faces in the image, where are they?”

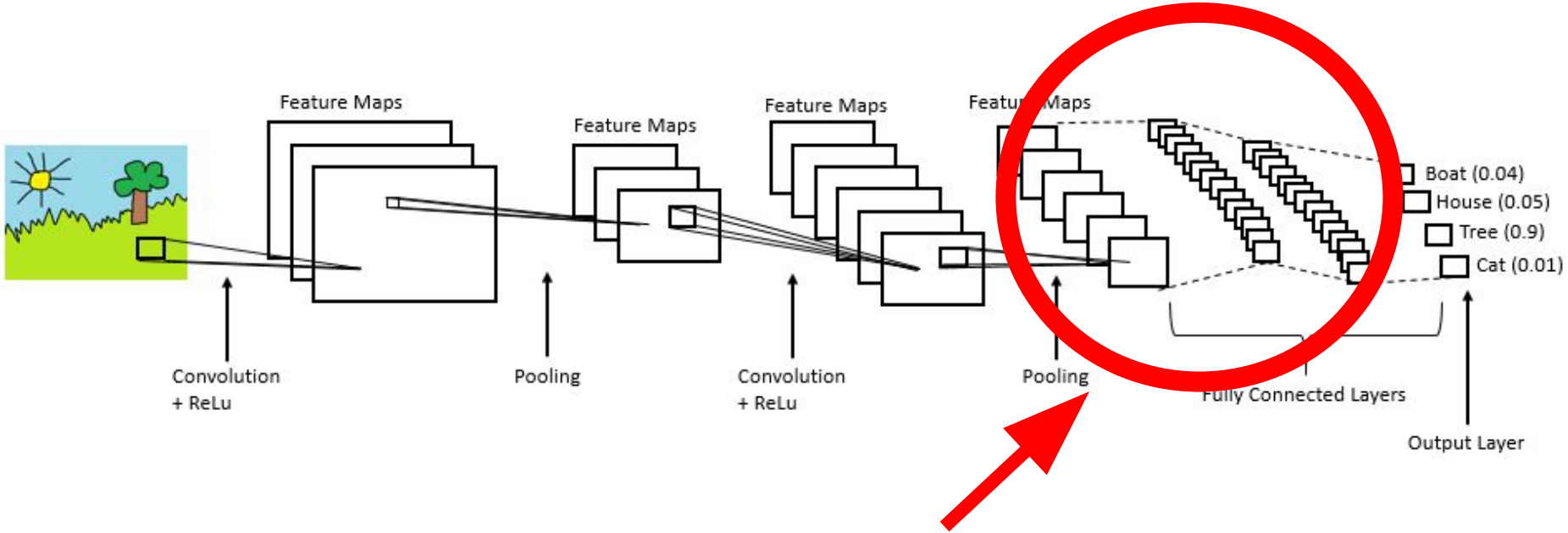


Constrained Object Detection

Object Detection



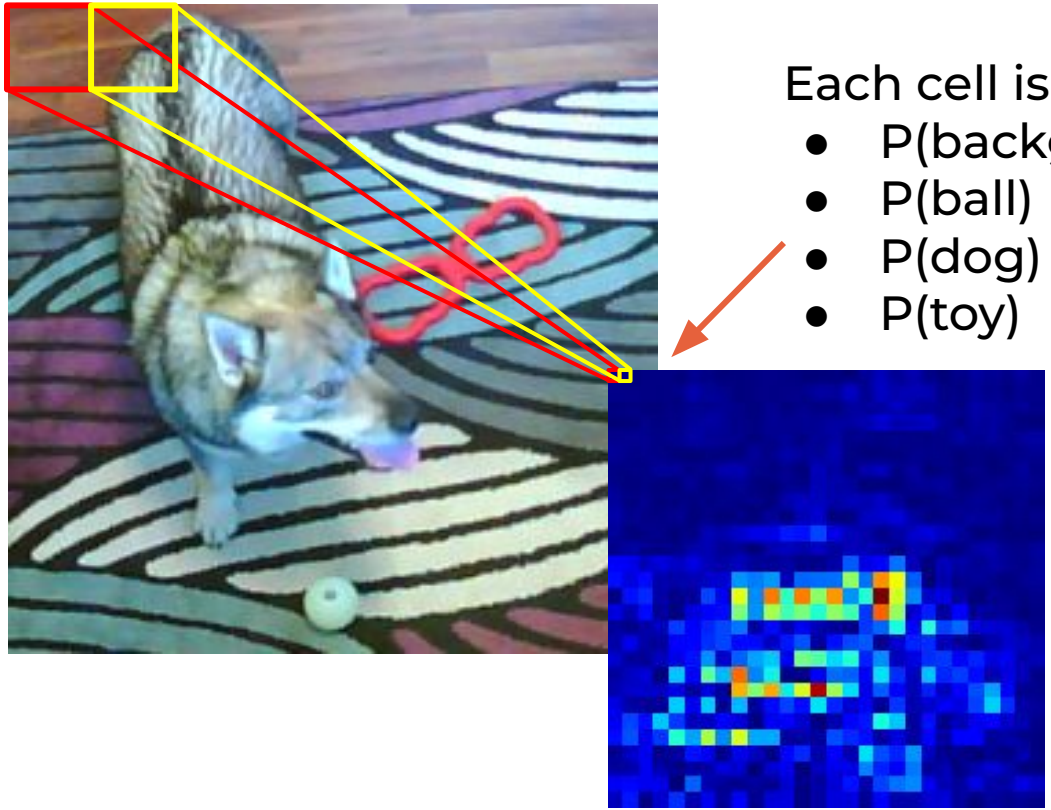
Faster Objects, More Objects (FOMO)



Replace with single per-region class probability map

Faster Objects, More Objects (FOMO)

Receptive field



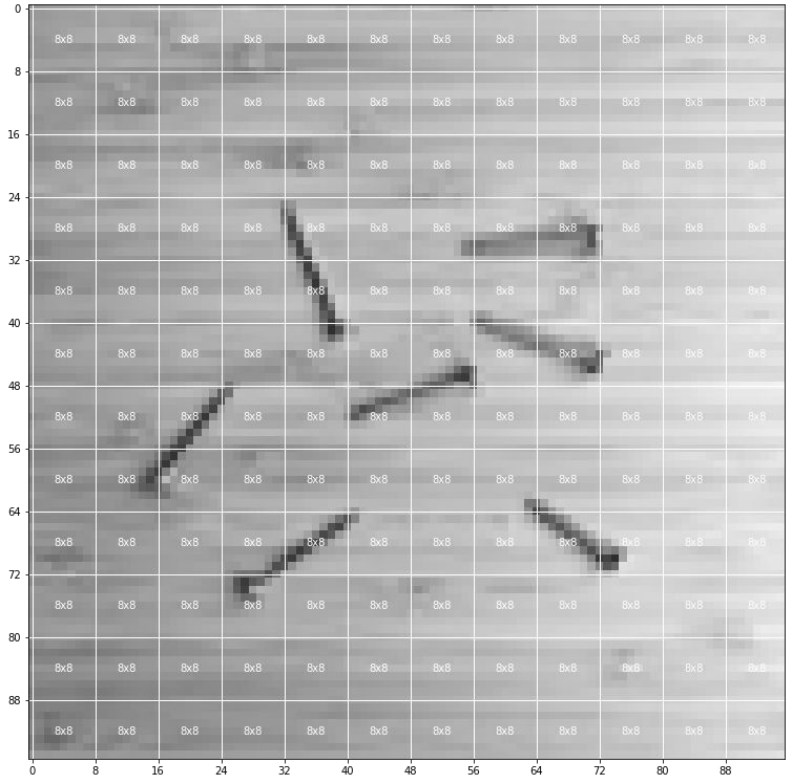
Each cell is given scores:

- P(background)
- P(ball)
- P(dog)
- P(toy)

Faster Objects, More Objects (FOMO)

Example: screws

- Grayscale
- Image: 96x96
- Feature maps: 12x12



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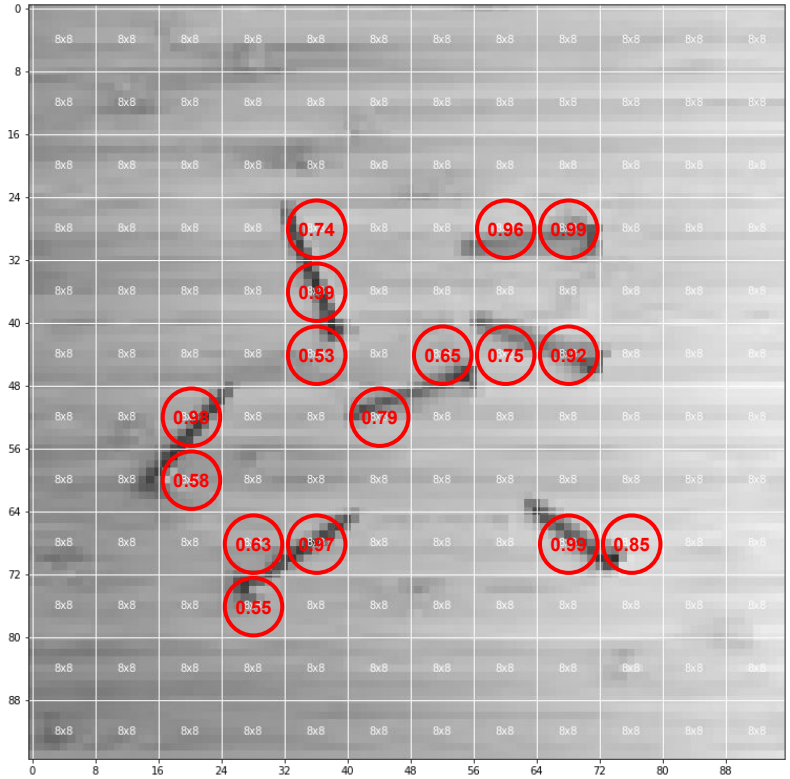
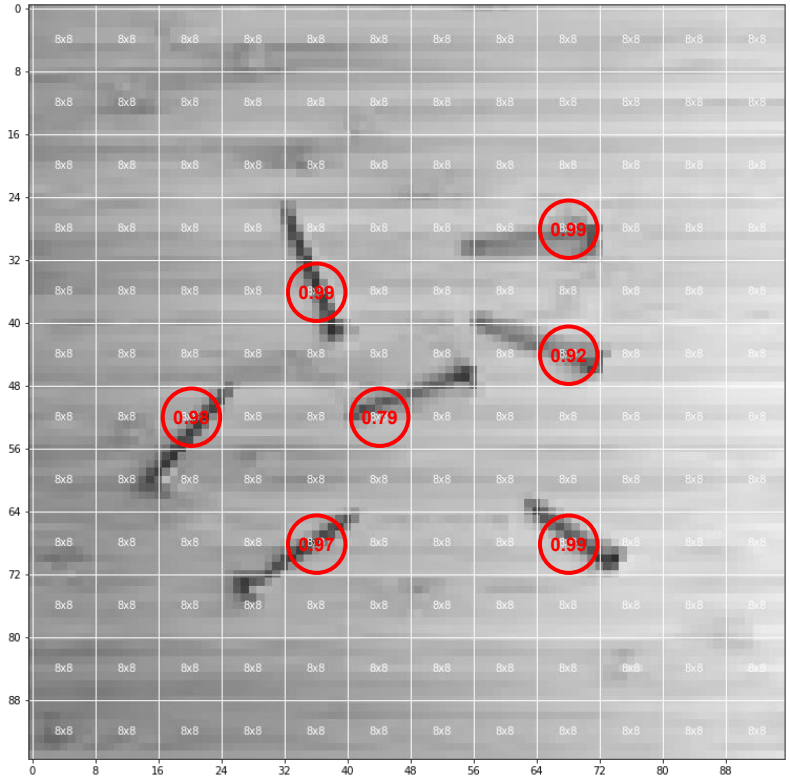


Faster Objects, More Objects (FOMO)

Example: screws

- Grayscale
- Image: 96x96
- Feature maps: 12x12

Neighboring cells with same class are removed (leaving highest scores)

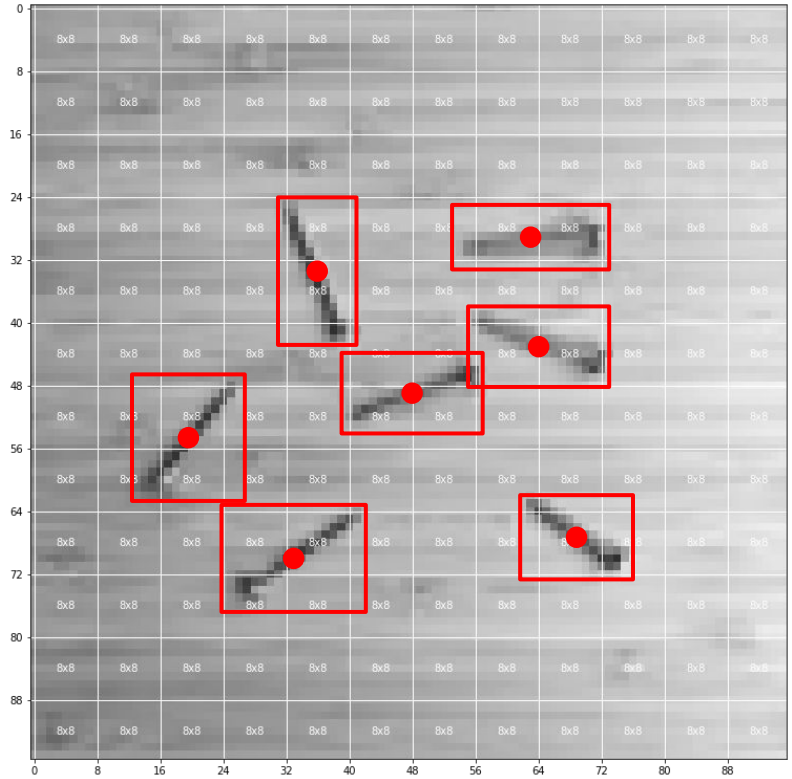


FOMO Ground Truth

Example: screws

- Grayscale
- Image: 96x96
- Feature maps: 12x12

User draws bounding boxes, tool picks cell with centroid of bounding box



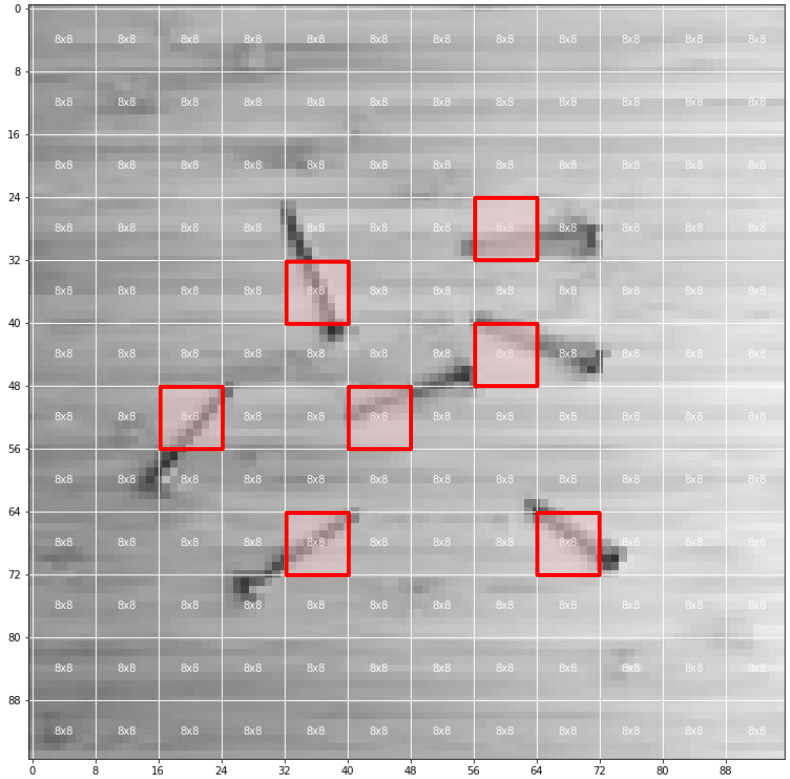
FOMO Ground Truth

Example: screws

- Grayscale
- Image: 96x96
- Feature maps: 12x12

User draws bounding boxes, tool picks cell with centroid of bounding box

Those cells are now representatives of that class



FOMO Uses + Limitations

Use Cases

Want to know **where** and **how many** objects there are

Recommendations for success:

- Objects are same size
- Objects are square/round
- Objects take up 1 cell

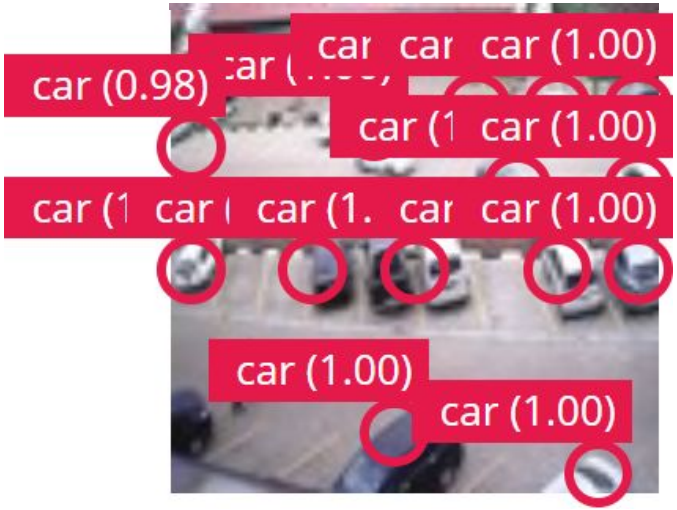
Very fast!

- Cortex-M7 at 480 MHz
- 240x240 image input
- 30 fps
- 245K RAM

https://matpalm.com/blog/counting_bees/

Limitations

- Each cell has its own classifier
- Neighboring objects may get lumped together
- Ends of oblong objects may be ignored
- Lots of objects/classes: use YOLOv5



Specifications	MobileNetV2 SSD FPN	FOMO
Labelling method	Bounding boxes	Bounding Boxes
Input size	320×320	Square (any size)
Image format	RGB	Greyscale
Output	Bounding boxes	Centroids
MCU	❌	✅
CPU/GPU	✅	✅
Limitations	- Works best with big objects - Models use high compute resources (in the edge computing world) - Image size is fixed	- Works best when objects have similar sizes & shapes - The size of the objects are not available - Objects should not be too close to each other

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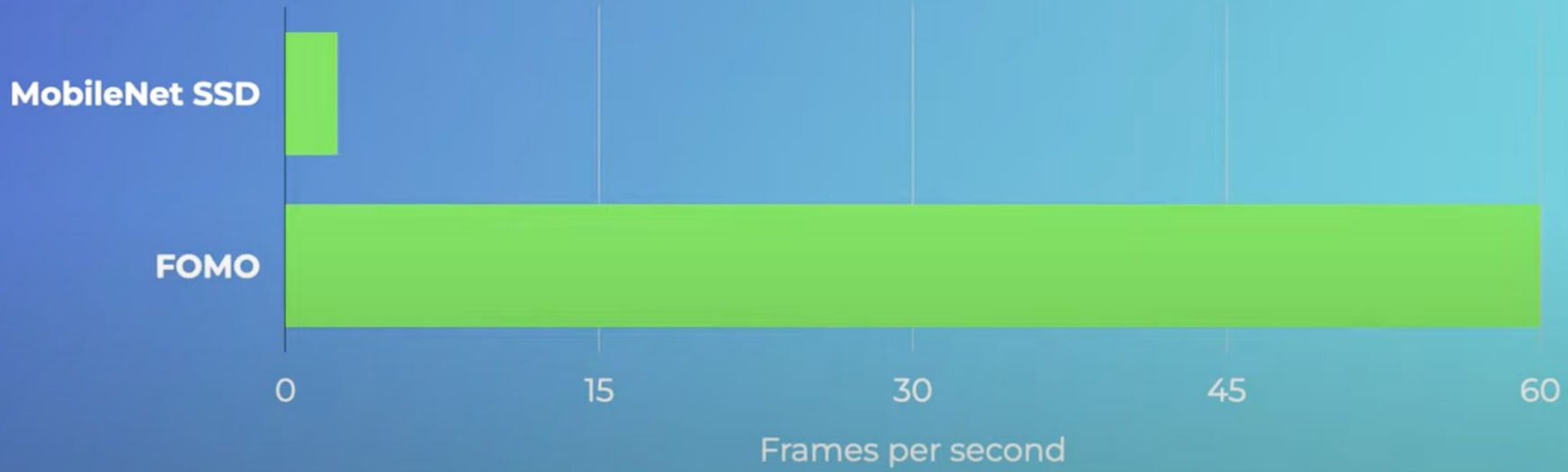
Object detection on Raspberry Pi 4

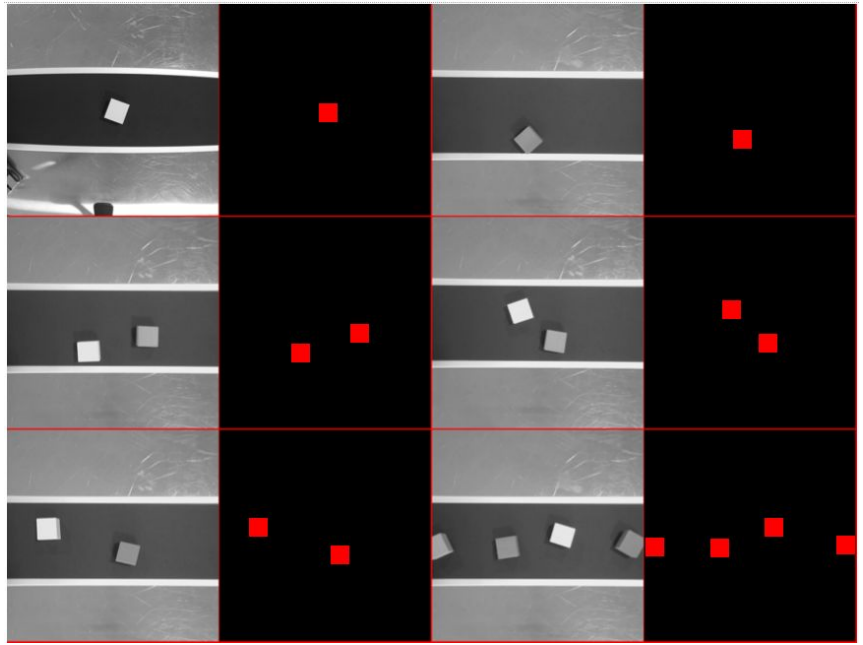


Demo

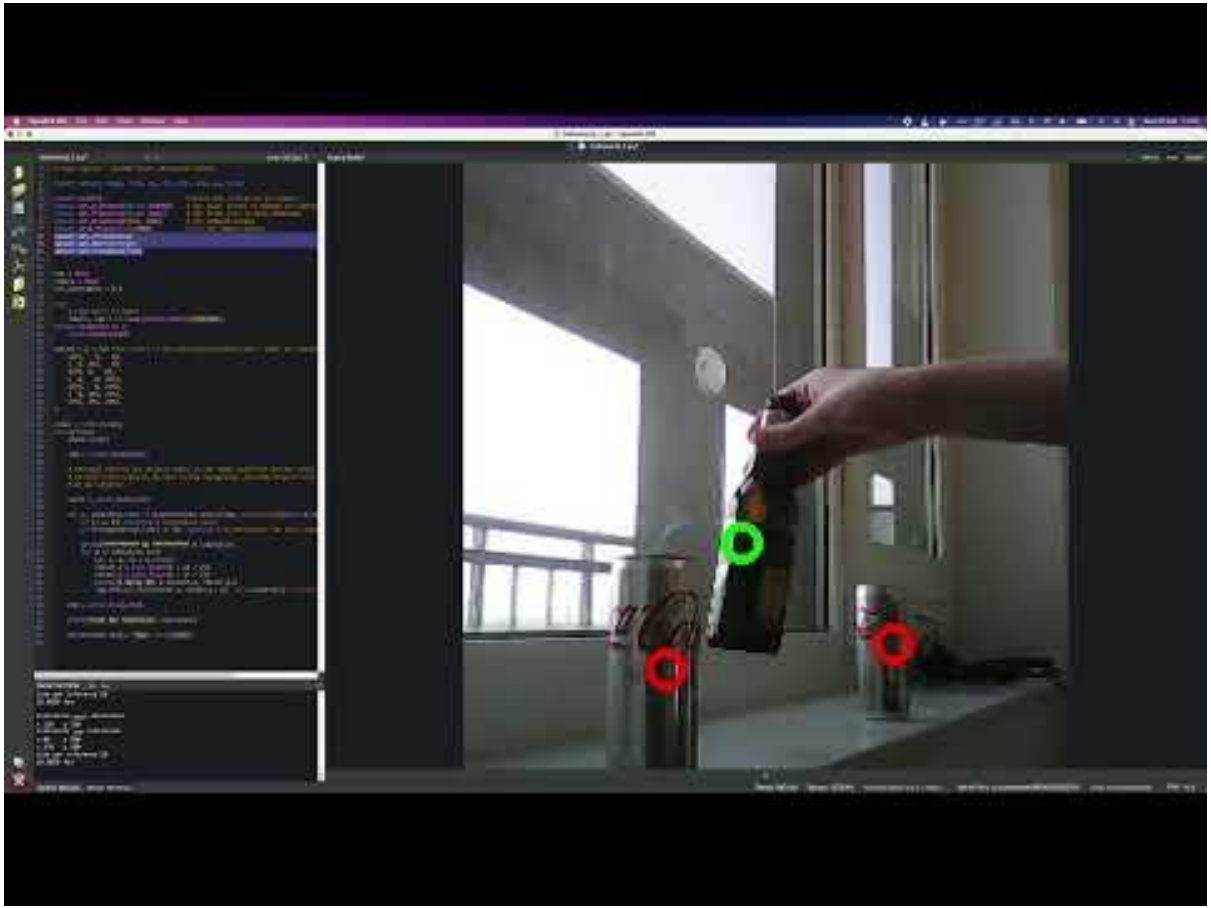
Getting Started w/ FOMO & Sony's Spresense

- docs.edgeimpulse.com/fomo
- Tutorials > Counting objects using FOMO

https://docs.edgeimpulse.com/docs/development-platforms/officially-supported-mcu-targets/sony-spresense



Demo



To go further

Create your free account on edgeimpulse.com

Build your first model in 5 minutes: studio.edgeimpulse.com/evaluate

FOMO: edgeimpulse.com/fomo

Documentation: docs.edgeimpulse.com

Another video on FOMO:
https://www.youtube.com/watch?v=9m8C0uLxjpY

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Thank you!

@jennymplunkett

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