Intelligent bear-proofing system

A New Approach to Resolving Human-Bear Conflicts

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CONTENT

Part 01

BACKGROUND

Human-bear conflicts

BACKGROUND: Human-bear conflicts

1. Safety Challenge

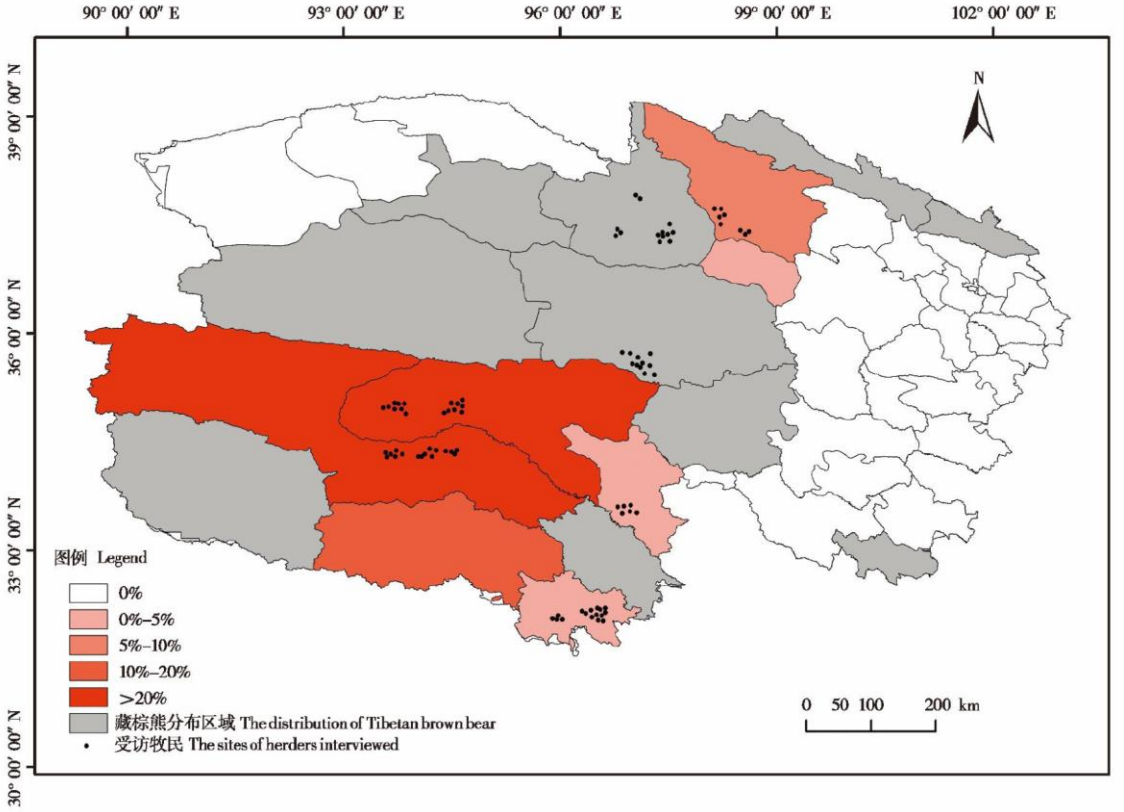


Fig.1 The range and intensity of human-Tibetan brown bear conflicts in Qinghai Province in 2012-2015. The gray indicates brown bear's distribution, the red parts having deeper color indicate the percentage of conflicts reported in the counties. The black points indicate the sites of herders interviewed

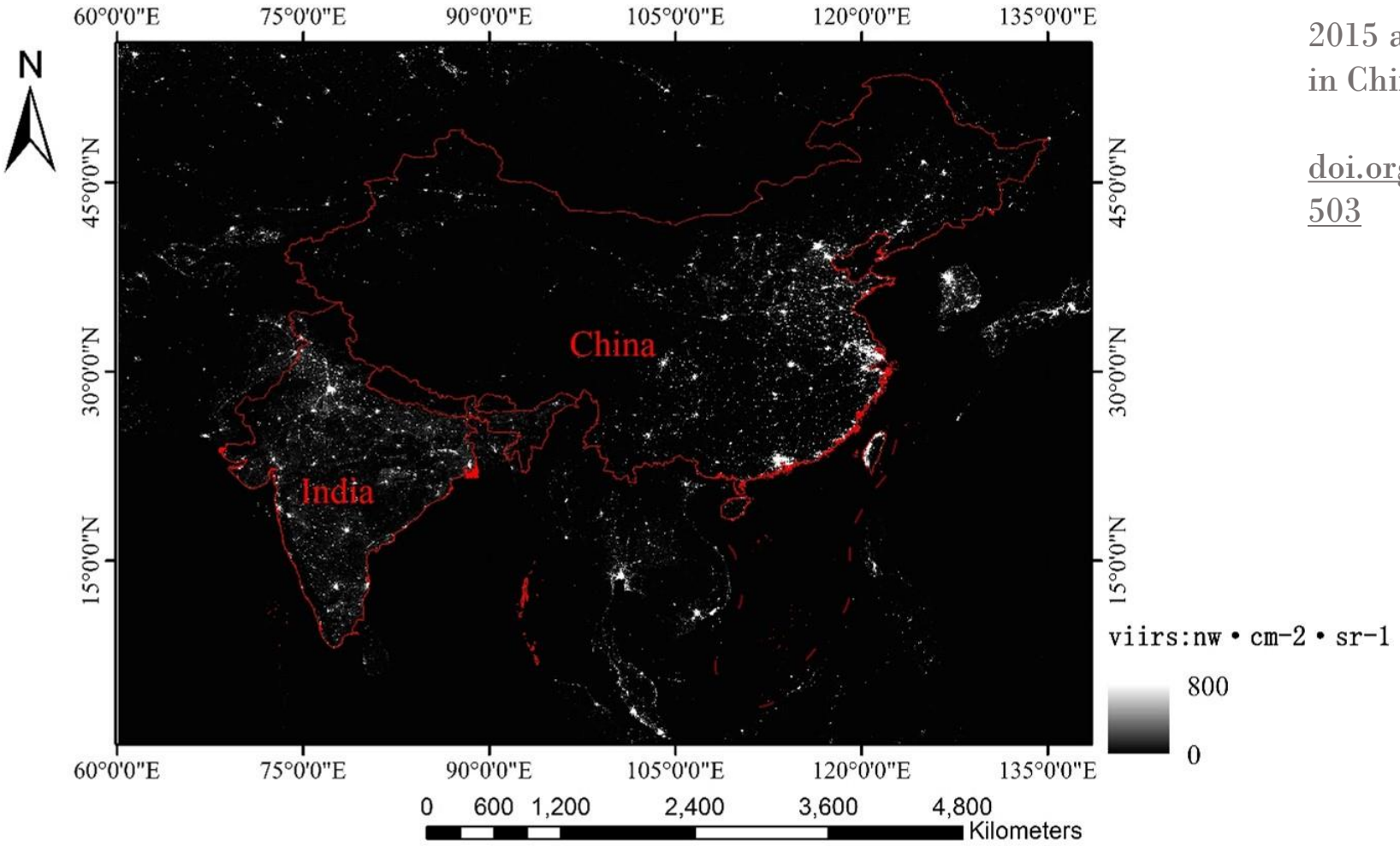
2. Ineffective Preventive Measures

a) Passive Methods: Local herders use visual tricks like scarecrows, make loud noises, set fires, and use electric fences to keep bears away. However, these methods are often not effective in the long term.

b) Active Methods: Some herders raise guard dogs to scare away or capture bears, while others choose to hunt and kill bears that cause economic losses. Common hunting methods include traps and poison bait. (The Tibetan brown bear is a Grade II protected animal in China.)

BACKGROUND: Human-bear conflicts

3. Shortage of electricity and network

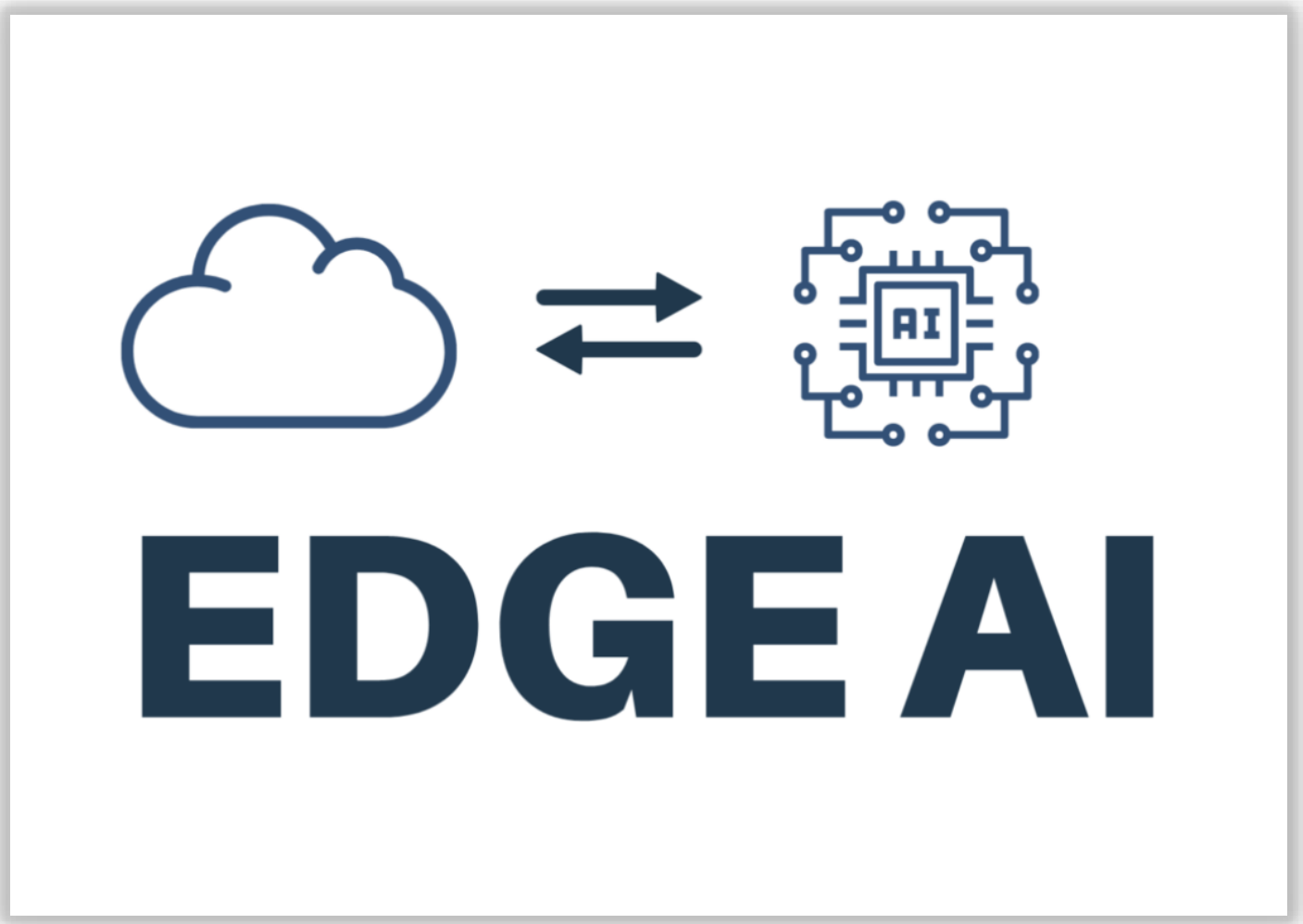


2015 annual average VIIRS data in China and India.

doi.org/10.1371/journal.pone.0262503

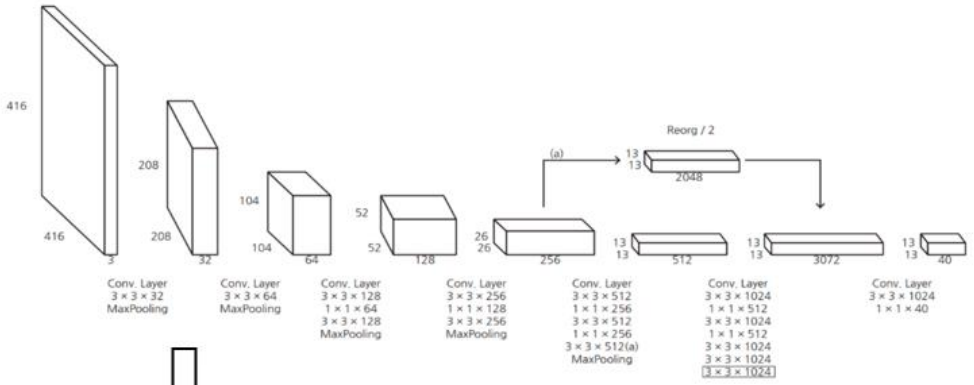
Part 02

METHODS

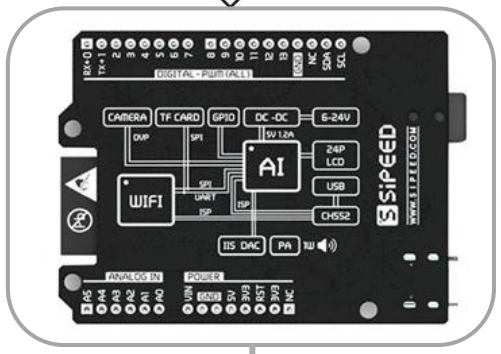


METHODS

Overall framework

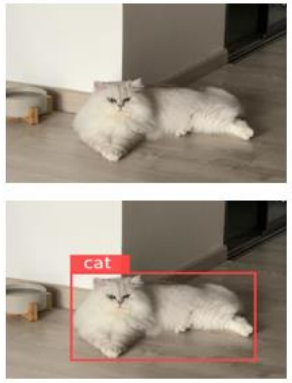


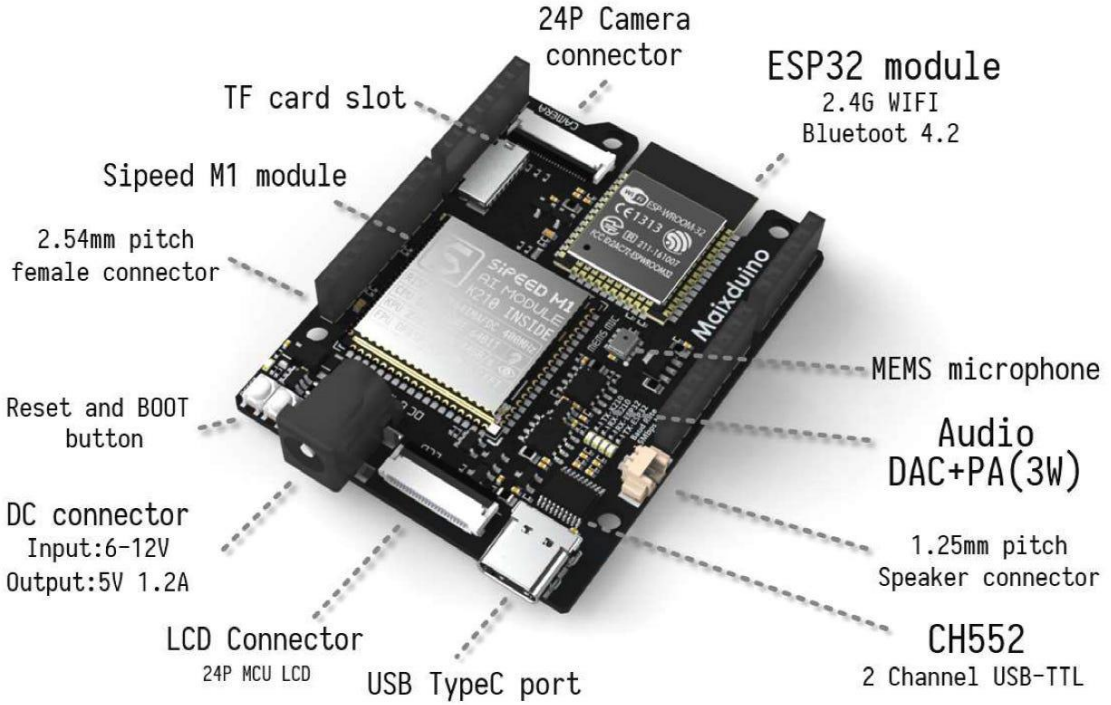
embed



import

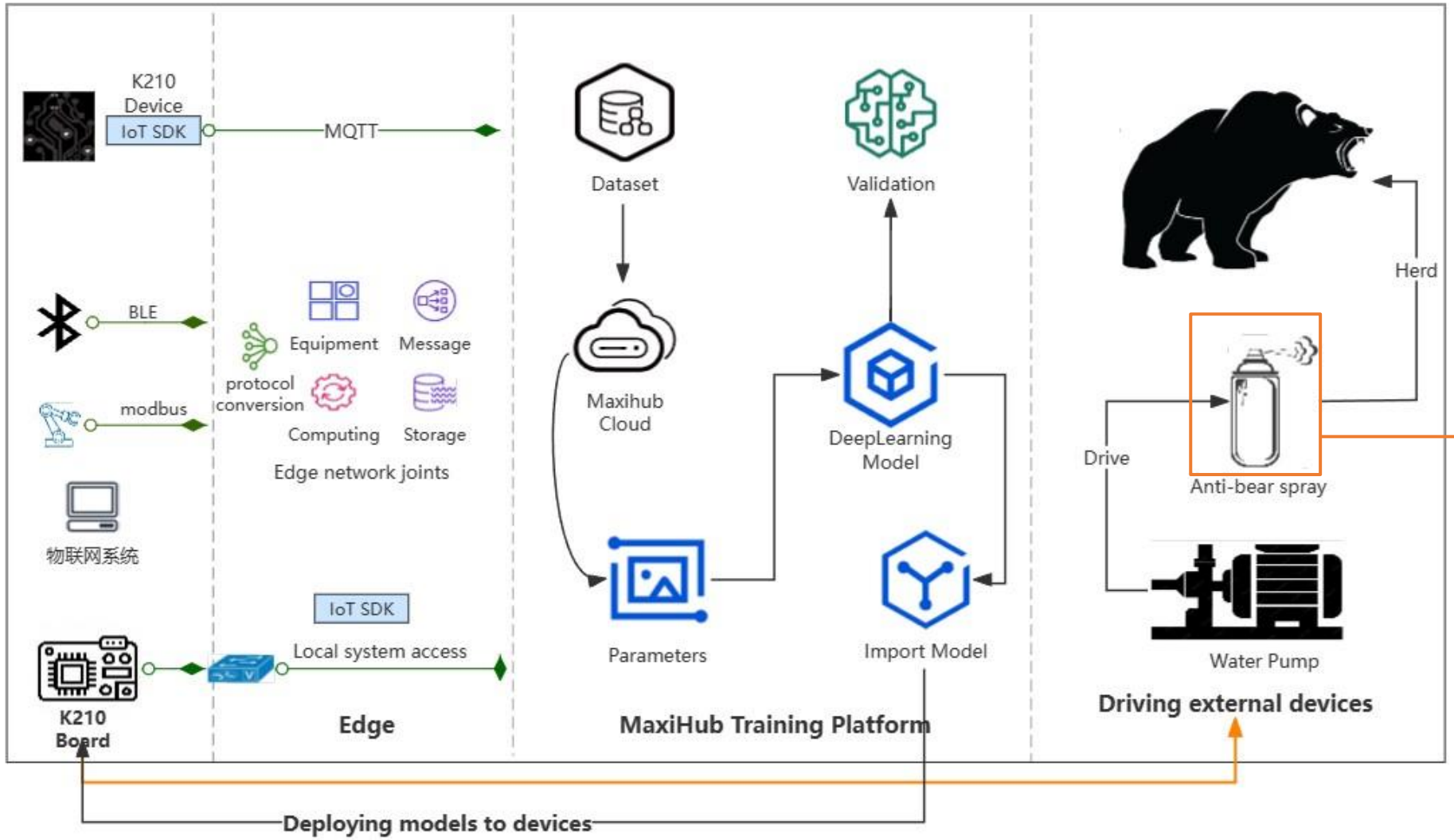
export





METHODS

Overall framework



METHODS

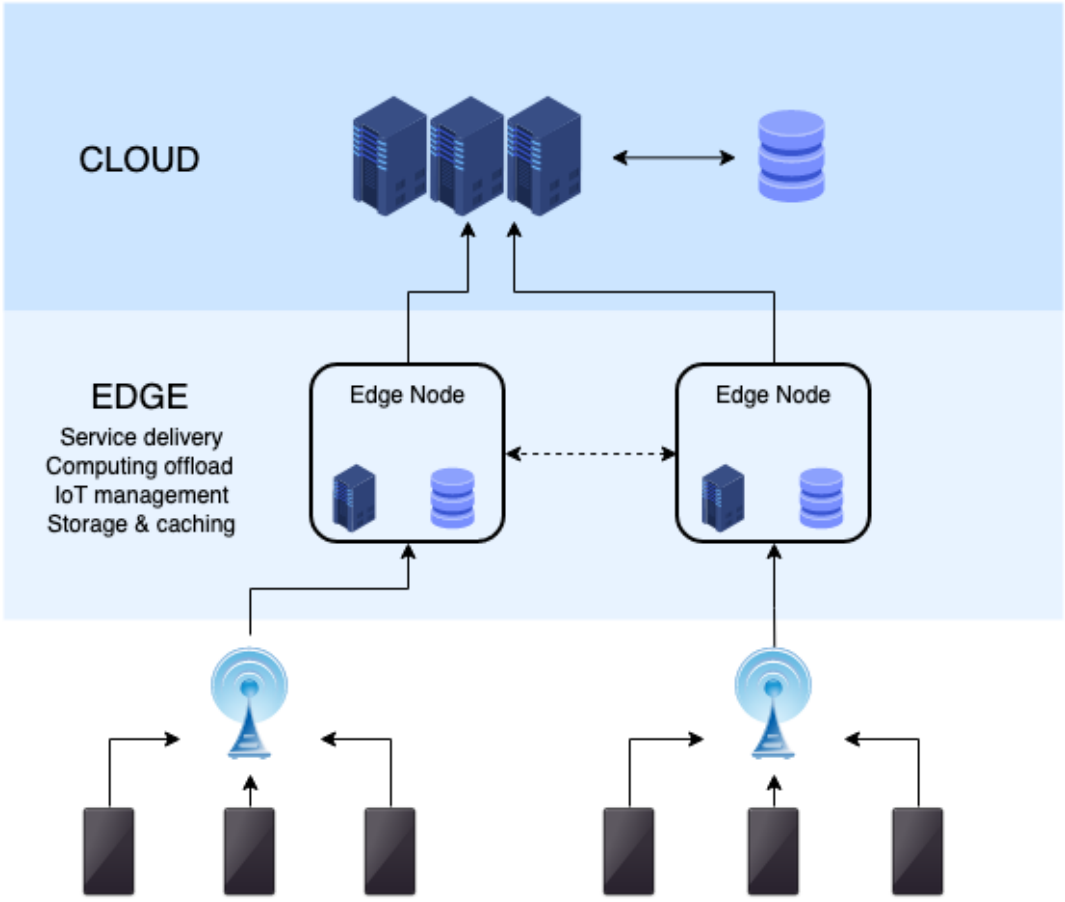
IoT devices

a) Low Energy Consumption :

IoT devices are often required to operate continuously or for extended periods. By minimizing energy consumption during both active and idle states, these devices can remain operational for longer durations.

b) Offline Operation:

Edge devices can continue to function even when they are not connected to the internet or a central server. This ensures that critical operations can continue in environments with intermittent connectivity.



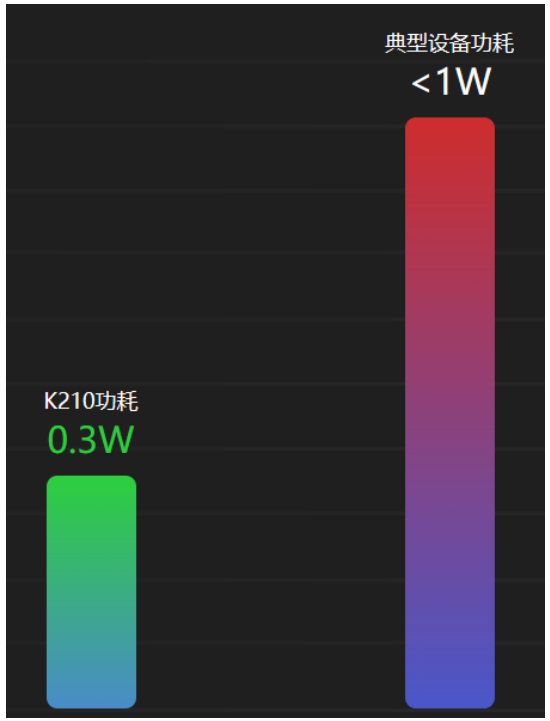
en.wikipedia.org/wiki/Edge_computing

METHODS

K210 is the most powerful edge computing chip, designs for both visual and semantic recognition, widely used in various scenarios.

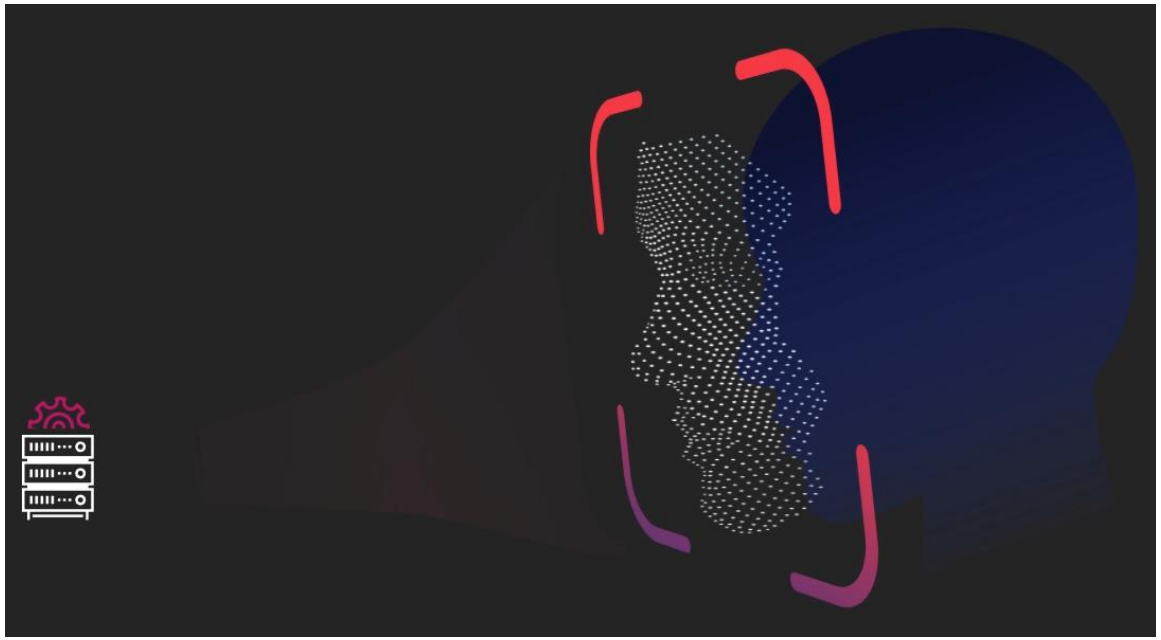
a) High Performance High Efficiency

With high computing power at 1TOPS, K210 consumes only 0.3W while other typical devices consume 1W.



b) Widely used in various scenarios

K210 is capable of the face detection and face recognition, image recognition and image classification, and anti-spoof.



METHODS

a) Backbone Network: Mobile Net

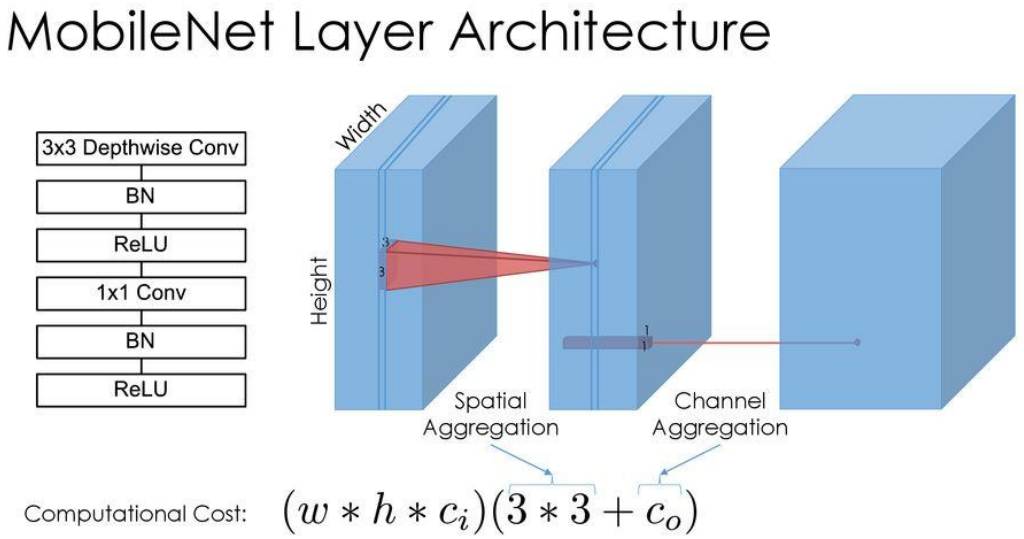
Designed for efficient and lightweight deep learning on mobile and embedded devices.

b) Network Model: YOLOV2

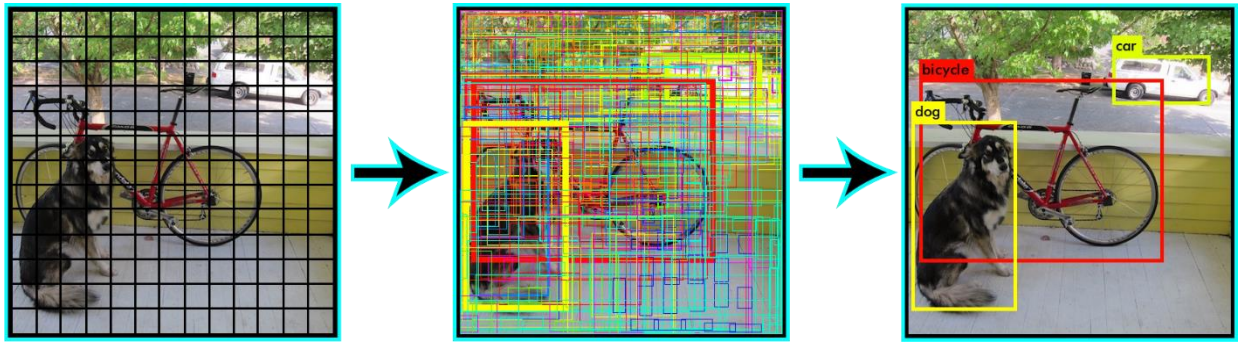
Speed and Efficiency; High Accuracy

c) Deployment platform: nncase (K210)

Model size cannot exceed 4MB

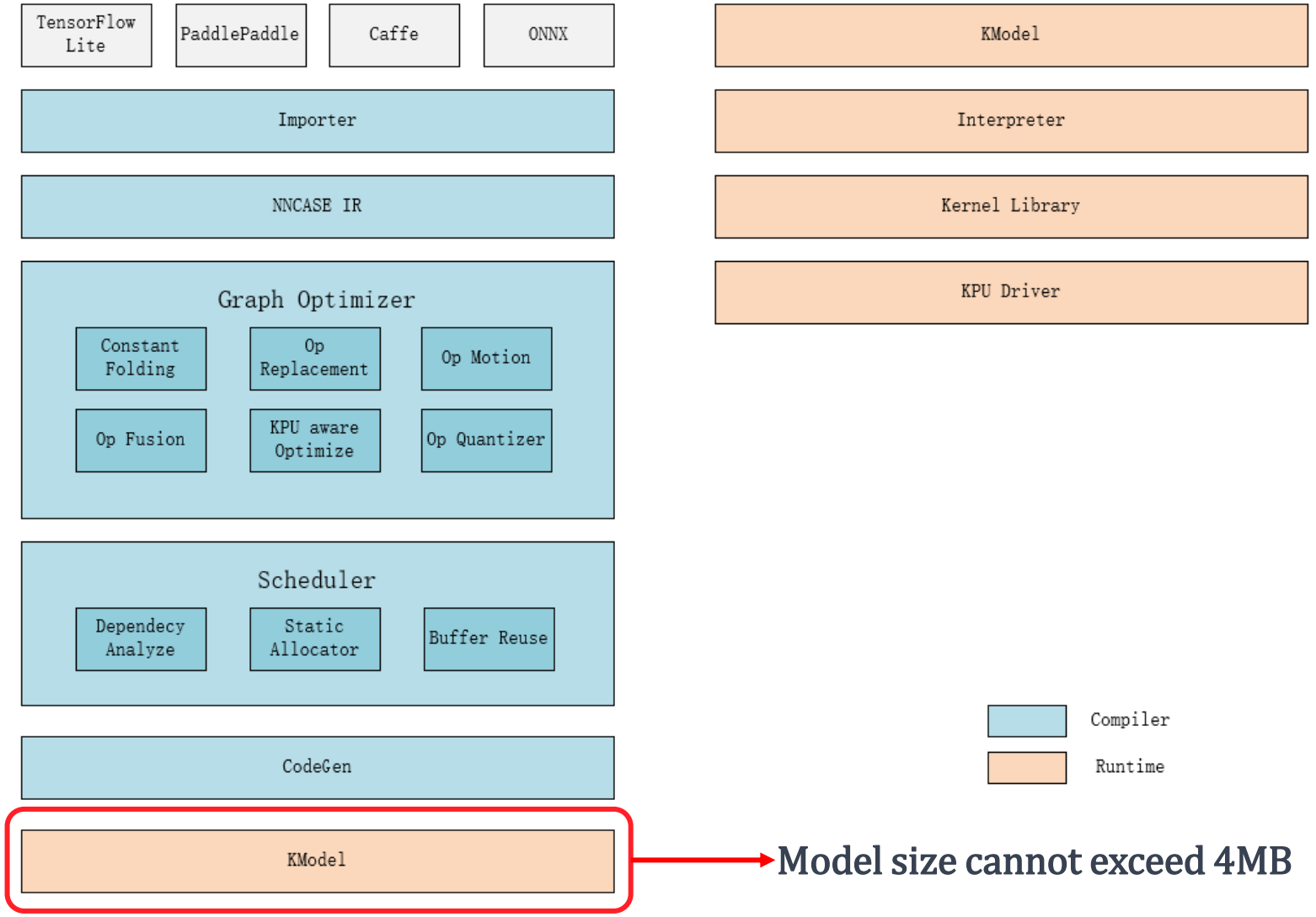


www.kaggle.com/code/yasserhessein/leaf-diseases-using-mobilenet



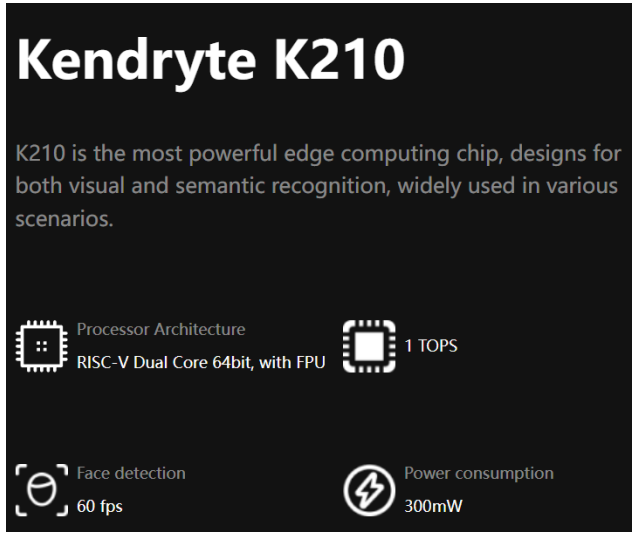
pjreddie.com/darknet/yolov2/

METHODS



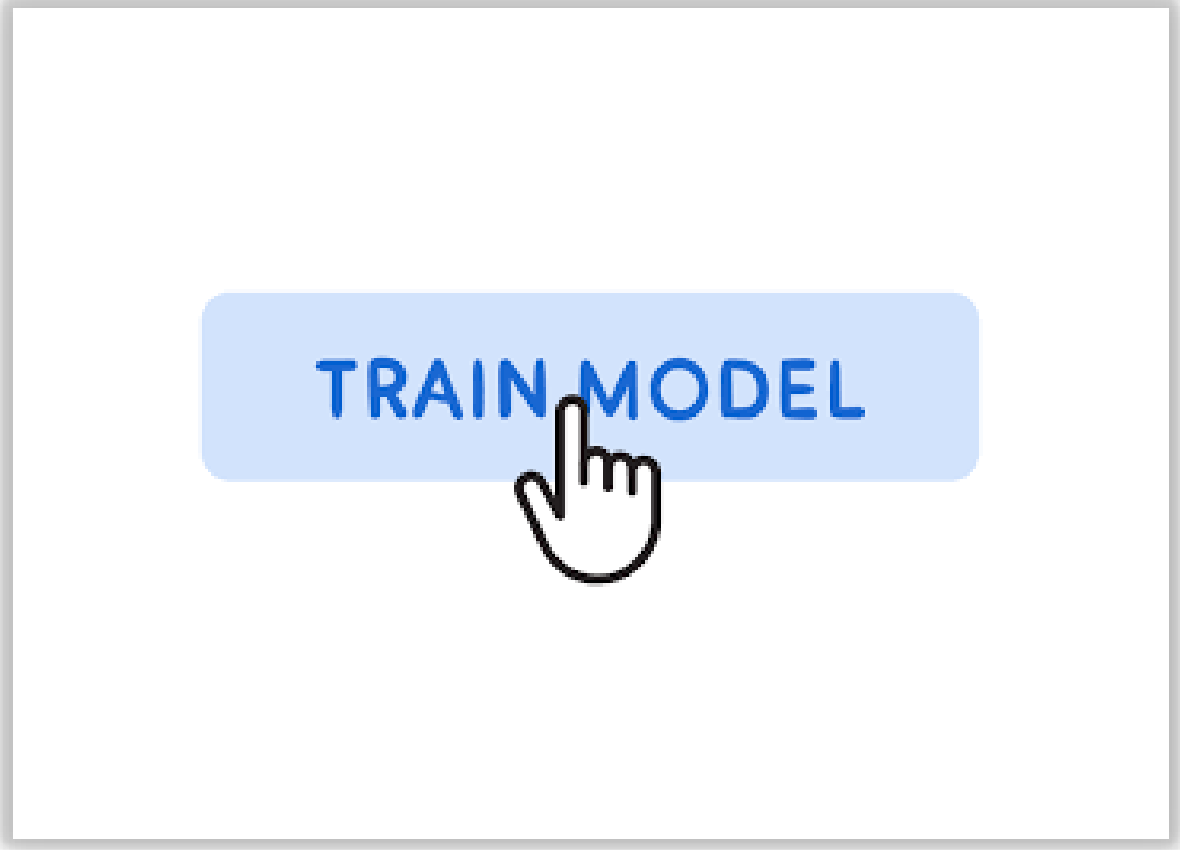
MaixHub

nncase



Part 03

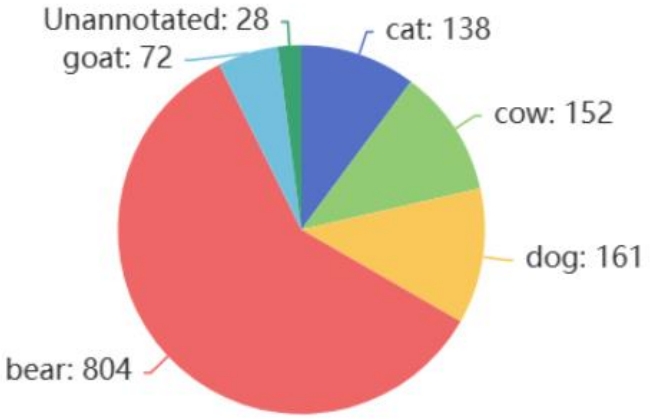
MODEL TRAINING



MODEL TRAINING

Dataset

Trainset: 1089
Valset: 58

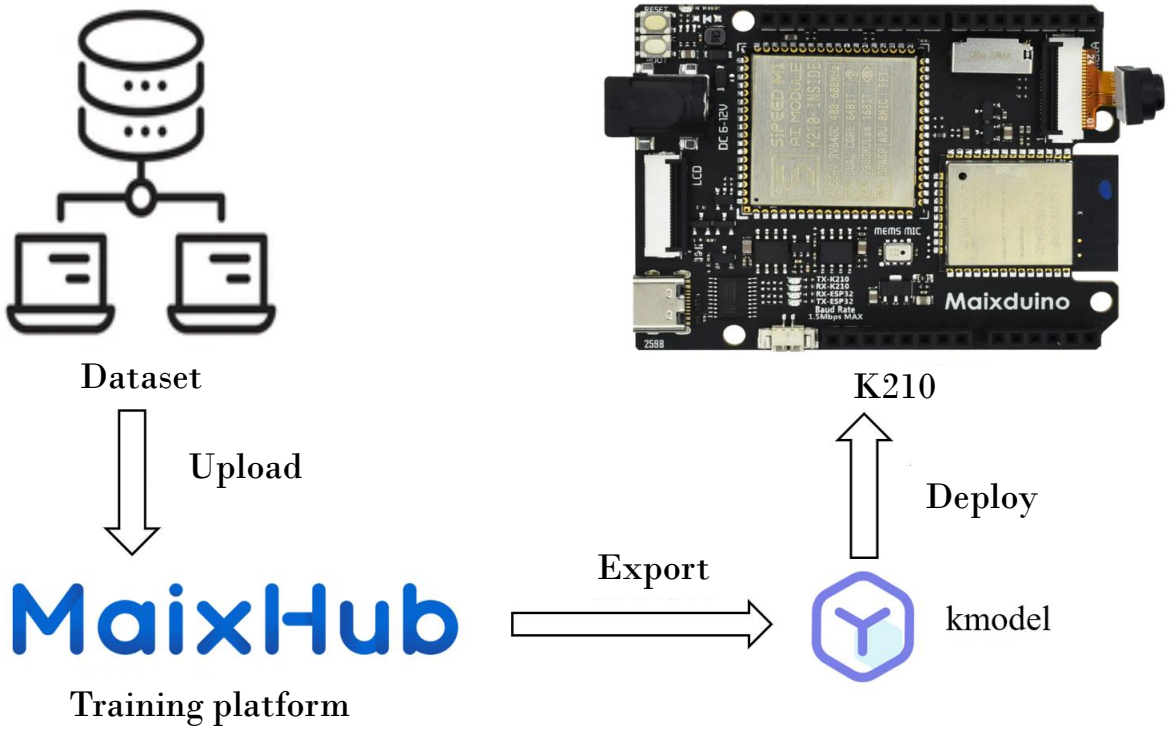


labels quantity

Negative Data

MODEL TRAINING

Overall framework



Training Parameters

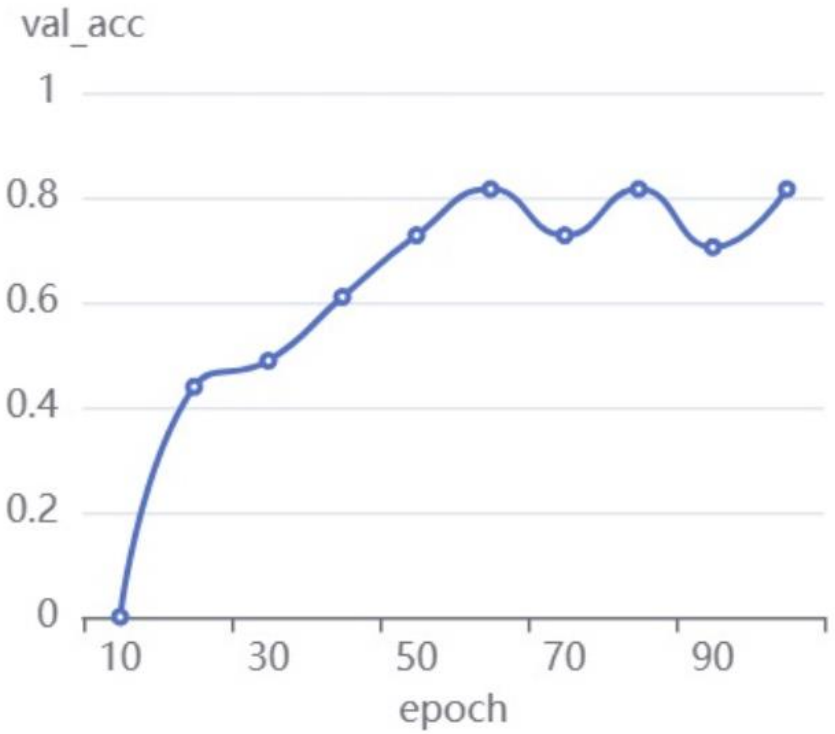
Image Augmentation	
Mirror	
Rotation	
Blur	
Resize method	contain
Scale width	224
Resize height	224
Avg	123.5
Std	58.395

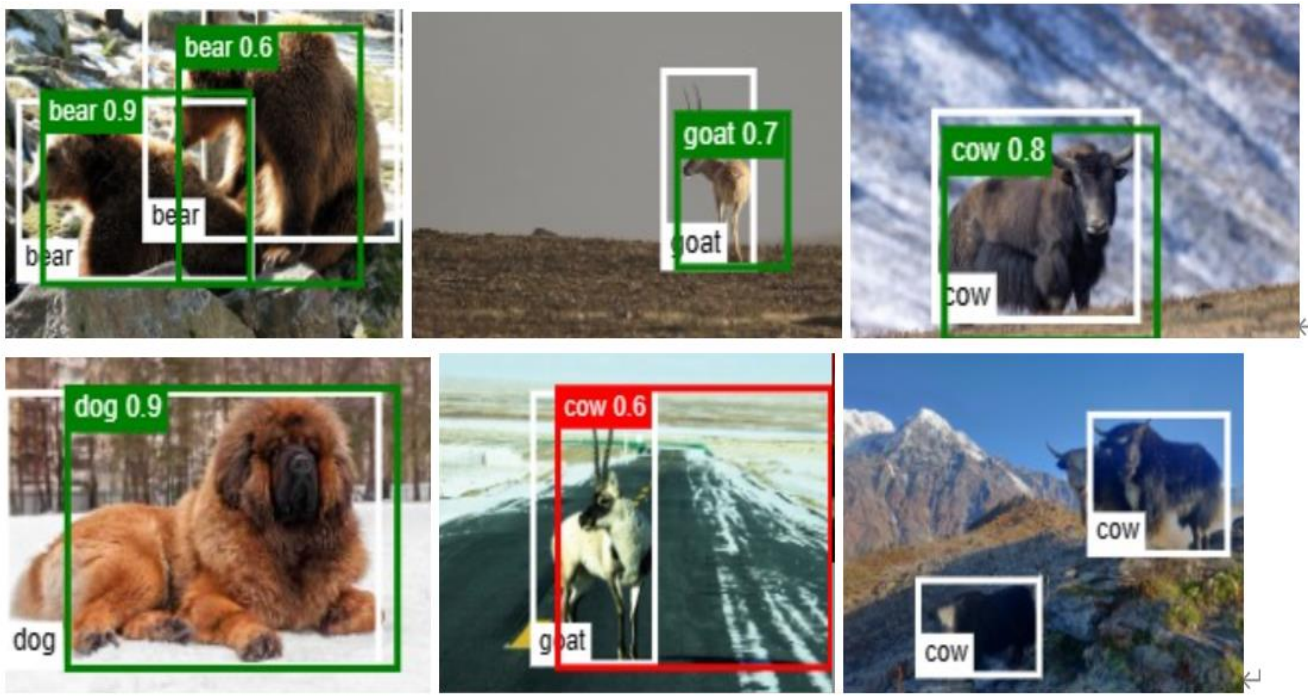
Model info	
Platform	nncase
Model type	transfer_learning
Network	yolov2
Backbone	mobilenet_0.75

Training Parameters	
Epochs	100
Batch size	32
Learning rate	0.001
Box min size	10
Data balance	
Negative data	

MODEL TRAINING

Training results

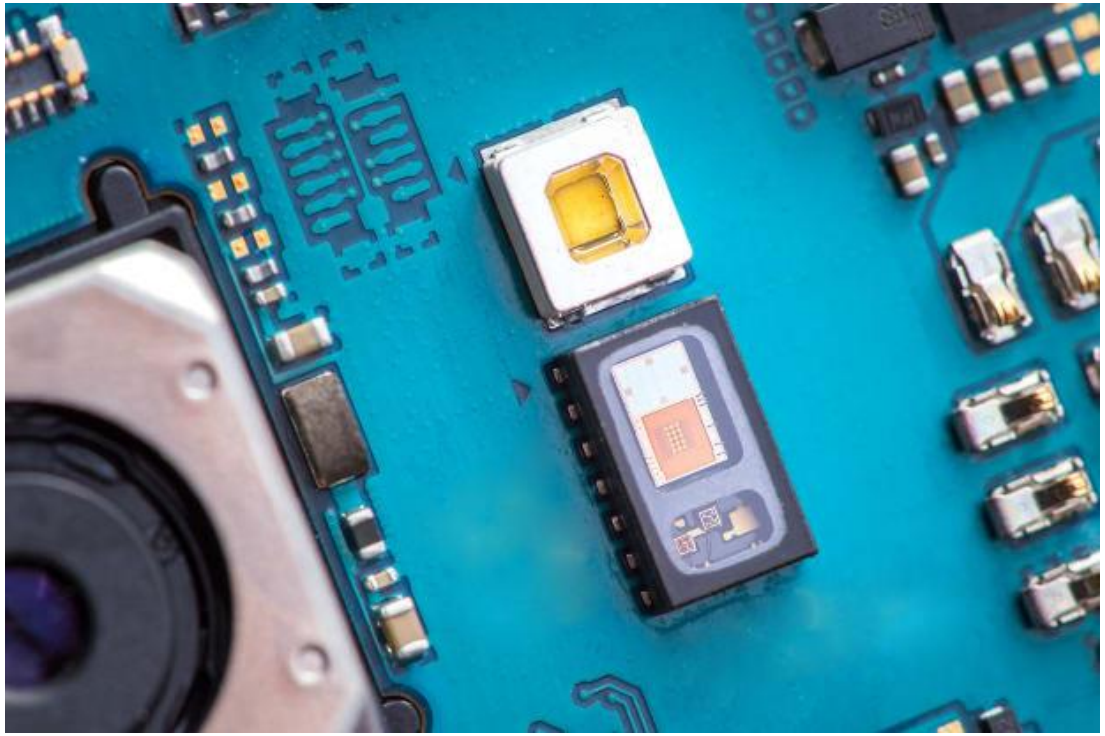




- White boxes are user labeled boxes
- Green boxes are model-correct prediction boxes
- Red boxes are model-incorrect prediction boxes

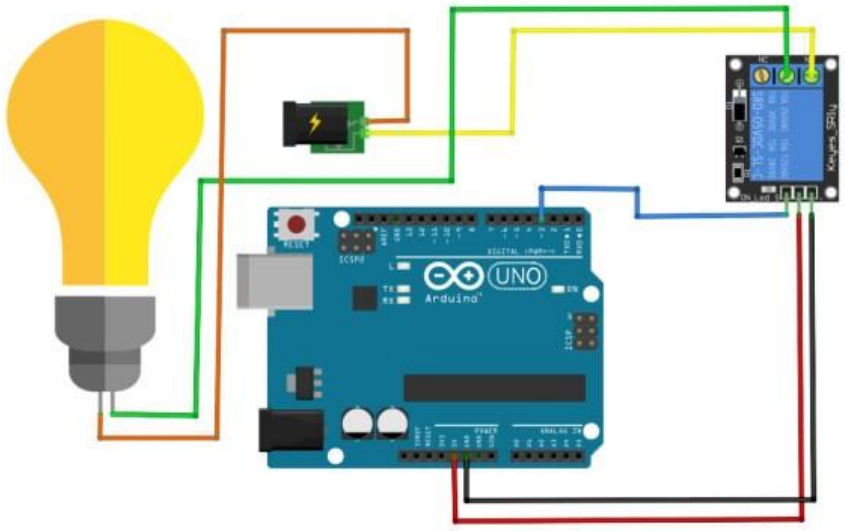
Part 04

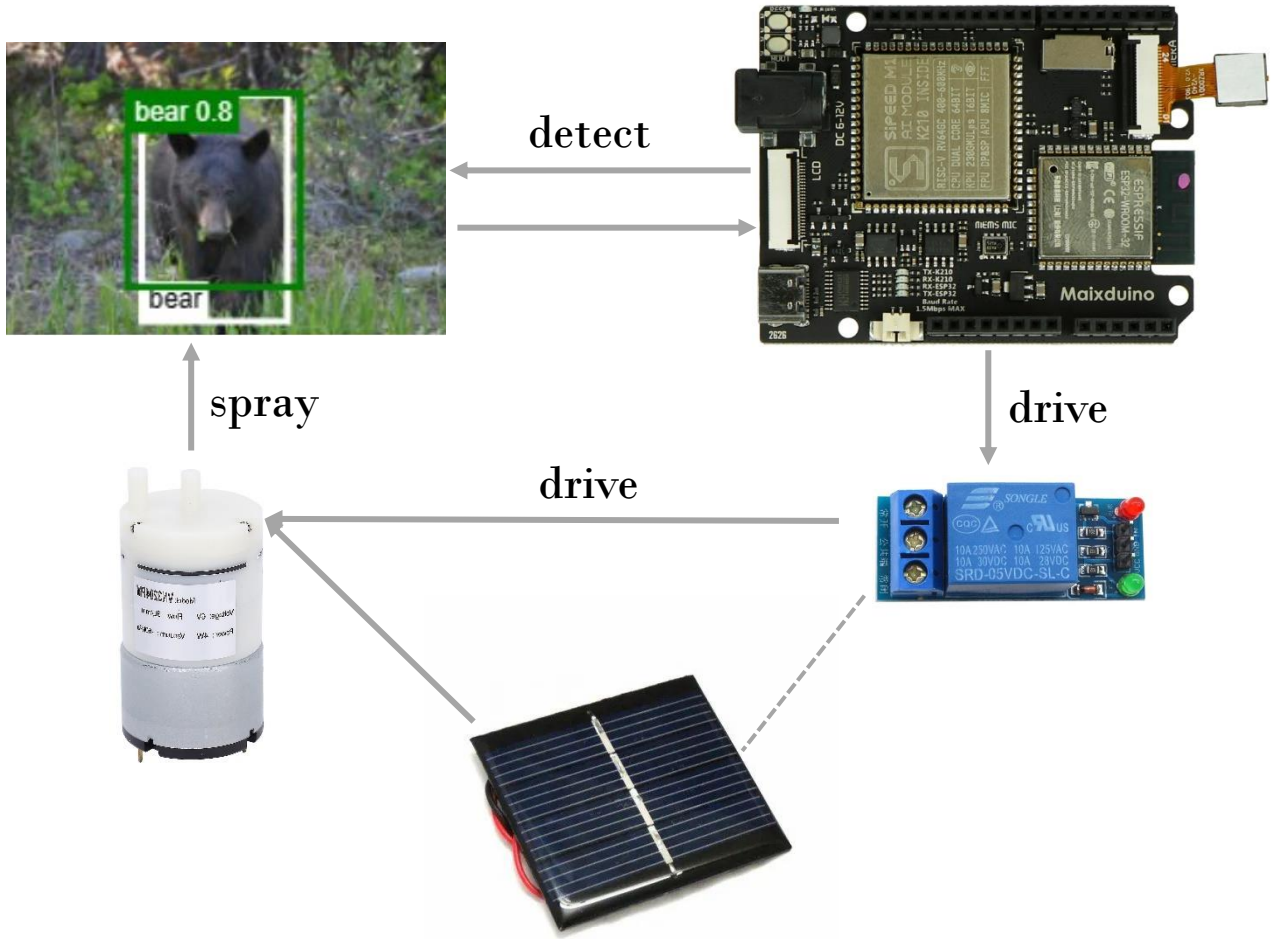
INSTALLATION



INSTALLATION

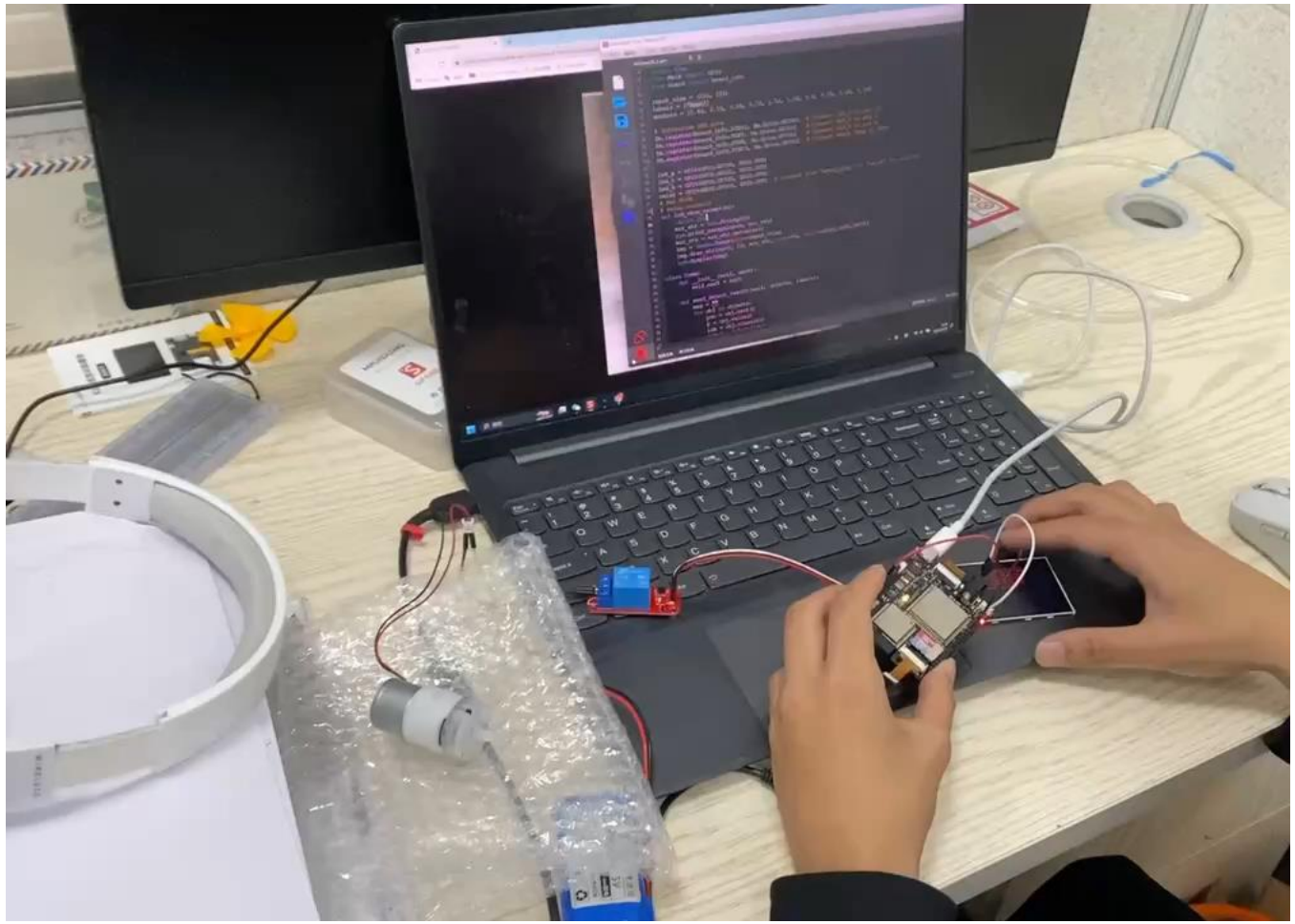
Overall framework





Object Detection --> Development Board --> Drive Relay --> Drive Pump --> Push Bear Away

Video demo



THANK. YOU

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