Park Smart: AI at the edge to solve the parking problem

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Motivation and Solution

Why?

The quest for parking affects up to **50% of urban traffic**!

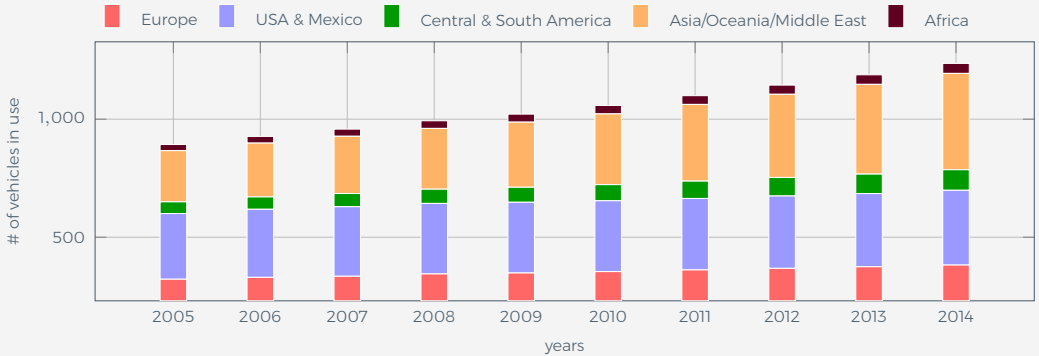
CONGESTION
60 – 62 Min/day

AVERAGE SPEED
22 km/h

SOCIAL COST
2.6 Billions €

Why?

The number of vehicles in use is growing[1]



[1] OICA report on vehicles in use. http://www.oica.net/category/vehicles-in-use/, 2014

Why?

The utilisation of parking spaces is inefficient!

Why?

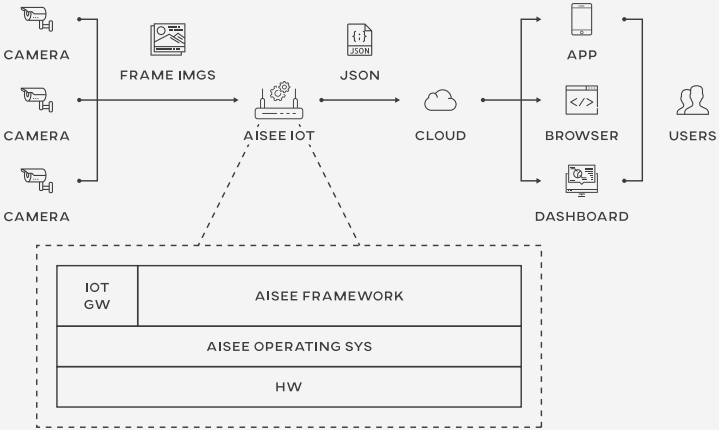
Why?

Looking for parking is stressful!

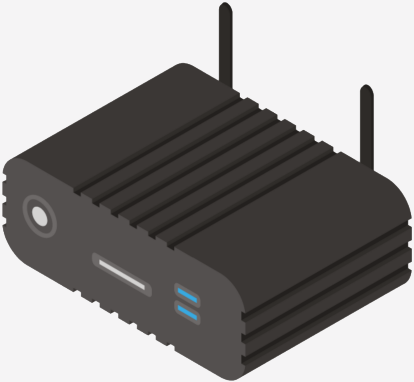
Why?

Looking for parking is stressful!

Park Smart!


CAMERA
CAMERA
CAMERA
FRAME IMGS
JSON
JSON
AISEE IOT
CLOUD
APP
BROWSER
DASHBOARD
USERS
IOT GW
AISEE FRAMEWORK
AISEE OPERATING SYS
HW

AISee



Depending on the configuration, the AISee can manage several cameras and perform fast inference and fine tuning.

AI at the Edge

Problem Formulation

We tackle the problem of declaring a parking stall as free or occupied as a binary classification problem.

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The resulting patches are then classified using a fine-tuned Deep Convolutional Neural Network.

Testing the idea

We fine-tuned three different architectures using the PKLot dataset.

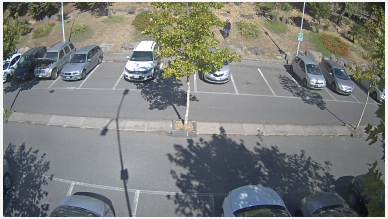
CNN Model	DS1	DS2	DS3	Avg Accuracy	Footprint
AlexNet	98.80%	99.20%	93.82%	97.27%	217M
GoogLenet	99.72%	99.58%	99.26%	99.52%	40M
VGG16	99.13%	98.70%	94.91%	97.58%	528M

lowest – highest

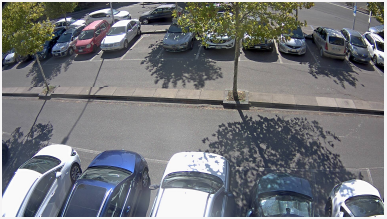
Our Living Lab

Dataset

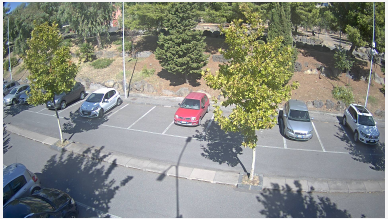
Camera #1



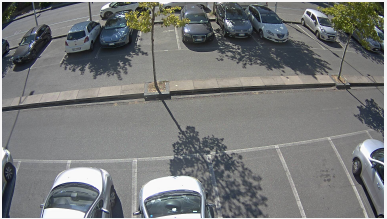
Camera #2



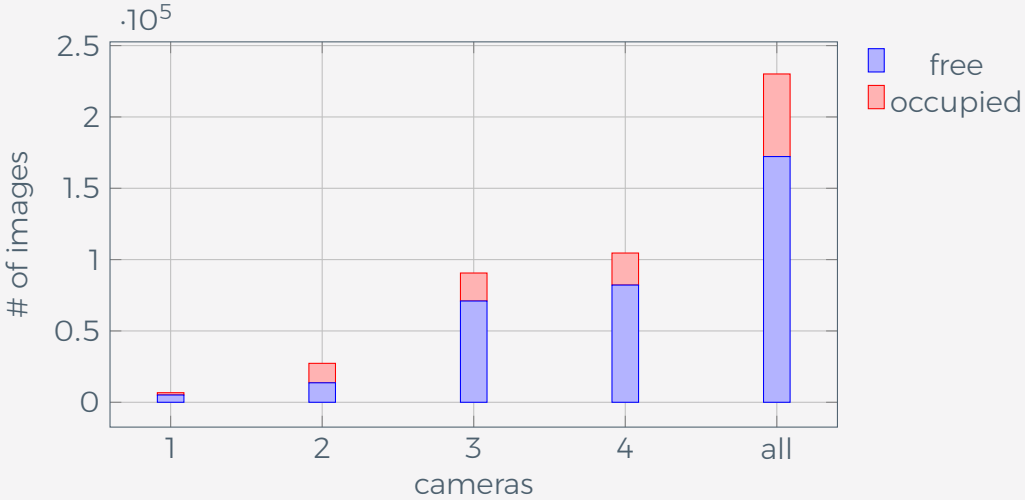
Camera #3



Camera #4



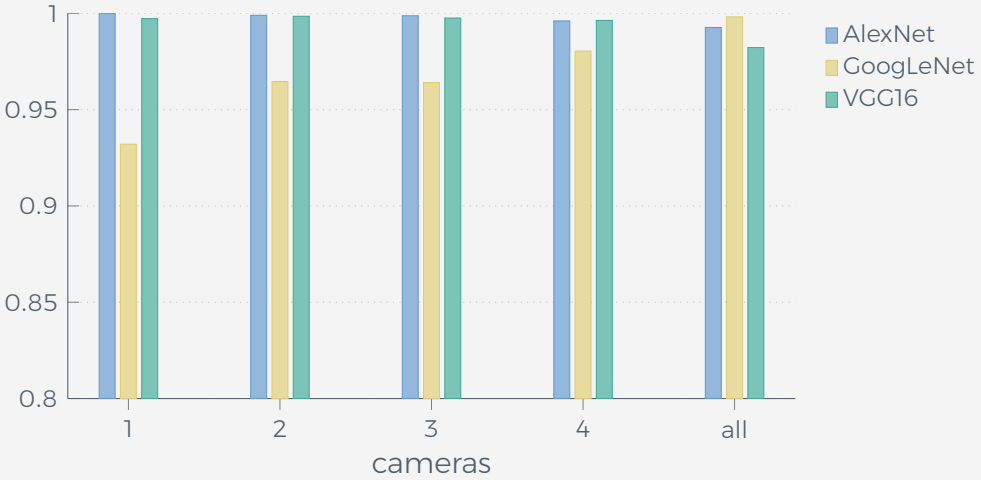
Dataset


$\cdot 10^5$
2.5
2
1.5
1
0.5
0
# of images
1
2
3
4
all
cameras
free
occupied

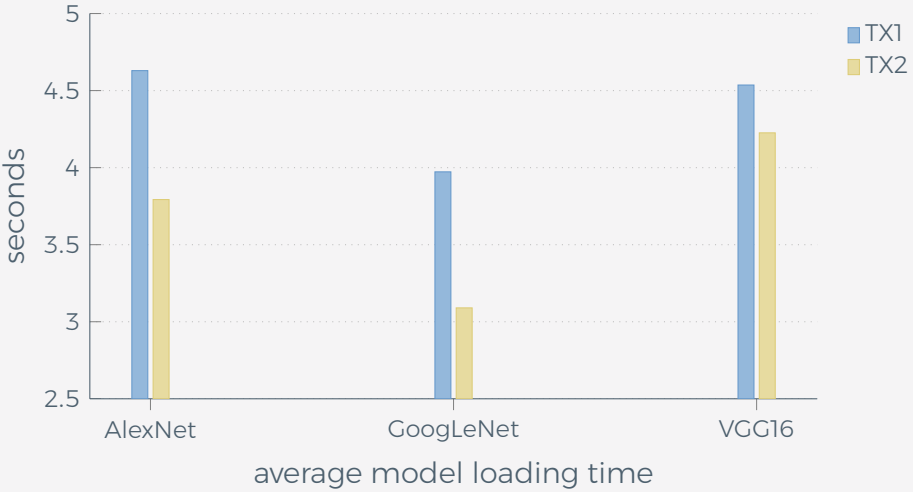
Experimental settings

- Architectures:
  - AlexNet;
  - GoogLenet;
  - VGG16.
- Evaluation measures:
  - Accuracy: weighted over classes;
  - Timing: model loading.
- Boards:
  - Jetson TX1 vanilla;
  - Jetson TX2 vanilla.

Accuracy



Comparison TX1 vs TX2



Demo!

Conclusions

+ simple approach;
+ fine-tuning can be performed on the box;
- need of manual cropping and labeling.

Future works

> include car detection;

> optimize software architecture;

> learn more general models;

> region proposal for semi-automatic cropping.

Remember...

Life is what happens to others

Remember...

Life is what happens to others while you're looking for parking!

Remember...

PARK SMART

Thanks for your attention!

Questions?

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http://www.parksmart.it