SmartCar

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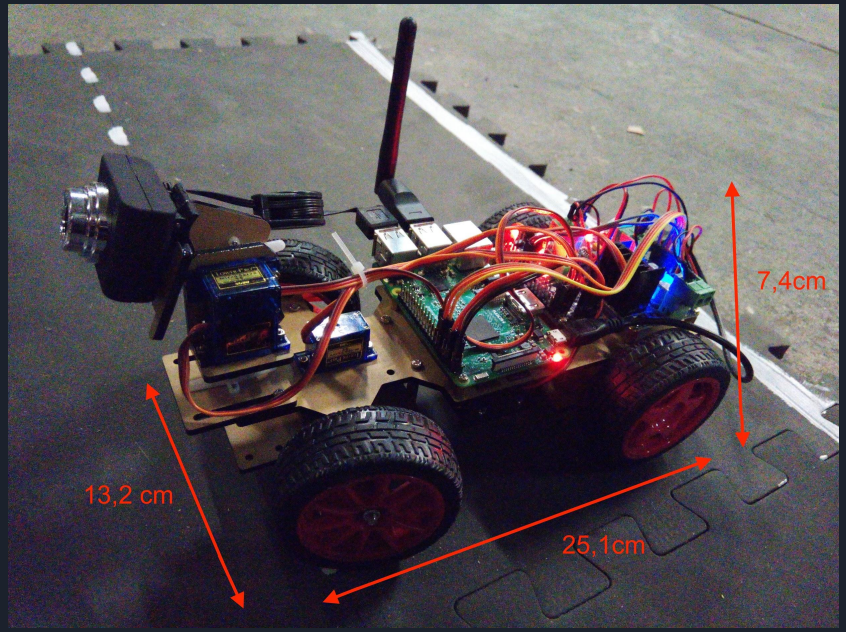
EPITA
ÉCOLE D'INGÉNIEURS EN INFORMATIQUE

SCIA 2018

Trailer

Raspberry Car's Hardware

- 13.2 x 25.1 x 7.4 (cm)
- 800 g
- Max speed 2 km/h
- 3 hour autonomy
- Wireless communication
- Remote access



Raspberry Car's Hardware

- Raspberry PI 3 equipped with 4 processor cores
- Wish-eye camera handeling 15 fps
- Ultrasonic sensor with 1m range
- Wireless antenna of 300 MBPS

Demo

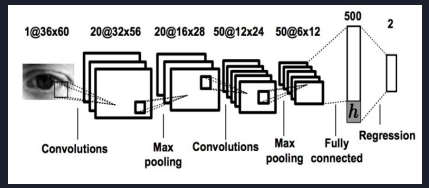
Car driving autonomously

Costs

Matériel	Quantité	Prix	Livraison	Total
Pack de 16 dalles	4	30.00	0	120.00
Smart Video Car Kit for Raspberry Pi	1	90.59	0	90.59
Raspberry PI 3 Model B	1	40.26	0	40.26
Clé Intel Movidius	1	98.96	0	98.96
Clé Wifi nets XF2123	1	11.99	0	11.99
Märklin World 72201	2	9.89	6.99	26.77
6 * AA Battery	2	6.00	0	12.00 €
Total				407.57

Trajectory Planning Pipeline

Raspberry Car → Generate Angle/Speed labeled data → Pre-process and augment data → Train Deep Learning model → Dump model on Raspberry Car → Real-time Angle/Speed prediction



Data Generation Method

Send joystick and trigger keys

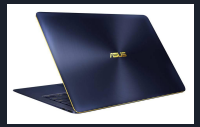
Send receive controller motion control

Record current image with associated angle/speed

Perform motion commands and send ready token

Controller (User)

Client (Computer)



Server (Raspberry)

Camera (Embedded)

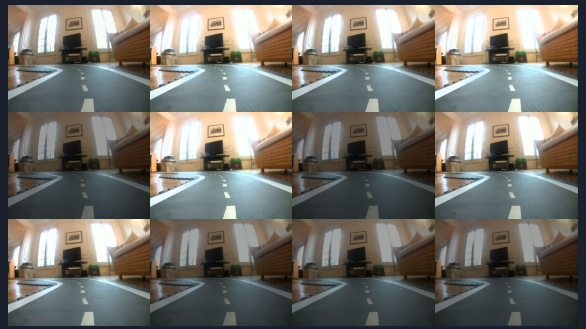
Data Augmentation

1. Flip Image

Original
angle_label = -1

Flipped
angle_label = 1

2. Random brightness generation on original and flipped images



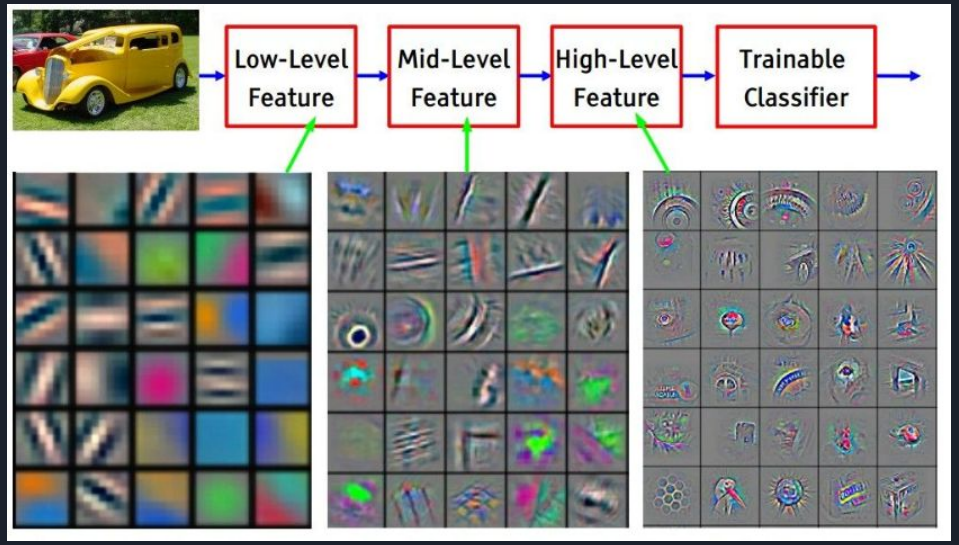
Why CNN ?

Pros :

- Invariant in translation
- Can analyze from small to high patterns
- State of the art in computer vision

Cons :

- Need a lot of data

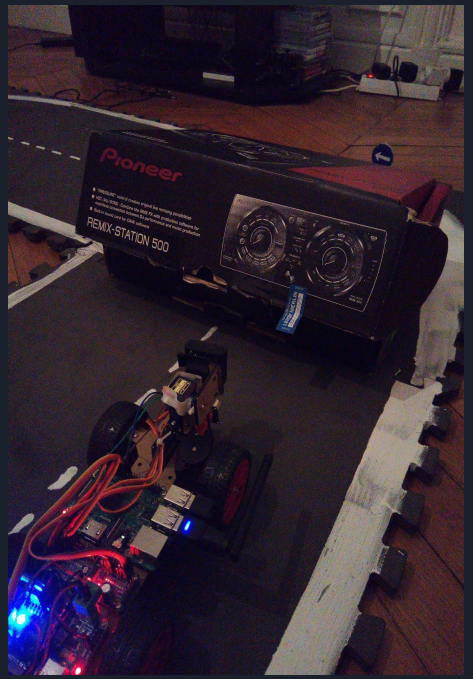


Model Architecture

- Light enough for real-time prediction on raspberry
- Good performance

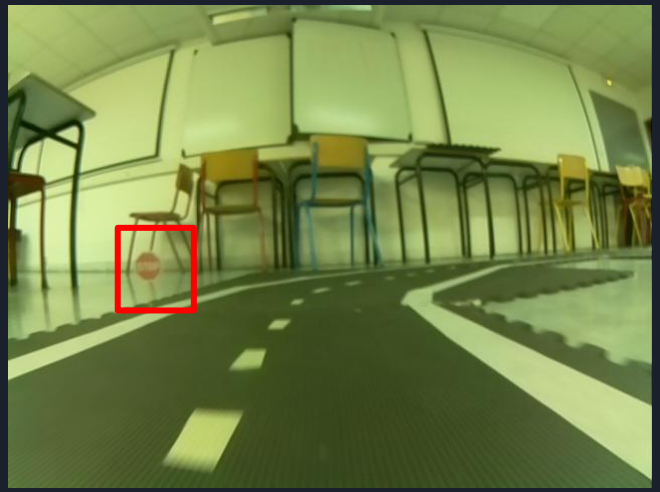
Obstacle Detection

- Ultrasonic sensor
- Range of 1 m
- Stop in front of obstacles



Sign Detection

- Need to detect boxes of the sign in the image
- Same model as angle/speed detection



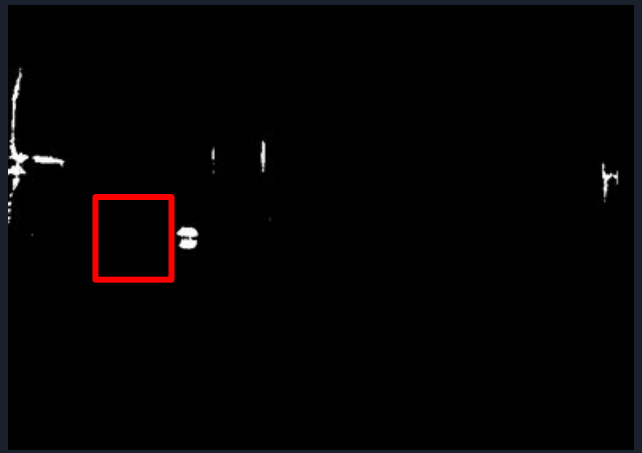
Box Detection Method

Hough transform:

- common method for circle detection
- not for real time

Hand-made method:

- edge detection
- try to fit circle
- predict with the sign classifier



Sign Dataset

1) Random flip
2) Random scale
3) Random shift
4) Random brightness

Improvement tracks

- Intersections management
- Improve computing power - Donkey Car
- Movidius - Inception
- LSTM

Contact

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THANKS!

ANY QUESTIONS?