http://autopilot-project.eu

Autopilot project

Marzieh Dolatabadi

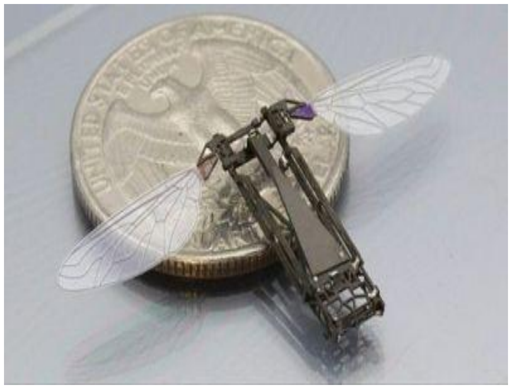
30-05-2018

About me:

- 2008- 2012 Bachelor of Science Aerospace Engineering, Iran.
- 2012-2014 Master of Science Aerospace Engineering, Iran.
- 15/04/2017 PhD , TU/e. Eindhoven, Netherlands.

Robotic challenge:

- Unmanned systems:

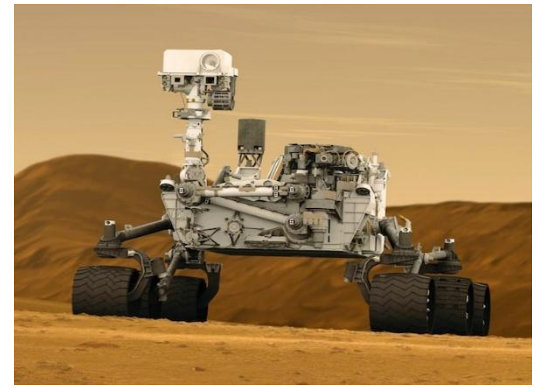


https://robobees.seas.harvard.edu

- Player robot:

- Surgery robot:

- Space robot:



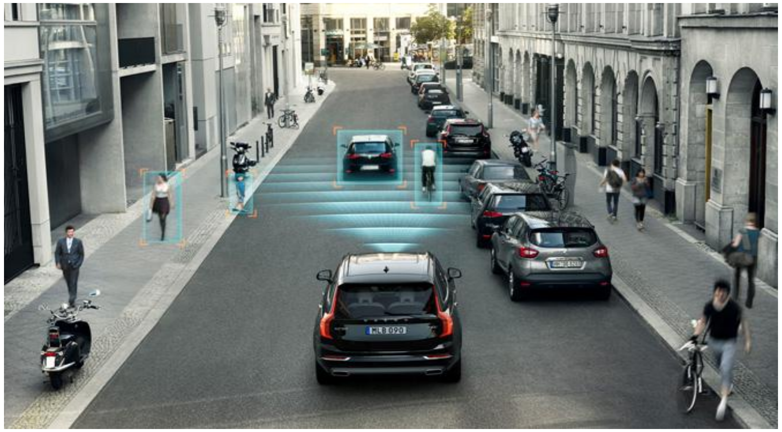
https://www.razorrobotics.com

- Agricultural robot:

CROPS EU-project. http://www.crops-robots.eu

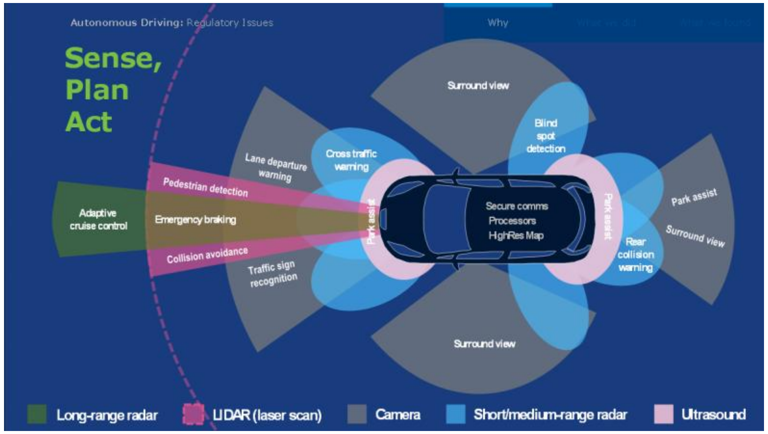
Autonomous vehicles:

- Environmental sense:



http://www.autoguide.com/author/jason-siu.html

- Sensors' role:



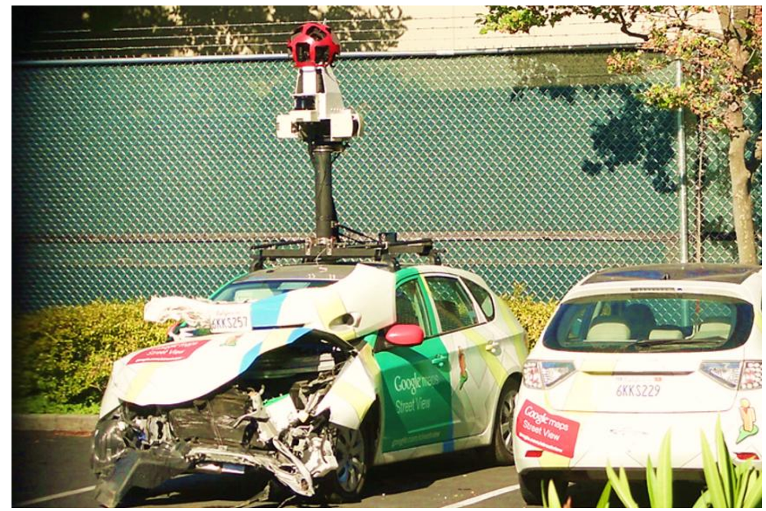
https://www.itf-oecd.org/cpb/pdf/autonomous-driving.pdf

- Feeling relax:

Autonomous vehicles:

- Self-Driving accident:
  - Tesla crash that killed a driver
  - Google Car Collides with Bus

www.CNN.com



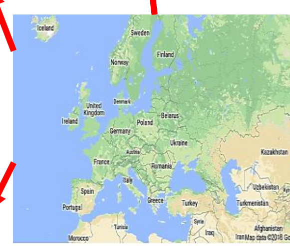
www.noweevil.com

Introducing AUTOPILOT:

- Enhance the driving environment.
- Innovation.
- Technologies.
- IoT.

Netherlands
Highway pilot
Automated Valet Parking
Platooning

France
Urban Driving
Automated Valet Parking



Germany
Highway pilot
Automated Valet Parking
Platooning

Italy
Urban Driving
Highway pilot

Spain
Urban Driving
Automated Valet Parking

Introducing challenges:

- Occlusions:

- Environment noise:

- Vision limitation

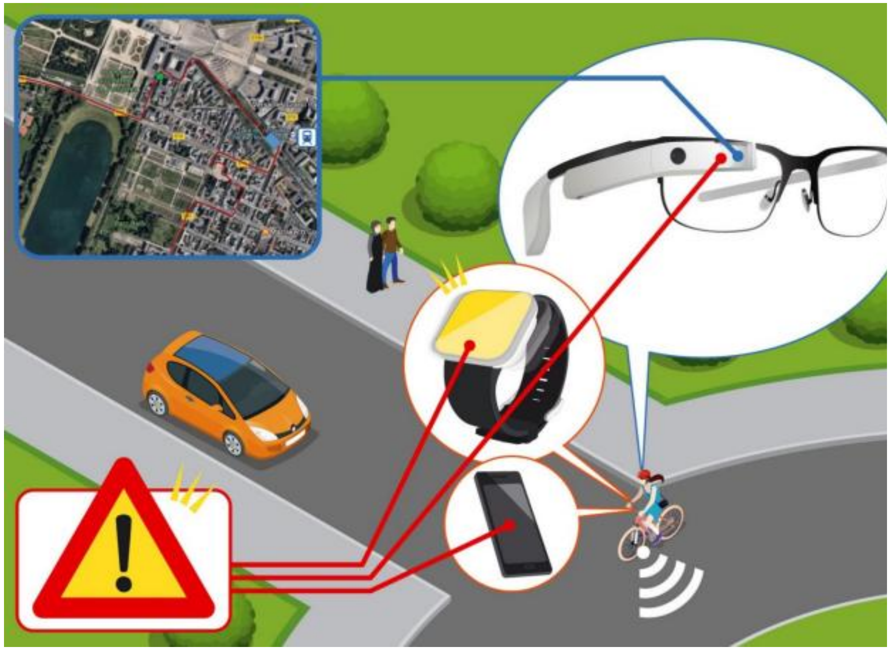
- No online bird view:

AUTOPILOT

Technische Universiteit Eindhoven University of Technology

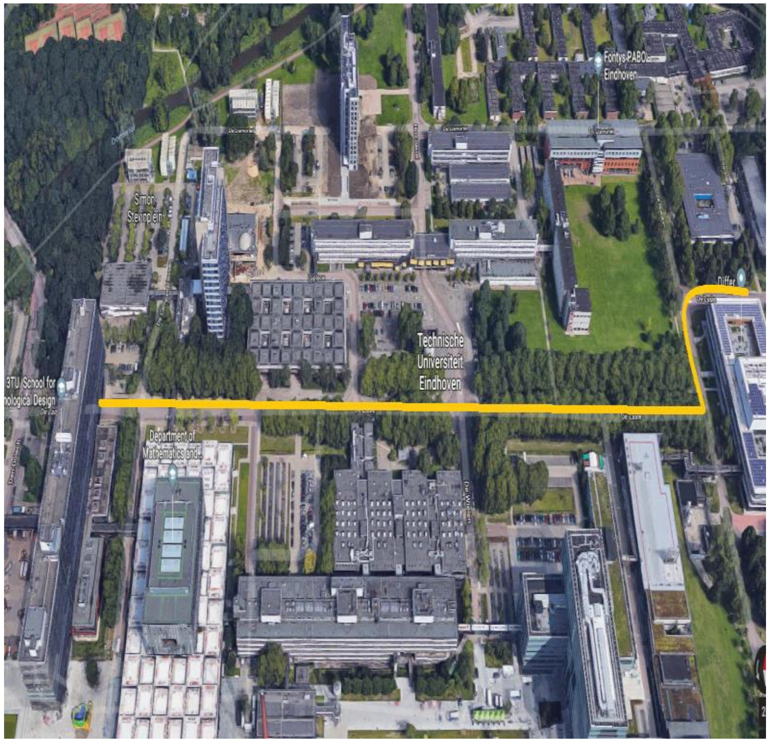
Introducing IoT:

- Devices:

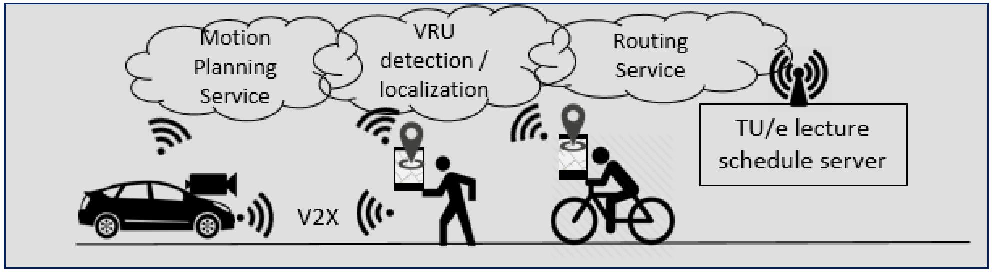


Objective:

- Driving autonomously (driver less) through TU\e campus.
- Predict VRU's behavior to enable decisions in complex situations.

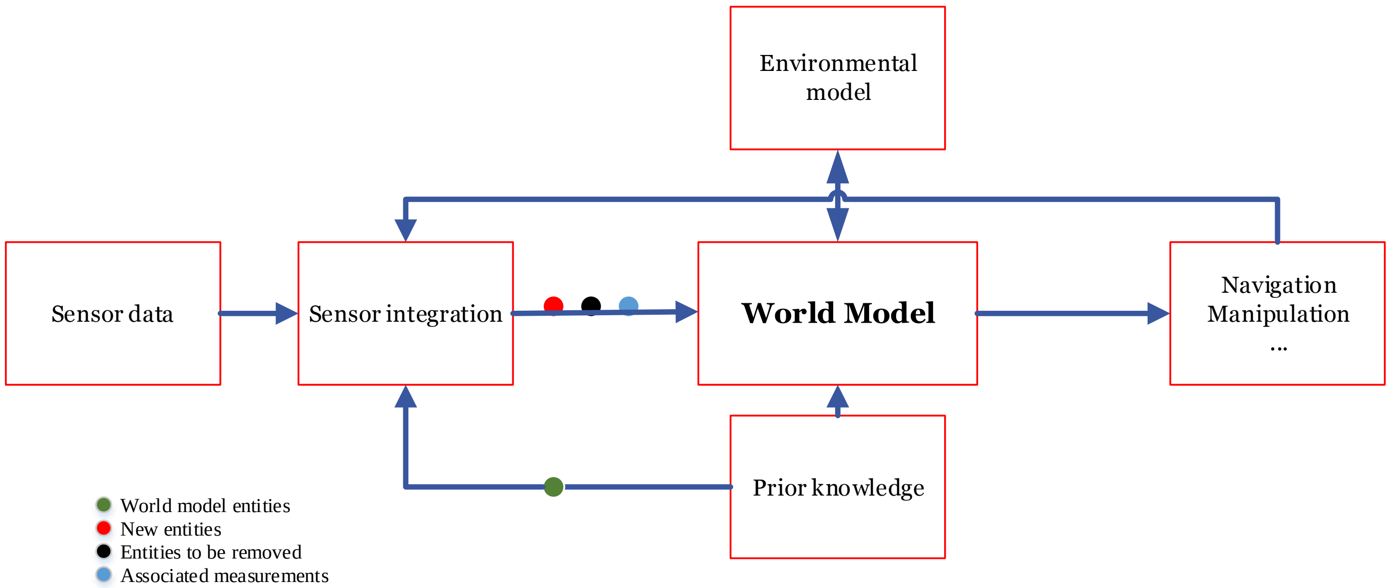


google.map.com



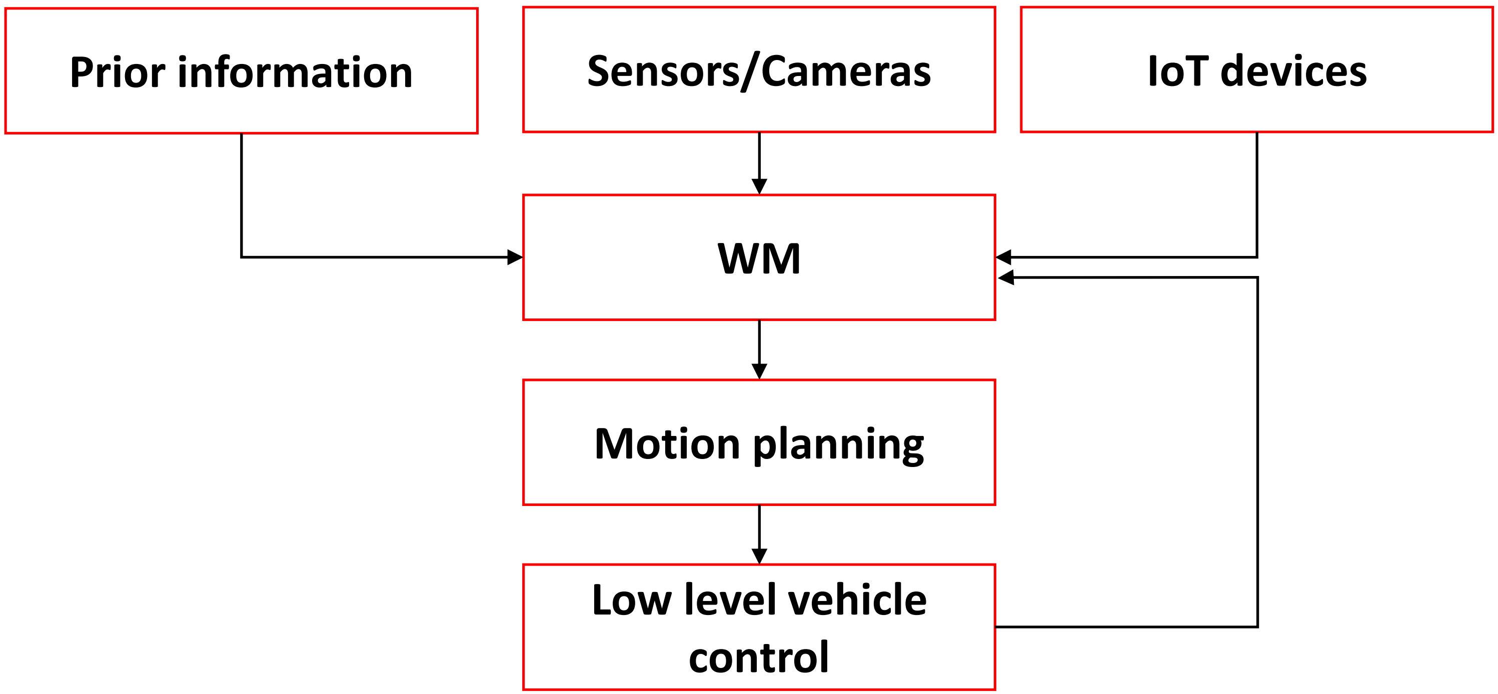
World model:

- Internal representation of environment.
- Bridge between behavior generation and sensory processing.



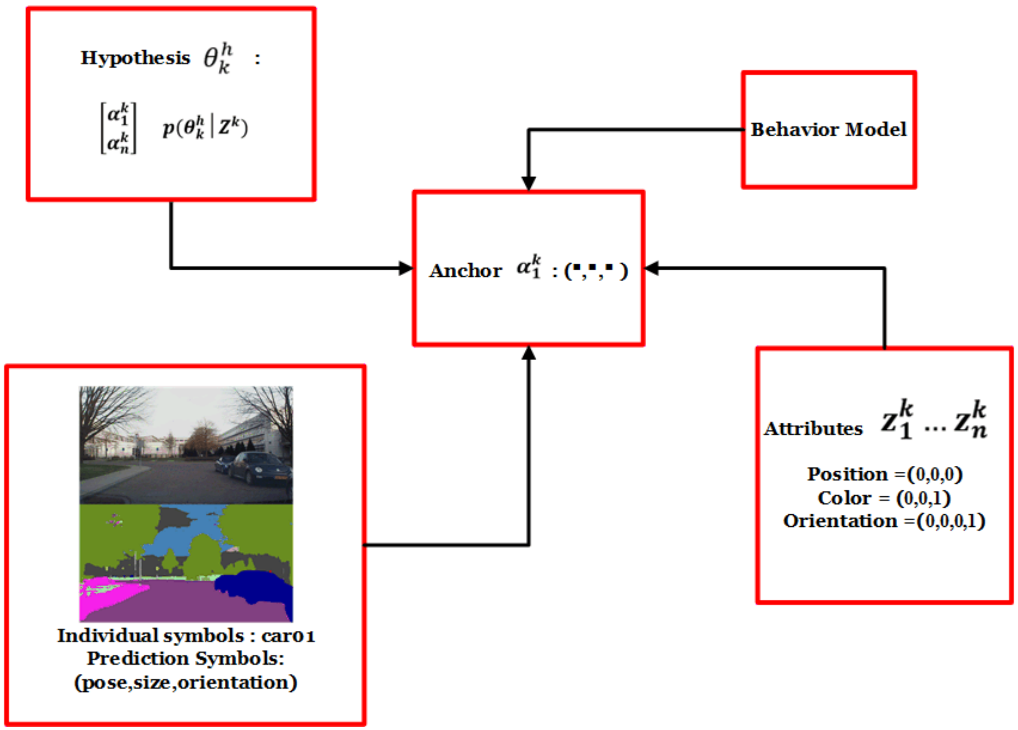
World model:

- A semantic environmental description (World Model) for autonomous cars.



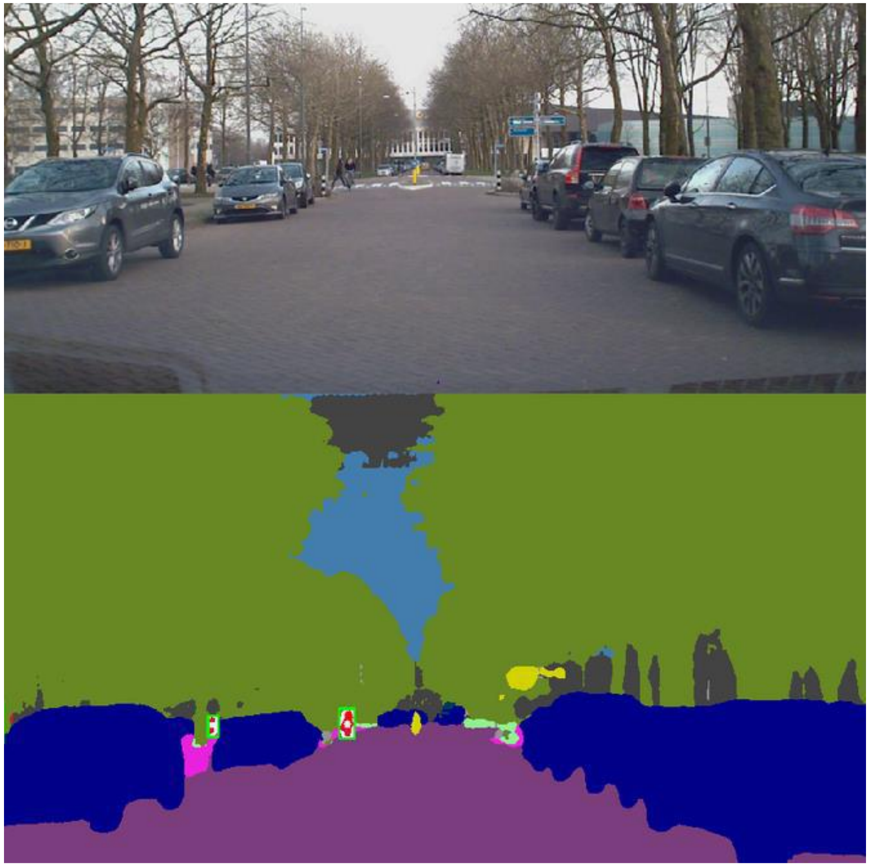
World model

- Contains two main parts:
  - Define multiple hypotheses for each object.
  - Make connection between measured attributes to semantically annotated objects.



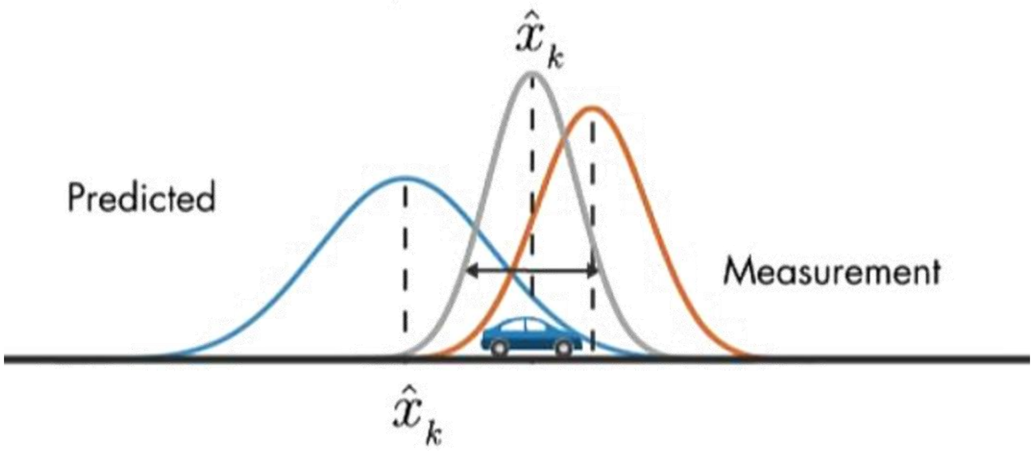
World model

- Individual and predicate symbols:
    - Image segmentation.
    - Object classification.
    - Orientation , size , color.



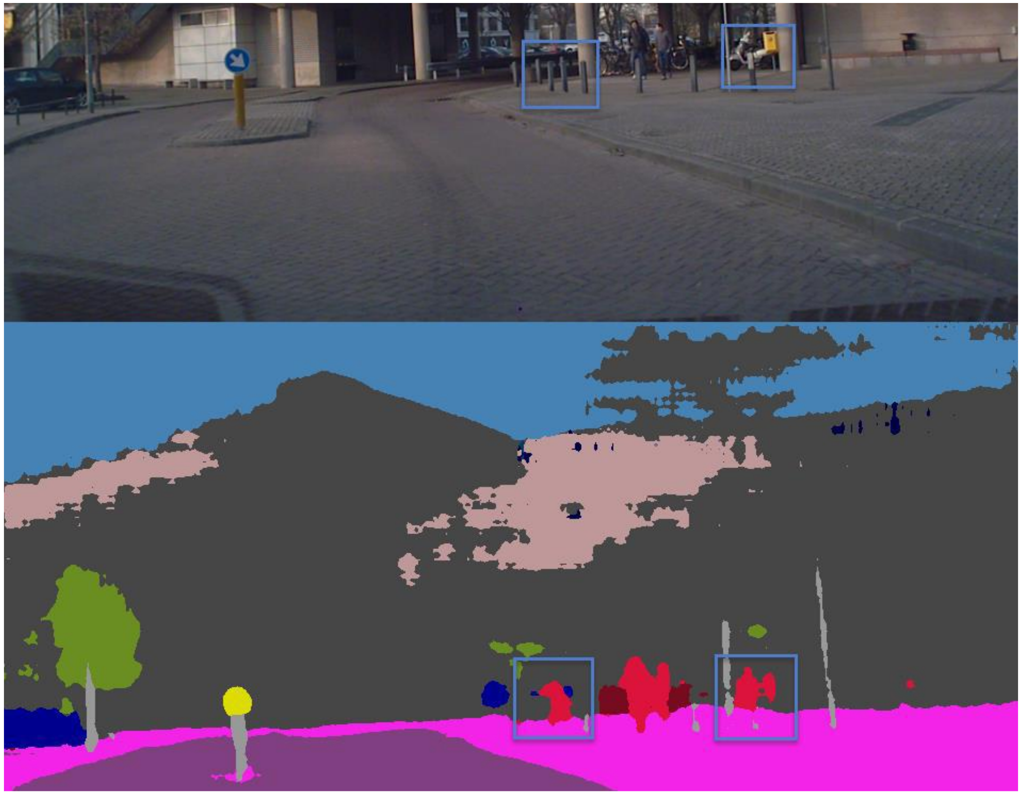
World model

- Behavior model:
  - Uniform distribution.
  - Gaussian distribution.
  - Kalman filter (constant speed)
  - Mixture distribution



World model

- Generating multiple hypotheses :
  - Represent a new object not yet present in the world model.
  - Originate from a previously observed (existing) object.
  - Be a false detection (clutter).



Achieved result

- Object's position.
- Amountof evidence.

```
[ INFO] [1521656503.410103747]: Received world state with 2 objects
[ INFO] [1521656503.410183735]:  Object:
[ INFO] [1521656503.410227660]:  - position:
[ INFO] [1521656503.410268558]:  - position: (2.143292,-0.094352,0.000000)
[ INFO] [1521656503.410308929]:  - diagonal position cov: (0.001000,0.001000,0.001000)
[ INFO] [1521656503.410357611]:  - color: red
[ INFO] [1521656503.410411444]:  - class pedestrain with probability 1.000000
[ INFO] [1521656503.410461836]:  Object:
[ INFO] [1521656503.410495980]:  - position:
[ INFO] [1521656503.410534889]:  - position: (1.756917,1.680836,0.000000)
[ INFO] [1521656503.410573154]:  - diagonal position cov: (0.001000,0.001000,0.001000)
[ INFO] [1521656503.410615807]:  - color: red
[ INFO] [1521656503.410660581]:  - class pedestrain with probability 1.000000
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AUTOPILOT

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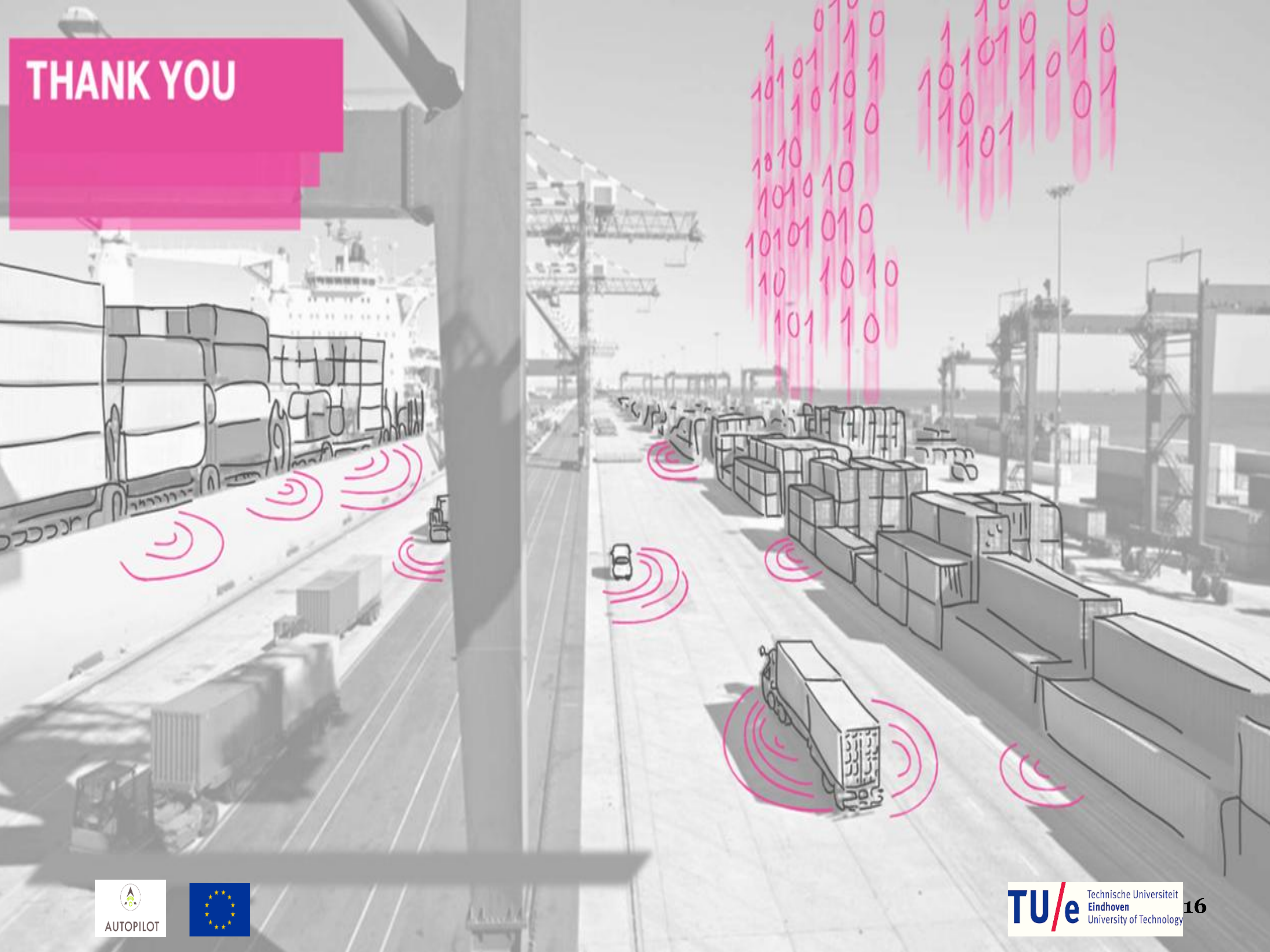
THANK YOU



Question

- How would you use hypothesis in the challenge?

- How many hypothesis do you need?