

Center for Science and Technology of Artificial Intelligence

Cognitive Dynamic Systems Laboratory MIPT

Hackathon 1. “Computer vision and reinforcement learning

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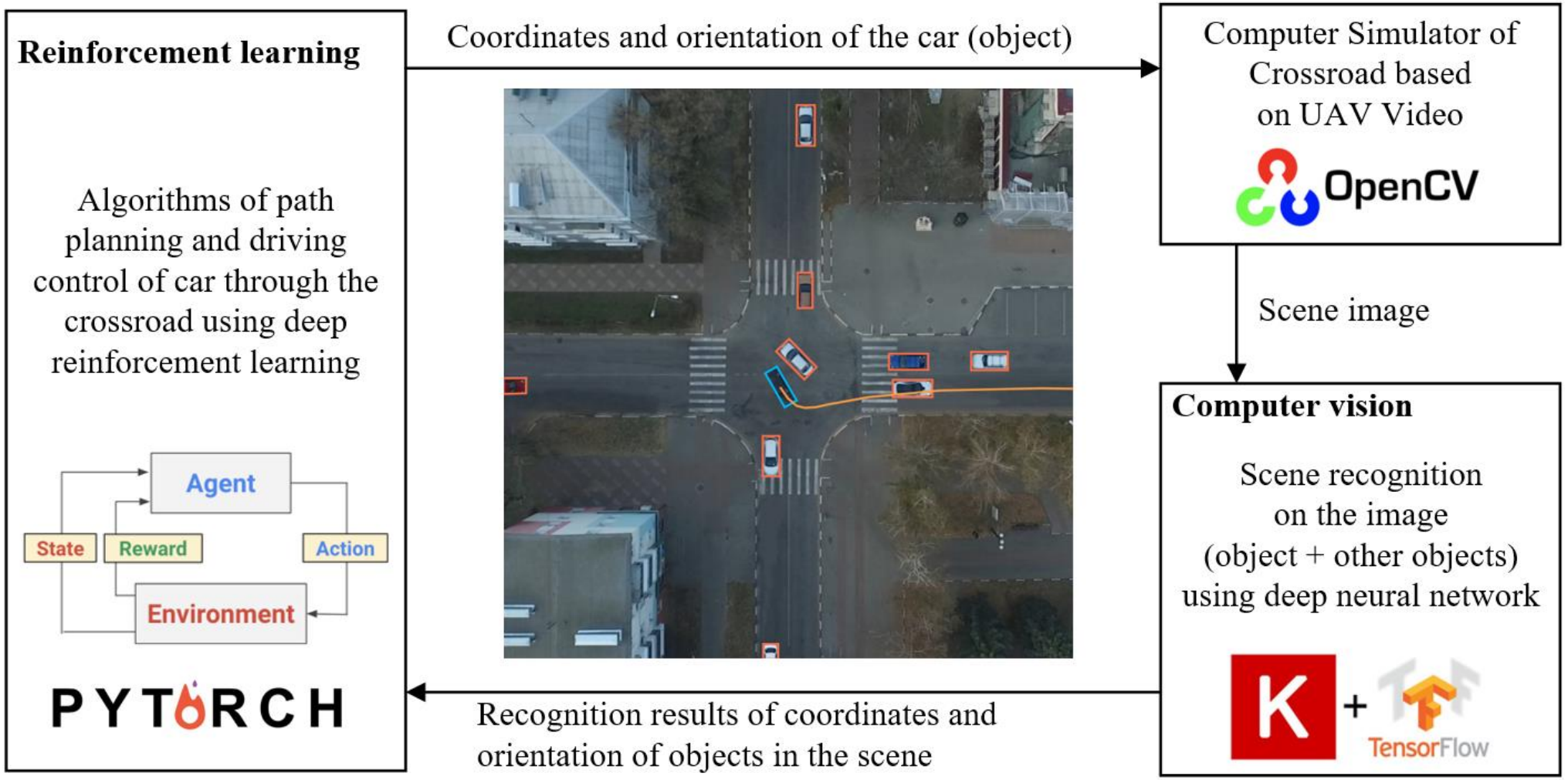
Hackathon 1. “Computer vision and reinforcement learning

Period: from 10:00 on July 5 to 16:00 on July 7, 2019 *in parallel with main program*

Team:

from 3 to 5 School participants.

Task: *creation of an improved program for the accident-free movement of a car at an unregulated crossroad using video from an unmanned aerial vehicle. This will require the usage of deep learning approaches to recognize cars on the images and reinforcement training to plan their movement.*



Benefits

- Learn how to prepare data for training of neural networks that detect objects and highlight them along the contour.
- Learn to apply the reinforcement learning approach to traffic planning.
- Learn how to work with popular deep learning libraries Keras and Tensorflow for solving computer vision tasks and Python libraries for reinforcement learning.
- Learn how to debug a Python program on a server with GPU on video cards with support for Nvidia CUDA technology.
- Develop a prototype of program to control the unmanned vehicle at the crossroad.
- The winners of the hackathon will have the opportunity to undergo an internship at the Laboratory of Cognitive Dynamic Systems of MIPT, as well as give an advantage in entering the new master's program “Methods and Technologies of Artificial Intelligence”, which opens in 2019 at MIPT.

Hardware and software

Hardware:

Server name	GPU	CPU	RAM	HDD
cds1	6xNVIDIA Tesla V100-SXM2-32GB	Intel Xeon Gold 6154 @ 16x 3GHz	128GB	400GB
cds2	4xNVIDIA Tesla V100-SXM2-32GB	Intel Xeon Gold 6154 @ 16x 3GHz	128GB	400GB

The server is provided by the hackathon partner:
the Center for Science and Technology of Artificial Intelligence (CSTI) of MIPT

Open software: Python 3, Keras, Tensorflow, OpenCV, RL stable-baselines, Pyqt5, CVAT

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Hackathon stages

1. Issuance to participants of a training sample containing 400 images of intersections with labeled areas (masks) of cars (‘car’ category).
2. Downloading by participants of the source code of the crossroad simulator and the Demo-solution of the task from github [https://github.com/cds-mipt/raai-summer-school-2019].
3. Install and configure the necessary tools for development:
4. All participating teams will be granted access to the server with Nvidia video cards. The server is provided by the hackathon partners - the Center for Science and Technology of Artificial Intelligence (CSTI) of MIPT.

   On the personal computer you need to install additional software: Python 3.5, pyqt5 (you can immediately install Anaconda3, which contains the Python interpreter, many additional libraries for data analysis, the environments manager), opencv-contrib-python, as well as a simulator with a basic solution.

   To train on the provided crossrad image data a deep convolutional neural network of one of the popular architectures, for example, U-Net using the Keras library. (For training a neural network can be used as a personal computer, and server equipment provided by the organizers)
5. Integrate the developed neural network detector with a program that provides path planning based on reinforcement learning.

Hackathon stages

6. In the allotted time, get a test task with a test set of images of the crossrad and with a new scenario of the cars behavior at the crossroad and ensure that the autonomous car reaches the goal in the shortest time since the launch of the simulator.
7. The organizers analyze 3 quality metrics of the participant decisions:

   1) Average Precision (AP) quality measure for cars detection implemented by participants compared to the reference labeling of a test sample. To do this, organisers will use the open source utility [https://github.com/rafaelpadilla/Object-Detection-Metrics] (should be maximized);

   2) reward to autonomous car for the reinforcement learning task,

   3) the quality of the solution presentation.
8. The teams demonstrate their decisions in the form of a presentation about the features of the technical implementation, indicating the prospects for the application (from 16:00 on July 7, 2019).
9. The team with the highest total score wins. The final total score is formed by the formula

$$I = A - (0.4 \cdot N_1 + 0.5 \cdot N_2 + 0.1 \cdot N_3),$$

   where A – total number of teams, N_i – occupied place in the rating on the i-th quality metric from p. 7.
10. Participants included in the winning team will receive a diploma, the right to internship at the Laboratory of Cognitive Dynamic Systems of MIPT, and an advantage in entering the new master's program “Methods and Technologies of Artificial Intelligence”.

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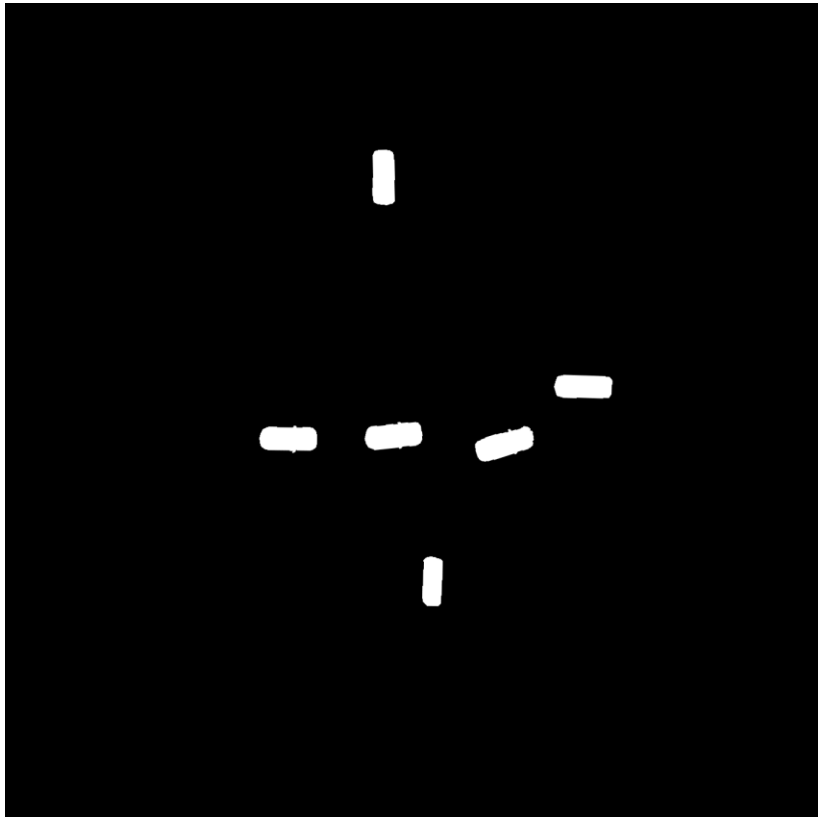
Datasets

CV Dataset



RL Dataset

Environment state: [x1, y1, angle1 …]

Car actions: [dx, dy, dangle …]

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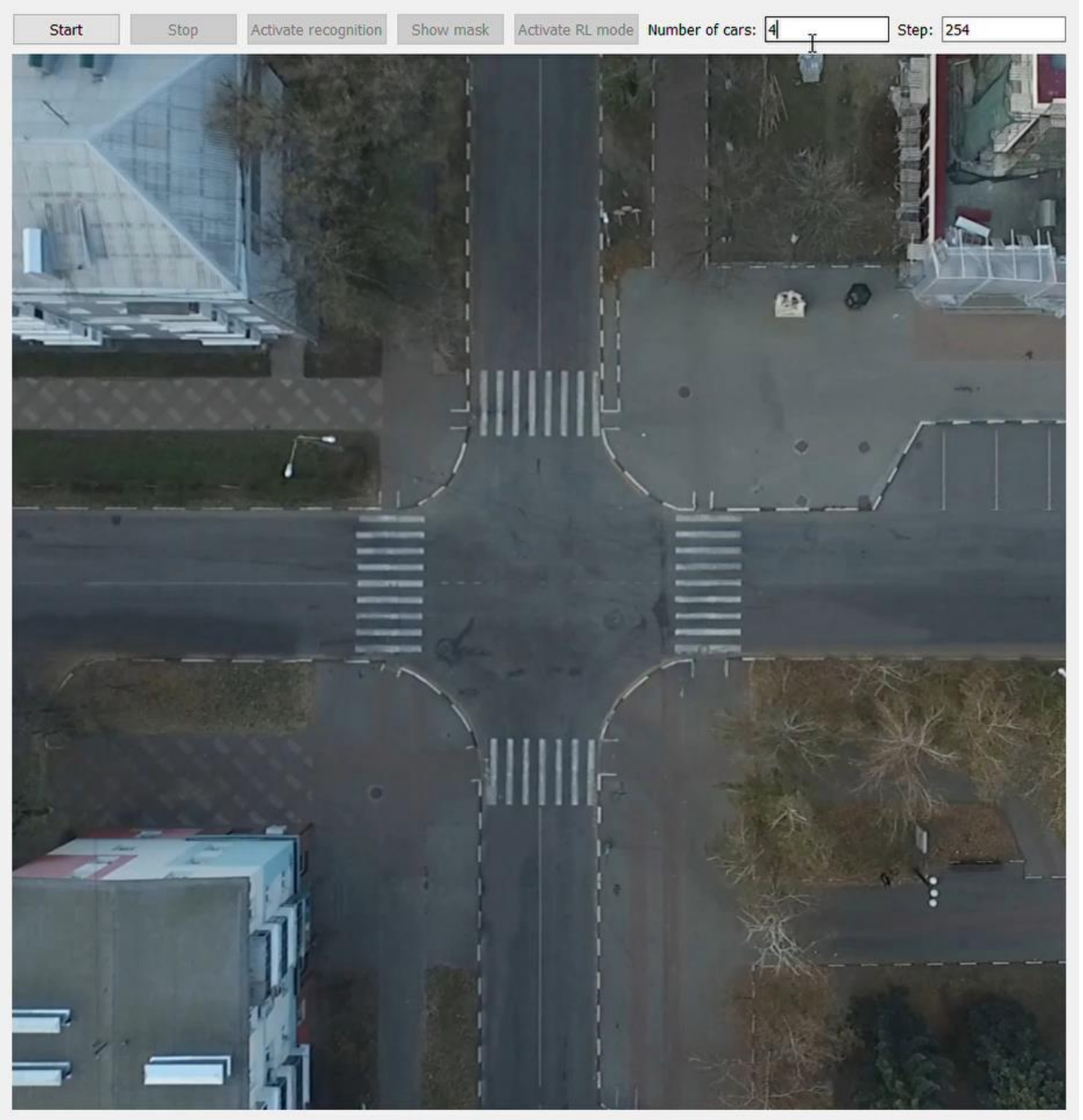
Demo-solution

Project on Github:
https://github.com/cds-mipt/raai-summer-school-2019

Demo-solution instructions:
Will be available from 10:00, 5 July 2019



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Registration on Hackathons of RAAI Summer School 2019

https://forms.gle/QBWJVviEmwhfvWeYA

Contacts

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