UDC 004.032.26:629.463.4

ARTIFICIAL NEURAL NETWORKS IN SELF-DRIVING CARS

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Task and purpose.

This research is dedicated to the future of motor transport. The main goal is to research the abilities of such kind of transport and overall look at technologies used in its development. Here we look at positive and negative sides of such novelty. Separately, the current level of progress in the branch of self-driving cars.

Object and subject of research.

In this research we will investigate what kind of hardware and software is used in order to give live to new driver-less future and the purpose of such kind of technology.

Scientific novelty.

Due to the progress of human society, the relevance of development and improvement of informational technologies, among which could be separated algorithmic and hard-software systems and complexes with elements of artificial intelligence take a valuable part, thanks to which – we can solve intellectual tasks and use functional, those were prerogative of humanity and weren't solvable otherwise. One of such tasks is the brain of driver-less cars.

Research results.

In the century of technological bloom, a lot of courageous ideas of humanity could be implemented into reality. Automobile industry is one of the spheres, that can be changed once and forever. This industry slowly but surely changes its development vector to the side of autonomous future, to create quite well-known thing, that is likely came from sci-fi romans. A lot of years' idea of autonomous, driver-less cars is under a wide focus between all of the biggest automobile manufacturers, those who try to give a live to this technology. However, a lot of effort was put in the development of new kind of transport in the last decade. As a result, classification of driving automation was created by the Society of Automotive Engineers (SAE). It has 6 levels:

«0» - The full-time performance by the human driver of all aspects of the dynamic driving task, even when "enhanced by warning or intervention systems;

«1» - The driving mode-specific execution by a driver assistance system of "either steering or acceleration/deceleration" with the expectation that the human driver performs all remaining aspects of the dynamic driving task;

«2» - The driving mode-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration with same expectations;

«3» - Driver is able not to control vehicle on areas of the rode with predictable movement but must be aware to take control on him/herself;

«4» - Analogical to the previous one, but doesn't require awareness of driver;

«5» - The only purpose of the driver – turning on the vehicle and setting up the coordinates.

The main concept in automated car – autonomous control of vehicle. A lot of problems that are connected with human factor are going to vanish, such problems as: car accidents. About 70% of them were caused by the driver's fault, the introduction of this type of transport must change situation a lot and reduce the amount of road accidents. Such things as established speed, observance of passage at the crossroads consistency etc. from the very beginning incorporated into the software of unmanned vehicle. So, impact on security because of human factor is minimized.

There are two approaches to train the car: the classic one and approach with the use of neural network. The first consists of four modules: localization, recognition, planning and management. When working with the second one a car receives data from the cameras, sends them to a neural network, and then determines, where to turn and at what speed to ride. Implementation of the neural network approach requires a large amount of input data for each of the possible situations, to teach a car how to behave like a person. It is quite difficult to do this, therefore many unmanned cars operate on the basis of a classic approach.

Classic approach works for the following scheme: car modules of recognition and perceptions send information to the planning module, which afterwards divides received and processed data with a car control system.

The mostly used recognition modules are: cameras, radars, lidars, infrared cameras.

In order to better distinguish what is around the car, the instance segmentation method can be used, where in contrast to normal segmentation objects do not merge in the same color but split into pieces. To implement this method, a specially trained artificial neural network on a beforehand prepared database of input data is used.

Vision of the car can be realized only with the help of cameras and radars — the cheapest technologies. The peculiarity of such a method lies in local use of technology: base maps are loaded into the onboard computer, processed by neural networks, and then compared to reality. Transport will navigate badly in cities similar to London, where there are often natural phenomena such as fog or heavy rain, which complicate perception even to a person. Also, the car will be "surprised" in cities where everything is actively being built and old buildings are under restoration.

Conclusions.

Before autonomous cars will reach a wide range of consumers, they will have to pass many tests and improvements. At the moment, there are very few unmanned cars of types 3, 4 and 5. However, this sphere is growing with remarkable speed and soon may change our daily lives.

Key words: autopilot, driverless cars, artificial neural networks.

REFERENCES

1. Thrun, Sebastian (2010). "Toward Robotic Cars". Communications of the ACM. 53 (4): 99–106.

2. https://www.bbc.com/russian/features 45942333?ocid=wsrussian.8ms.ppc.adwords.google.RussianLaunch-AI-Ukraine.nneed2.DriverlessCars.ad2.mktg;

3. https://tproger.ru/articles/self-driving-cars-howto/

4. Gehrig, Stefan K.; Stein, Fridtjof J. (1999). Dead reckoning and cartography using stereo vision for an automated car. IEEE/RSJ International Conference on Intelligent Robots and Systems. 3. Kyongju. pp. 1507–1512.

5. "Get ready for automated cars". Houston Chronicle. 11 September 2012. Retrieved 5 December 2012.