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PROSPECTS OF USING A CONVERSION NEURAL NETWORK TO PREVENT TRAFFIC ACCIDENTS IN A POPULAR POINT

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Abstract. This article examines the possibilities of artificial neural networks for the probable avoidance of motor vehicle drivers from traffic accidents, testing was carried out in a populated area.

Keywords: data analysis, statistics, modeling, convolutional neural network; traffic safety, photo-video recording complex, road parameters, safety.

ПЕРСПЕКТИВИ ВИКОРИСТАННЯ ЗГОРТКОВОЇ НЕЙРОННОЇ МЕРЕЖІ ДЛЯ ЗАПОБІГАННЯ ДТП В НАСЕЛЕНОМУ ПУНКТІ

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Анотація. У статті розглядаються можливості штучних нейронних мереж для ймовірного уникнення дорожньо-транспортних пригод, тестування проводилося в населеному пункті.

Ключові слова: аналіз даних, статистика, моделювання, згорточна нейронна мережа, безпека руху, комплекс фото-відео фіксації, параметри доріг, безпека.

Introduction. Judging by the growing number of publications from companies professionally engaged in the prevention of traffic accidents and emergency situations, great importance is attached to the solution of this task. Therefore, preparation of this issue is relevant for specialists of various profiles. In particular, the problem of identifying the factors of the probable danger of road accidents is one of the most difficult tasks in the field of information technologies due to a wide variety of distortions, such as different expressions of the environment, shooting conditions, etc. To solve this problem, it is effective to use neural networks due to the fact that they are weakly sensitive and have a high recognition speed.

A convolutional neural network (CNN, ConvNet) is a class of forward propagation deep artificial neural networks that has been successfully applied to the analysis of visual images [1].

As part of this work, a study of the influence of various factors on the number of administrative and criminal offenses in the field of traffic was conducted. Statistical data on offenses and traffic accidents in Ukraine and some countries of the European Union were analyzed. Accordingly, the following factors are highlighted:

− traffic intensity;
− road visibility characteristics (slopes, turns);
− condition of the road, purpose of the road;
− availability of markings, width and number of lanes;
− additional speed limits in this section;
− weather conditions, time of day and seasonality;
− distance from the settlement.

Tasks that are solved to achieve the set goal:

1. Study of existing neural-based software tools
network for the prevention of road accident incidents.
2. Study of existing methods of building "Smart City" systems.
3. Selection of devices, hardware, software.
4. Development of algorithms for managing the operation of objects.
5. Implementation of the developed algorithms on the selected software.

To develop this project, it is necessary to follow the structure of the convolutional neural network for the automation system. This architecture represents a sequence of convolution layers, which first reduce the spatial resolution of the image, and then increase it, having previously combined with the data and passed through other convolution layers.

The essence of the method proposed in the work, the method is intended for management in an emergency situation of TK. is that after accumulating information about the incoming traffic situation for a few time cycles from various sources, and the formation of correspondence, the classification of the situation is carried out - its assignment to the appropriate category.

In order to check the efficiency of the method, the overtaking situation was simulated on a two-lane road, where overtaking is carried out with an exit to the lane of oncoming traffic. When modeling using the TensorFlow neural network, two layers of tf.keras.layers were used. Dense. Training was conducted in 5 stages (Figure 2).

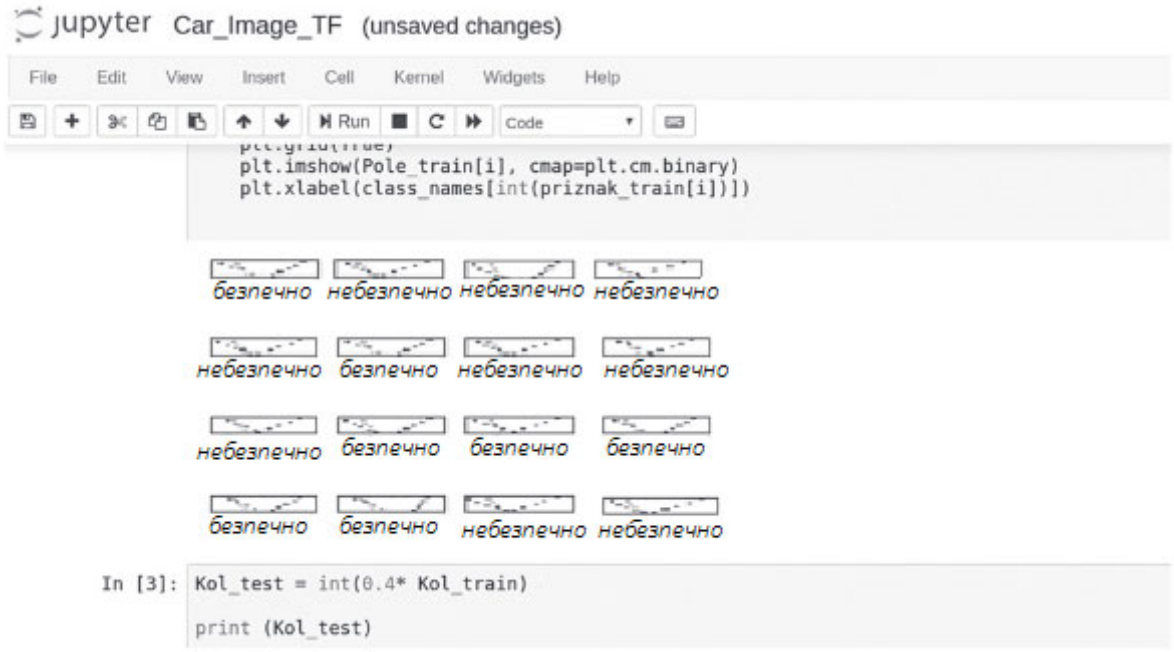

Figure 1 – A fragment of a program in Jupyter Notebook. Generation of sets of states

Epoch 1/5
12000/12000 [==============================] - 1s 74us/step - loss: 0.1554 - acc: 0.9353

Epoch 2/5
12000/12000 [==============================] - 0s 30us/step - loss: 0.1103 - acc: 0.9544

Epoch 3/5
12000/12000 [==============================] - 0s 30us/step - loss: 0.1076 - acc: 0.9545

Epoch 4/5
12000/12000 [==============================] - 0s 31us/step - loss: 0.1052 - acc: 0.9552

Epoch 5/5
12000/12000 [==============================] - 0s 30us/step - loss: 0.1036 - acc: 0.9550

Out[4]: test_loss, test_acc = model.evalute(test_images, test_;labels)
print('Test accuracy: ', test_acc)

4800/4800 [==============================] = 0s 16us/step
Test accuracy: 0.95979266666667

Figure 2 – The result of the simulation on the detection of emergency dangerous situation in Python

The accuracy of recognizing an emergency situation when overtaking was approximately 0.92. The assessment of the speed of solving the problem, which was presented in the work, was not carried out, since at this stage such an assessment is temporary. Therefore, the use of a convolutional neural network to

process information [2] about the road situation allows for the detection of road accidents, and the integration of such an algorithm in car control systems can prevent road accidents.

The **conclusions** and recommendations of the work can be concretely implemented in the activities of state institutions of the Main Directorate of the National Police of Ukraine, the Department of Patrol Police of the National Police of Ukraine, as well as in private organizations, in terms of proposals for the implementation of the enterprise activity management system in the context of ensuring its competitiveness.

In particular, in conclusion, it should be noted that no software, hardware, or other solutions can ensure absolutely reliable continuity of data transmission in neural networks. At the same time, reducing the risk of losses to a minimum is possible only with a comprehensive approach to issues. Therefore, the use of a complex neural network for processing information about the traffic situation allows to detect accidents, and the integration of such an algorithm in car handling systems can save accidents [3]. The conducted experiment showed a perspective and opens up new opportunities for the development of fast, compact, energy-independent artificial intelligence systems. In the future, based on this topic, there are prospects for developing software, as part of additional research on the expansion and improvement of neural network learning.

REFERENCES

1. Cremer M., Ludwig J. A fast simulation model for traffic flow on the basis of Boolean operations // Mathematics and Computers in Simulation. 1986. V. 28. N 4. P. 297–303. doi: 10.1016/0378-4754(86)90051-0

2. Dai J., Li Y., He K., Sun J. R-FCN: Object detection via region-based fully convolutional networks // Proc. 30 th Annual Conference on Neural Information Processing Systems (NIPS 2016). P. 379–387

3. Alvarez I., Poznyak A., Malo A. Urban traffic control problem via a game theory application // Proc. 46th IEEE Conference on Decision and Control (CDC 2007). 2007. P. 2957–2961. doi: 10.1109/CDC.2007.4434820