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IMPROVED DEEP LEARNING ALGORITHM FOR SELF-DRIVING CARS CONTROL

This paper presents the method of machine learning algorithms combination for training self-driving cars. It improves the overall accuracy and speeds up the training process.

Keywords*: machine learning, self-driving car, algorithm, classification, linear regression, stochastic gradient descent, accuracy.*

Today, machine learning (ML) is among the hottest technologies for autonomous driving. One of the main challenges in autonomous driving systems that have ML components is to choose an appropriate training algorithm to get the most effective results [1].

This research aims at developing an optimized algorithm through the implementation and combination of classification (K-Nearest Neighbors algorithm), linear regression and stochastic gradient descent. Comparative analysis of the algorithms shows that the created one outperforms the other methods with a high accuracy.

The research is provided for the development of a simulator for self-driving cars training using machine learning. The optimized algorithm aims to speed up the training process and get more accurate results.

This method lies in subsequent usage of classification, linear regression and stochastic gradient descent.

Classification is a process of categorizing a given set of data into classes. Here it is used for clear determination of states, for example, turn, straight drive etc. Classification of discrete states based on analog signal explained in [2]. According to the defined state linear regression is performed.

Linear regression performs the task to predict a dependent variable value based on a given independent variable. So, this regression technique finds out a linear relationship between the input and output. Here it is used for accurate determination of such values like the wheel angle, speed etc.

The next step aims at the optimization of obtained data by the use of stochastic gradient descent. This method replaces the actual gradient (calculated from the entire dataset) by an estimate thereof (calculated from a randomly selected subset of the data). Especially in high-dimensional optimization problems this reduces the computational

burden, achieving faster iterations in trade for a lower convergence rate [3].

To approve and assess an improvement of the described method the accuracy of algorithms in the training dataset is computed separately and in combination. The results are shown in the figure below:

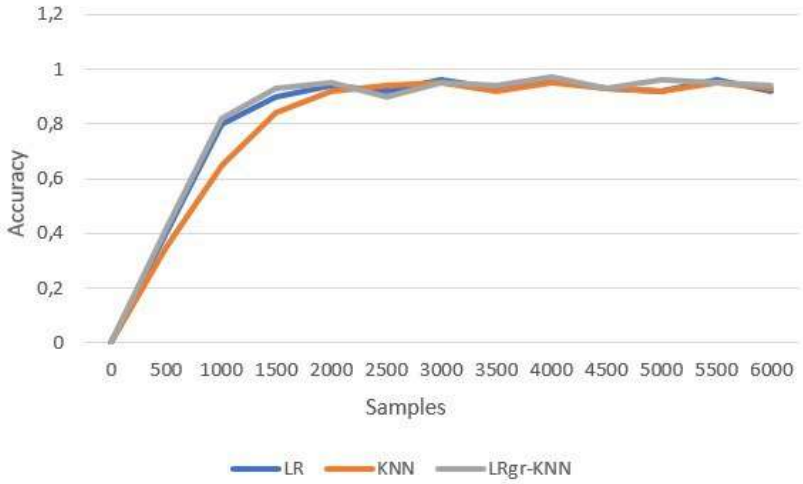

Fig. 1. Accuracy of used algorithms

According to the figure 1 it can be stated that subsequent usage of classification, linear regression and stochastic gradient descent gives higher accuracy in most cases of training the dataset for 94%.

During the research, it was established that the proposed approach of usage combination of methods allows to increase the overall accuracy of the training model, which enables to get more effective self-driving car behavior on the track.

REFERENCES

1. M. Cococcioni, F. Rossi, E. Ruffaldi and S. Saponara, "Novel Arithmetics to Accelerate Machine Learning Classifiers in Autonomous Driving Applications," *2019 26th IEEE International Conference on Electronics, Circuits and Systems (ICECS)*, Genoa, Italy, 2019, pp. 779-782, doi: 10.1109/ICECS46596.2019.8965031.

2. M. Kozlenko, I. Lazarovych, V. Tkachuk and V. Vialkova, "Software Demodulation of Weak Radio Signals using Convolutional Neural Network," *2020 IEEE 7th International Conference on Energy Smart Systems (ESS)*, Kyiv, Ukraine, 2020, pp. 339-342, doi: 10.1109/ESS50319.2020.9160035.

3. Bottou, Léon; Bousquet, Olivier (2012). "The Tradeoffs of Large Scale Learning". In Sra, Suvrit; Nowozin, Sebastian; Wright, Stephen J. (eds.). *Optimization for Machine Learning*. Cambridge: MIT Press. pp. 351–368. ISBN 978-0-262-01646-9.