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Software implementation of monitoring the psychophysical properties of a driver using gaming technologies

With the development of computer technology, both the driver's behavior on the road and the flow structure itself change. Various levels of autonomy of vehicles occur on the roads making their own adjustments to the driver's behavior on the roads. The device of cars becomes more complex. There are many electronic elements that, on the one hand, help the driver, on the other hand a sequence of actions is required to perform for their implementation without errors. Therefore, it is necessary to assess, besides the driving experience, the condition and mood of the driver. There is a need to classify the driver behavior on the road and develop methods for monitoring and assessing dangerous driving. The psychophysical state greatly influences the driving style. Thus, the development of approaches to the study of the dependence of the probability of driver's decision-making on the driver's condition is relevant. The proposed approach is based on conducting tests using gaming technologies and conducting a statistical analysis of the experimental results. This analysis can greatly assist in predicting the road behavior of fully autonomous vehicles.

This paper proposes an approach to the study of the psychophysical properties of a road user, namely a driver, when developing an information system using gaming technologies.

Key words: traffic flow, client server system, computer game programming, driver attention, statistical analysis.

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Optimization of the min-sum decoding algorithm for low-density parity-check codes

In this paper iterative decoding algorithms of low-density parity check codes are considered. Various modified versions of the minsum algorithm are considered. Dependency graphs of the bit error on various coefficients when transmitting data over a binary communication channel with additive white Gaussian noise are constructed. Comparison of the complexity of the implementation of various decoding algorithms is studied.

Key words: LDPC-code, sum-product algorithm, min-sum algorithm, min-sum normalized algorithm, min-sum offset algorithm, combined min-sum algorithm, normalization factor, shift factor.

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Analysis of the weighted Shiryaev–Roberts procedure in the problem of changepoint detection for models with unknown post change parameters

A problem of detecting a change in the properties of a random process (disorder) with unknown post change parameters is considered. In this problem, two models of an observable random process are considered: a Gaussian process and an autoregressive process of the first order. In this paper, we propose a changepoint detection algorithm for models with unknown post change parameters, viz. the weighted Shiryaev–Roberts procedure. This approach makes it possible to effectively solve many problems encountered in practice when the properties of a random process after the changepoint are not fully known. Analysis of detection characteristics for the weighted Shiryaev–Roberts procedure is carried out and compared with the detection characteristics of the Shiryaev–Roberts procedure, when the post changes of the parameters of the random process are known. The results show that the use of the weighted Shiryaev–Roberts procedure allows for detecting the changepoint with a given level of false detections, while not losing significantly to the characteristics of the Shiryaev–Roberts procedure, when the parameters of the random process after the changepoint are known.

Key words: changepoint detection, Shiryaev–Roberts procedure, Gaussian process, autoregressive process of the first order, Monte Carlo.

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Numerical comparison of objects' tracks initiation algorithms

In many problems of the initialization of objects' tracks, changepoint detection algorithms can be used. In the past when computational complexity was an issue, the K/N algorithm gained its popularity due to computational simplicity. A substantially more efficient track initiation algorithm can be built based on the sequential change detection technique. In this paper, we consider the Finite Moving Average algorithm. We compare the performance of the K/N algorithm with the Finite Moving Average algorithm. The optimality criterion is to maximize a probability of correct detection in a certain time interval under the given false alarm risk measured as a local probability of a false alarm. For performance, we obtain a theoretical estimate and an estimate by Monte Carlo simulations. The results show that the Finite Moving Average algorithm performs significantly better than the K/N procedure.

Key words: sequential changepoint detection, probability of correct detection, local probability of false alarm, K/N algorithm, finite moving average algorithm.