Abstract

This dissertation focuses on the supervised incremental machine learning algorithms and the evaluation of their classification quality. The main objective of the work was to develop and implement a new incremental data classification algorithm, both in software and hardware, which proved to be no worse than the existing algorithms in the class of shallow algorithms.

As part of the work, a new incremental data classification algorithm (SEVQ) with a minimal number of tunable parameters was proposed. Comprehensive comparative studies of the new classifier were conducted, considering a large number of datasets, many previously used shallow algorithms (both incremental and non-incremental), and various classification quality indicators. Grouping using the Scott-Knott algorithm and the Wilcoxon test was applied to rank the new SEVQ algorithm among the previously used algorithms.

The new algorithm was implemented in software using the Python language and in hardware on FPGA devices. Both implementations were compared, taking into account data classification quality indicators, learning time, and classification duration. A universal tool for supporting the process of comprehensive testing of data classification algorithms was also developed, meeting essential requirements for benchmark research and equipped with a graphical user interface.

The conducted research demonstrated that the proposed SEVQ algorithm, despite its simplicity, is no worse than most of the previously used shallow algorithms. The hardware implementation of the algorithm on an FPGA allowed for a significant acceleration of its operation, particularly in the context of handling large datasets, while maintaining comparable classification effectiveness.

Keywords: supervised learning, shallow classifiers, incremental algorithm, hardware implementation, classification quality evaluation