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Extensions of dynamic programming: Applications for decision trees

In the presentation, we consider extensions of dynamic programming approach to the investigation of decision trees as algorithms for problem solving, as a way for knowledge extraction and representation, and as classifiers which, for a new object given by values of conditional attributes, define a value of the decision attribute. These extensions allow us to describe the set of optimal decision trees, to count the number of these trees, to make sequential optimization of decision trees relative to different criteria, to find the set of Pareto optimal points for two criteria, and to describe relationships between two criteria. The applications include the minimization of average depth for decision trees sorting eight elements (this question was open since 1968), improvement of upper bounds on the depth of decision trees for diagnosis of 0-1-faults in read-once combinatorial circuits over monotone basis, existence of totally optimal (with minimum depth and minimum number of nodes) decision trees for Boolean functions, study of time-memory tradeoff for decision trees for corner point detection, study of relationships between number and maximum length of decision rules derived from decision trees, study of accuracy-size tradeoff for decision trees which allows us to construct enough small and accurate decision trees for knowledge representation, and decision trees as classifiers, outperform often decision trees constructed by CART.

Biography

Mikhail Moshkov is a Professor in CEMSE division at King Abdullah University of Science and Technology (KAUST), Saudi Arabia since October 1, 2008. He completed his Master's degree at Nizhny Novgorod State University; Doctorate degree at Saratov State University and; Habilitation at Moscow State University. From 1977 to 2004, he was at Nizhny Novgorod State University. Since 2003, he worked at Institute of Computer Science, University of Silesia, Poland and; at Katowice Institute of Information Technologies since 2006. His main areas of research are complexity of algorithms, combinatorial optimization, and machine learning. He is an author and co-author of five research monographs published by Springer.

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