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Extensions of dynamic programming for decision and inhibitory tree study

Mikhail Moshkov
King Abdullah University of Science and Technology, Saudi Arabia

In this presentation, we consider extensions of dynamic programming approach to the study 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 results 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, 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 that, as classifiers, outperform often decision trees constructed by CART. We describe how the considered tools can be used for the study of inhibitory trees in which terminal nodes are labeled by expressions "≠ decision"? The end of the presentation is devoted to the introduction to KAUST.

mikhail.moshkov@kaust.edu.sa