Learning Decision Trees in Continuous Space

Ákos Zsiros

A lot of applications on the area of artificial intelligence and data mining leads to a similar task: constructing classification model based on our knowledge. A typical type of classification models is the decision tree, which is hierarchical system of decision rules.

The classical ID3 algorithm is based on attribute selection, where only discrete attributes can be used. Although it has a continuous extension (C4.5), it operates like ID3 using discretization of numerical values. There is an alternative way of building and pruning decision trees, in which it's not necessary to discretizate continuous values and we can handle arbitrary continuous attributes.

The geometric interpretation of classification is the following: separate the n-dimensional Euclidean space into regions and label each region with the class of its points. The C4.5-type algorithm uses only hyperplanes which are orthogonal to the axis to separate the space. In our new method we can use any other surfaces, for example hyperplanes, n-dimensional sphere, ellipsoid, etc.

The ID3-type algorithm uses special measure coming from information theory. In this method a new decision function is used, which is closely related to the fuzzy operators. The parameters of the surface is determinated by the global minimum of this decision function.

Our test shows that this new method is efficient and it generalize the original problem.