Constructing fuzzy rule-based systems with the R package “frbs”

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Fuzzy sets as proposed by Zadeh (1965) are a generalization of classical set theory, in which objects, instead of just being members of a set or not, have a gradual degree of membership. Fuzzy rule-based systems (FRBS) have been used in the past successfully in many applications. They are competitive methods for classification and regression, especially for complex problems. One of their leading properties is that they are usually easy to interpret.

In CRAN, there exist already some packages for building FRBSs. The sets package (Meyer and Hornik 2009) implements the fundamental operations on fuzzy sets, and allows to build Mamdani-type FRBSs manually. The package fugeR (Bujard 2012) implements a method that is capable of learning FRBSs from data using a coevolutionary genetic algorithm.

We present the frbs package (published on CRAN, Riza et al. 2013), which is focused on the deployment of FRBSs, and their construction from data using procedures from Computational Intelligence (e.g., neural networks and genetic algorithms) to tackle classification and regression problems. The types of FRBSs considered in the package are Mamdani, Takagi Sugeno Kang, and other variants. For the learning process, frbs provides a host of standard methods, such as Wang & Mendel’s technique, ANFIS, HyFIS, DENFIS, subtractive clustering, SLAVE, and several others. The package allows for a flexible model construction by implementing multiple choices for operators (conjunction, disjunction, implication, etc.) and membership functions (e.g., triangle, trapezoid, Gaussian, etc.). Additionally, our package also allows for constructing FRBSs from human expert knowledge. In sum, with the package frbs we present a package that provides the most widely used algorithms and a comprehensive methodology in the field of FRBSs for regression and classification.

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