

Identification of Fuzzy Rule Based Systems : Some important but less-discussed issues and possible ways to address them

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While generating a fuzzy rule based system from data using exploratory analysis, there are many issues that must be addressed, particularly if we want to exploit the benefits of interpretability of fuzzy systems. There are several methods for generation of fuzzy rules, which may extract useful (in terms of accuracy) rules for high dimensional data also. But even for rules involving moderately large number of attributes, the main attraction of fuzzy systems cannot be exploited. These issues are akin to dimensionality reduction/structure identification and interpretability of the systems. We shall present an “interesting” mechanism to deal with some of these issues in an integrated manner. A unique attribute of this approach is that it can exploit subtle non-linear interactions between features, the problem (that we intend to solve), and the tool (that is used to solve the problem). The formulation is adapted to all three types of fuzzy systems: classification systems, Mamdani type systems and Takagi-Sugeno type systems. This approach can deal with necessary features, indifferent features, and derogatory features in an appropriate manner but may not minimize the use of redundant features. So, we further generalize the scheme so that it can control the redundancy in the selected features. The underlying philosophy can be easily adapted to other learning frameworks such as neural networks. Automatic extraction of rules also leads to conflict/inconsistency in the generated rules. We shall discuss how the level of conflict can be quantified so that it can be controlled. The effectiveness of the approaches will be demonstrated using a set of applications.