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Robust rules for prediction and description

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Propositions

accompanying the thesis

Robust rules for prediction and description

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1. Mining rules with different objectives, such as in machine learning and data mining, leads to rules with different properties that represent different perspectives of the same data.
2. MDL for point hypothesis selection can be interpreted as the goodness of fit plus a penalty for multiple hypothesis testing. The goodness of fit is given by the maximum likelihood estimate and the multiple hypothesis testing by model complexity, which in practice counts all possible models with a minimum number of assumptions.
3. An approximate solution to an exact problem can be better than an exact solution to an approximate problem.
4. In most practical settings, it is not computationally feasible to find the best machine learning model. Still, it is possible to heuristically find a model that guarantees some quality criteria most of the time.
5. Interpretability is a personal or community-related property. "Interpretability is a domain-specific notion, so there cannot be an all-purpose definition. Usually, however, an interpretable machine learning model is constrained in model form so that it is either useful to someone, or obeys structural knowledge of the domain, (...), or physical constraints that come from domain knowledge." (in Rudin, Cynthia. 2019)
6. The idea that simpler models are more interpretable arises from the assumption that less effort to read models is associated with interpretability. Nonetheless, this assumption can be erroneous; for example, if the variables used to construct these models are not easily understood or misleading to the end-user.
7. For most real-world machine learning problems, the idea of an optimal model is a mere mathematical construction. This is the main idea of the "Rashomon effect" (Breiman et al., 2001), where "(...) there is no "best" model from most finite data sets, only many good descriptions." (Semenova, Lesia, et al. 2019).
8. From the perspective of how a rule describes its target class (in classification), rules can be divided into two types: discriminative and characteristic. Discriminative rules describe the target class by the smallest number of distinctive properties that can discriminate it. Characteristic rules describe the target class by all the properties that are characteristic of it. Rule-based algorithms have long focused on the discriminative rules but should, depending on the task, provide both perspectives to the user.
9. Modern versions of MDL can use all the data available to extract the best fitting model that is statistically robust without resorting to cross-validation or hold-out data.
10. Learning comes from asking questions. From all the questions we ask, only a few answers we find in response ever become facts.