Machine Learning - (One|Simple) Rule - (One Level Decision Tree)

You are here: (https://gerardnico.com/wiki/start)

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1 - About

One Rule is an simple method based on a 1-level decision tree (https://gerardnico.com/wiki/data_mining/decision_tree) described in 1993 by Rob Holte, Alberta, Canada.

Simple rules often outperformed far more complex methods because some datasets are :

- really simple
- so small/noisy/complex that nothing can be learned from them

2 - Articles Related

- Data Mining - (Classifier|Classification Function) (https://gerardnico.com/wiki/data_mining/classification)
- Statistics - (Confidence|likelihood) (Prediction probabilities|Probability classification) (https://gerardnico.com/wiki/data_mining/confidence)
- Data Mining - Decision Tree (DT) Algorithm (https://gerardnico.com/wiki/data_mining/decision_tree)
- Machine Learning - Decision Stump (https://gerardnico.com/wiki/data_mining/decisionstump)
- Machine Learning - Linear (Regression|Model) (https://gerardnico.com/wiki/data_mining/linear_regression)
- Data Mining - Naive Bayes (NB) (https://gerardnico.com/wiki/data_mining/naive_bayes)
- Data Mining - (Decision) Rule (https://gerardnico.com/wiki/data_mining/rule)

3 - Implementation

3.1 - Basic

- One branch for each value
- Each branch assigns most frequent class
- Error rate: proportion of instances that don’t belong to the majority class of their corresponding branch

- Choose attribute with smallest error rate

```
For each attribute,
   For each value of the attribute,
   make a rule as follows:
       count how often each class appears
       find the most frequent class
       make the rule assign that class to this attribute-value
   Calculate the error rate of this attribute's rules
Choose the attribute with the smallest error rate
```

Example of output for the weather data set (https://gerardnico.com/wiki/data_mining/weather)

```
outlook:
    if sunny    -> no
    if overcast -> yes
    if rainy    -> yes
```

with this one-level decision tree, 10 instances are correct on 14.

3.2 - Other

Algorithm to choose the best rule

```
For each attribute:
  For each value of that attribute, create a rule:
      1. count how often each class appears
      2. find the most frequent class, c
      3. make a rule "if attribute=value then class=c"
  Calculate the error rate of this rule
Pick the attribute whose rules produce the lowest error rate
```

4 - One Rule vs Baseline

OneR always outperforms (or, at worst, equals) Baseline (https://gerardnico.com/wiki/data_mining/baseline) when evaluated on the training data. (evaluating on the training data doesn't reflect performance on independent test data.)

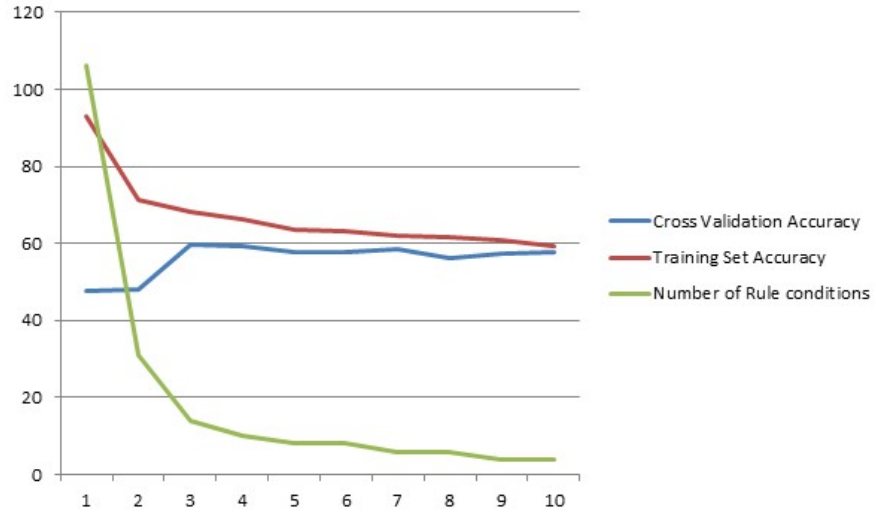
ZeroR (https://gerardnico.com/wiki/data_mining/baseline) sometimes outperforms OneR if the target (https://gerardnico.com/wiki/data_mining/target) distribution is skewed or limited data is available, predicting the majority class can yield better results than basing a rule on a single attribute. This happens with the nominal weather dataset (https://gerardnico.com/wiki/data_mining/weather)

5 - minBucket Size

The “minBucket size” parameter of weka (https://gerardnico.com/wiki/data_mining/weka) limits the complexity of rules in order to avoid overfitting (https://gerardnico.com/wiki/data_mining/overfitting) (Default 6)

With one “minBucket size” the accuracy on the training data set is really high and decreases whereas the “minBucket size parameter” increases.

The cross validation (https://gerardnico.com/wiki/data_mining/cross_validation) evaluation method (10 folders) limits the accuracy effect and make it more stable through the “minBucket size” values.



(https://gerardnico.com/wiki/_detail/data_mining/one_r_graph.jpg?id=data_mining%3Aone_rule)

min Bucket Size Parameter	Eval Method: Cross Valid-ation Accuracy	Eval Method: Training Set Accuracy	Number of conditions generated
1	47.66	92.99	106
2	48.13	71.5	31
3	59.81	68.22	14
4	59.35	66.36	10
5	57.94	63.55	8
6	57.94	63.08	8
7	58.41	62.14	6
8	56.07	61.68	6
9	57.48	60.75	4
10	57.94	59.34	4

- (https://delicious.com/post?title=Machine+Learning+-+%28One%7CSimple%29+Rule+-+%28One+Level+Decision+Tree%29&url=https%3A%2F%2Fgerardnico.com%2Fwiki%2Fdata_mining%2Fon
- (https://digg.com/submit?phase=2&title=Machine+Learning+-+%28One%7CSimple%29+Rule+-+%28One+Level+Decision+Tree%29&url=https%3A%2F%2Fgerardnico.com%2Fwiki%2Fdata_mining%2Fon
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- (http://www.stumbleupon.com/submit?title=Machine+Learning+-+%28One%7CSimple%29+Rule+-+%28One+Level+Decision+Tree%29&url=https%3A%2F%2Fgerardnico.com%2Fwiki%2Fdata_mining%2Fon
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