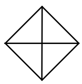


Why

How should we compare two classifiers?

Definitions

Let $a^1, \dots, a^n$ in A be a dataset of inputs and $b^1, \dots, b^n$ in B be a dataset of labels. Let $G : A \to B$ be a classifier.

For each $i = 1, \dots, n$, the classifier associates a prediction $G(a^i)$ with a^i. The prediction $G(a^i)$ is *correct* if $G(a^i) = b^i$ and *incorrect* (*wrong*, *error*) if $G(a^i) \neq b^i$. The *error rate* is the proportion of the dataset for which the classifier's prediction is an error. In other words, $1/n \left|\{i \mid G(a^i) \neq b^i\}\right|$.

Given two classifiers, it is natural to prefer the one with the lower error rate. Given that these two are the results of different inductors applied to the same, we can use a separate dataset to *validate* these.

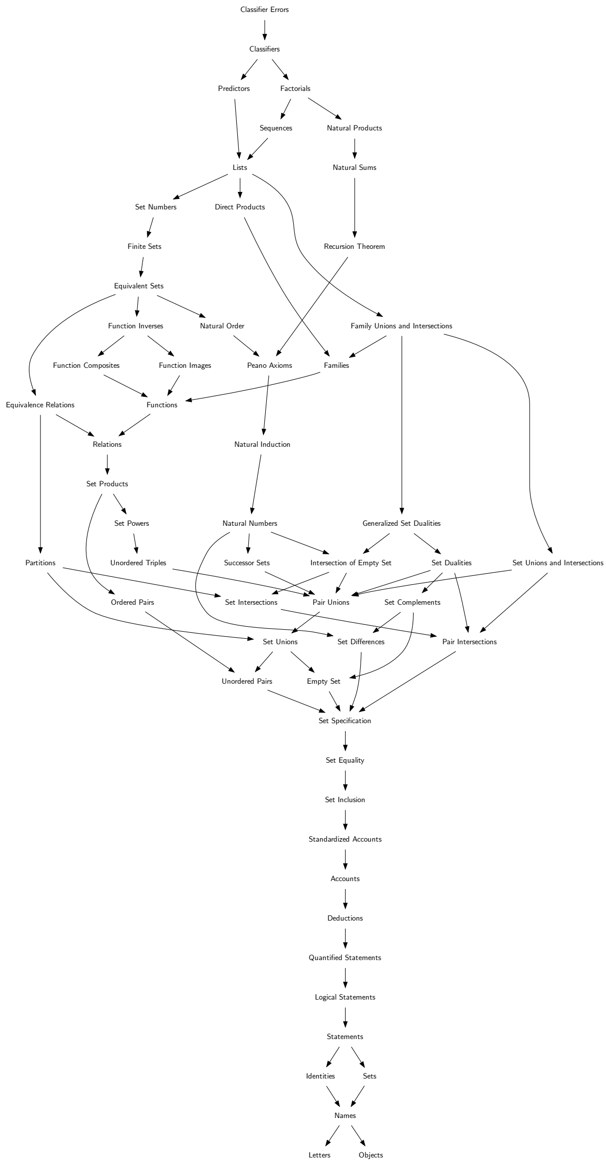
Boolean case

In the case that $B = \{-1, 1\}$, we call the class -1 *negative* and the class $+1$ positive. Similarly, we call an example (a^i, b^i) a *negative example* if $b^i = -1$ and a *positive example* if $b^i = 1$.

We call the result of G on a^i a *true positive* if $b^i = 1$ and $G(a^i) = 1$, a *true negative* if $b^i = -1$ and $G(b^i) = -1$, a *false negative* (or *type II error*, read "type two error") if $b^i = 1$ and $G(a^i) = -1$ and a *false positive* (or *type I error*, read "type one error") if $b^i = -1$ and $G(a^i) = 1$.

The *false positive rate* (*false negative rate*) of a classifier on a dataset is the proportion of dataset elements for which it predicts a *false positive* (*false negative*).

The *true positive rate* (or *sensitivity*, *recall*) of G on a dataset is the proportion of positive examples which G labels positive. The *precision* (or *positive predictive value*) of G is the proportion of all examples which the classifier labels *positive* whose label is positive. The *true negative rate* (or *specificity*, *selectivity*) is the proportion of negative examples which G labels negative. The *false alarm rate* is the proportion of negative examples which G *incorrectly* labels positive.



Classifier Errors
Classifiers
Predictors
Factorials
Sequences
Natural Products
Lists
Natural Sums
Set Numbers
Direct Products
Finite Sets
Recursion Theorem
Equivalent Sets
Function Inverses
Natural Order
Family Unions and Intersections
Function Composites
Function Images
Peano Axioms
Families
Equivalence Relations
Functions
Relations
Natural Induction
Set Products
Set Powers
Natural Numbers
Generalized Set Dualities
Partitions
Unordered Triples
Successor Sets
Intersection of Empty Set
Set Dualities
Set Unions and Intersections
Ordered Pairs
Set Intersections
Pair Unions
Set Complements
Set Unions
Set Differences
Pair Intersections
Unordered Pairs
Empty Set
Set Specification
Set Equality
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Identities
Sets
Names
Letters
Objects