

Bayesian ARTMAP

User guide

Files included:

- BA.m
- defaults.mat
- example.m

BA.m

A MathWorks MATLAB file defining a class for a Bayesian ARTMAP model that can be trained and used for classification. The following methods are available:

```
obj = BA(smax, pmin, type, covarType)
obj = setFeatures(obj, featuresToUse)
obj = train(obj, patterns, labels)
classPosterior = val(obj, patterns)
[classification classPosterior] = classify(obj, patterns)
[inference classification classPosterior] = test(obj, patterns, labels)
```

BA

A constructor that takes four *optional* parameters. For an explanation of s_{MAX} and p_{MIN} please refer to: *Vigdor, B., Lerner, B.: The Bayesian ARTMAP. IEEE Transactions on Neural Networks 18, 1628–1644 (2007)*

The parameter **type** can get the following values:

- 'ba' – regular Bayesian ARTMAP (Vigdor and Lerner)
- 'sba' – Soft Bayesian ARTMAP. This is a less deterministic variation of the algorithm. Instead of ultimately assigning each pattern to a single category (and therefore only incrementing that category's class membership) each category gets an update proportional to the probability of the pattern belonging to it. This type is recommended
- 'fix_smax' – s_{MAX} remains fixed throughout the life of the model

The parameter **covarType** can get the following values: 'full', 'diagonal' or 'equal' – denoting the type of covariance matrix that the model will use to represent clusters in the ART modules.

setFeatures

Set which features are used by the model. By default all features are used. Use this method **before training the model** as the used features cannot be altered after training has begun.

This method takes one parameter, **featuresToUse**: a row vector of feature indices to use.

train

This method is used to train the model. Takes patterns and labels as parameters:

patterns: a matrix in which each row is a pattern and each column is a feature. The values must be **numerical** (categorical values should be pre-processed and represented by numerical values).

labels: a column vector in which each row is a class label that corresponds to the rows (patterns) of **patterns**. These should be **positive integers**.

val

Takes patterns (formatted as in 'train') and returns a matrix where each row corresponds to an input pattern and each column to a class. Each entry in the output matrix is an estimated class-posterior-probability for each pattern.

classify

Takes patterns (formatted as in 'train') and returns a column vector of predicted classifications (one for each input pattern). The second (optional) output is the class-posterior-probability as in 'val'.

test

Takes patterns and class labels (formatted as in 'train') to be used as a test/validation set. The output is the inference (the proportion of correctly classified patterns). The optional outputs are the predicted classifications and the class-posterior-probability as in 'classify'.

defaults.mat

A .mat file containing default values for the BA code. This file is accessed by the BA constructor for use when optional input parameters are omitted.

Property	Value	Description
pmin	0.55	p_{MIN}
pmins	[0.45,0.55]	Alternative recommended p_{MIN} values
smax	$10^{1.5}$	s_{MAX}
smaxs	$10^{-2.5}, 10^{-2.25} \dots 10^{2.5}$	Alternative recommended s_{MAX} values
covarType	'full'	Type of covariance matrix
type	'sba'	Type of Bayesian ARTMAP model

Example

The XOR problem is given as an example in the file example.m.

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