# Relevance vector machine

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(Redirected from Relevance Vector Machine)

In mathematics, a **relevance vector machine (RVM)** is a machine learning technique that uses Bayesian inference to obtain parsimonious solutions for regression and probabilistic classification.[1] The RVM has an identical functional form to the support vector machine, but provides probabilistic classification.

It is actually equivalent to a Gaussian process model with covariance function:

$$k(\mathbf{x},\mathbf{x}') = \sum_{j=1}^{N} \frac{1}{\alpha_j}\varphi(\mathbf{x},\mathbf{x}_j)\varphi(\mathbf{x}',\mathbf{x}_j)$$

where $\varphi$ is the kernel function (usually Gaussian), $\alpha_j$'s as the variances of the prior on the weight vector $w \sim N(0, \alpha^{-1}I)$, and $\mathbf{x}_1, \ldots, \mathbf{x}_N$ are the input vectors of the training set.[*citation needed*]

Compared to that of support vector machines (SVM), the Bayesian formulation of the RVM avoids the set of free parameters of the SVM (that usually require cross-validation-based post-optimizations). However RVMs use an expectation maximization (EM)-like learning method and are therefore at risk of local minima. This is unlike the standard sequential minimal optimization (SMO)-based algorithms employed by SVMs, which are guaranteed to find a global optimum (of the convex problem).

The relevance vector machine is patented in the United States by Microsoft.[2]

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## See also [edit]

- Kernel trick
- Platt scaling: turns an SVM into a probability model

## References [edit]

1. ^ Tipping, Michael E. (2001). "Sparse Bayesian Learning and the Relevance Vector Machine". *Journal of Machine Learning Research* **1**: 211–244.
2. ^ US 6633857, Michael E. Tipping, "Relevance vector machine"

## Software [edit]

- dlib C++ Library
- The Kernel-Machine Library
- rvmbinary:R package for binary classification

## External links [edit]

- Tipping's webpage on Sparse Bayesian Models and the RVM
- A Tutorial on RVM by Tristan Fletcher

Categories: Classification algorithms | Kernel methods for machine learning | Non-parametric Bayesian methods

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