# Chapter 4 - Applications of supervised learning


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**Abstract**

This chapter presents applications of supervised learning in various geophysical disciplines, being them seismology, geodesy, magnetism, and others. For all examples, we provide a brief introduction to the geophysical background. Practical aspects, such as normalization issues and feature selection, are discussed. A posteriori considerations shed light on the geophysical problem, such as the importance of model parameters in regression, the possible nonuniqueness in inversion, and flaws in the definition of targets. We demonstrate multilayer perceptrons (MLPs) as classifiers of seismic waveforms. Besides, we show how the use of MLP is straightforward in the context of inversion of various kinds of data, for example, seismic, geodetic, and magnetic. Regression with MLP is applied to magnetotelluric and seismic data. Multiclass classification with support vector machine (SVM) is discussed for infrasound waveforms and volcanic rocks using geochemical characteristics. We introduce the use of SVM in the context of regression, which is formally less immediate than for MLP, but yields good results. An example deals with empirical ground motion estimation during earthquakes. In hidden Markov models and Bayesian networks one considers the interrelation between observations rather than single patterns. We show their benefits in various applications, from seismic waveform classification aimed at the forecast of volcanic unrest up to their use in tsunami early-warning systems.