

Logistic regression

Lesson No. 5

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1 Introduction

A **discriminative models**, also known as conditional models, are a class of models used in statistical classification, especially supervised machine learning. A discriminative classifier fits a model, with the form $p(y|x)$, based only on the observed data; however, these models rely strongly on data quality.

Some examples of discriminative learning approaches are: logistic regression (LR), support vector machines (SVM) and conditional random fields (CRFs).

2 Model specification

A **logistic regression** can be generalized to a binary classification model as follows:

$$p(y|x, w) = \text{Ber}(y|\mu(x)) \quad (1)$$

Further, $\mu(x)$ can be computed as a linear combination of the inputs ($w^T x$), and we pass through a sigmoid (also known as logistic or logit) function that ensures $0 \leq \mu(x) \leq 1$. Then,

$$p(y|x, w) = \text{Ber}(y|\sigma(w^T x)) \quad (2)$$

where $\sigma(\cdot)$ is the sigmoid function.

3 Model fitting

This section presents some algorithms for estimating the parameters of the logistic regression model.

3.1 Maximum Likelihood Estimate