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4 Answers

Badri Narayan, Machine Learning Research Scientist

3.6k Views

Hmm, depending on the level of abstraction you are willing to reason in, I can argue the following is *intuitive* ;)

Log loss function is the objective to minimize in order to fit a log linear probability model to a set of binary labeled examples. (Note that a log linear model is a probability model such that the logarithm of the probability of the target given the features is a weighted linear combination of features - these weights are the parameters of the model.)

How is this expressed mathematically? Since the "best fit" is the information projection (closest probability distribution) of the empirical probability of examples to a log linear model, the log loss is written as the cross entropy between the empirical probability distribution and the log-linear probability distribution.

Why log-linear model you may ask? Well, it turns out that in some sense (which I will make precise) log-linear models are the least biased models which preserve the empirical feature probabilities.

Recall that entropy is a measure of uncertainty of a probability distribution and therefore a maximum entropy distribution would be the least biased or the least predictable distribution. Thus, intuitively, a reasonable model for an unknown binary probability distribution given some data is a maximum entropy distribution whose feature expectations agree with the empirical feature expectations in the data. It turns out that log-linear models satisfy this.

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Log-loss measures the accuracy of a classifier. It is used when the model outputs a probability for each class, rather than just the most likely class.

Log-loss is a “soft” measurement of accuracy that incorporates the idea of probabilistic confidence. It is intimately tied to information theory: log-loss is the *cross entropy* between the distribution of the true labels and the predictions. Intuitively speaking, entropy measures the unpredictability of something. Cross entropy incorporate the entropy of the true distribution, plus the extra unpredictability when one assumes a different distribution than the true distribution. So log-loss is an information-theoretic measure to gauge the “extra noise” that comes from using a predictor as opposed to the true labels. By minimizing the cross entropy, one maximizes the accuracy of the classifier.

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Artem Onuchin, software engineer from Russia
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It is a machine learning model's performance measure (Binary classification).
It is model's likelyhood (Likelihood function).
It is the probability of seeing the test data if model were absolutely accurate.

Log-loss can be usefull when your goal is not only say if an object belongs to class A or class B, but provide its probability (say object belong to class A with probablitity 30%).

Good example of case where log-loss can be usefull is predicting CTR or click probability in on-line advertising: in paper http://static.googleusercontent.... googler's use log loss as ctr prediction metric.

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Log-Loss function is used with [math]y_i\in\{0,1\}[/math] type of data with estimates [math]\hat{y}_i\in\{0,1\}[/math]. Log-Loss function is defined as

[math]L = -\frac{1}{n}\sum_{i=1}^n[y_i log(\hat{y}_i)+ (1-y_i)log(1-\hat{y}_i)][/math]

Hence, Log-Loss is a criterion about the classification. It punishes infinitely any kind of deviation of the estimate from the data. Therefore, people use other (milder) versions of the Log-Loss functions.

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