GENERALIZED MAXIMUM ENTROPY

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Abstract

A long standing mystery in applying MaxEnt is how to deal with constraints whose values are uncertain. This situation arises when constraint values are estimated from data, due to finite sample sizes. One approach to this problem, advocated by E.T. Jaynes [1], is to ignore this uncertainty, and treat the empirically observed values (i.e. the observed frequencies) as exact. We refer to this as the classic MaxEnt approach. Classic MaxEnt gives point probabilities as the MaxEnt values (subject to the given constraints), rather than probability densities. We develop an alternative approach that assumes that the uncertain constraint values are represented by an appropriate probability density (e.g. a Gaussian), and this uncertainty yields a MaxEnt posterior probability density. That is, the classic MaxEnt point probabilities are regarded as a multidimensional function of the given constraint values, and uncertainty on these values is transmitted through the MaxEnt function to give uncertainty over the MaxEnt probabilities. We illustrate this approach by explicitly calculating the generalized MaxEnt density for a simple but common case. This paper expands the generalized MaxEnt concept introduced in a previous paper [2].

References:

[1]"Where do we stand on Maximum Entropy", E.T. Jaynes, in R.D.Rosenkrantz ed., E.T.Jaynes: Papers on Probability, Statistics and Statistical Physics, D.Reidel, Dordrecht, Holland, 1983.

[2] "On the Relationship between Maximum Entropy and Bayesian Inference", P.C. Cheeseman and J.C. Stutz, In Proc. MaxEnt, Garching, 2004.

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