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"Statistical Model Assessment and Model Choice"

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ABSTRACT

Models, deterministic or stochastic, are used in almost every field of scientific investigation. D. R. Cox (1990) stated that the role and purpose of statistical models is to provide a *concise description of the aspects of the data judged relevant for interpretation.* This means we would like our models to offer *parsimonious* descriptions of the systematic variation, *concise* summary of the statistical (or random) variation and point towards interpretation and the process that might have generated the data.

In this talk, we will address the problem of model assessment and model choice using the concept of *statistical distance.* A key to our approach based on statistical distances is that we *do not wish to use hypothesis testing to determine the adequacy of the model, we wish to estimate by confidence interval a measure of adequacy and use it to decide whether the model is suitable.* This measure of adequacy is the statistical distance. A well known statistical distance that is used extensively in practice is the Kullback-Leibler. Another example is the class of *chi-squared* distances. This is a *robust* class of distances and has a nice statistical interpretation.

How do we choose a statistical distance to work with? The answer to this question is related to the answer of the question *"What do we want from a statistical distance"*? To answer this we first concentrate on the discrete probability model framework and discuss some classes of distances. We emphasize meaningful statistical interpretations and connections with Fisher information. The ideas are extended to the continuous model framework. The key issue here is how to balance *sensitivity of the distance and statistical noise.* In the classical goodness of fit literature this balance is fixed.

We then discuss the construction of a *statistical tube* around the model class $\mathcal{M}$. This can be done by solving an appropriate optimization problem. The lower confidence limit of the adequacy measure is the obtained by applying *linked bootstrap.*

Remark: This talk is based on material that is contained in the research monograph entitled *Statistical Distances: A Global Framework to Inference*, coauthored with B. G. Lindsay of the Pennsylvania State University, and to be published by Springer-Verlag.