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Learning Optimal Test Statistics in the Presence of Nuisance Parameters

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The design of optimal test statistics is a key task in frequentist statistics and for a number of scenarios optimal test statistics such as the profile-likelihood ratio are known. By turning this argument around we can find the profile likelihood ratio even in likelihood-free cases, where only samples from a simulator are available, by optimizing a test statistic within those scenarios. We propose a likelihood-free training algorithm that produces test statistics that are equivalent to the profile likelihood ratios in cases where the latter is known to be optimal.

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