

**A Competitive Neyman-Pearson Approach to Universal Hypothesis Testing with Applications**

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**ABSTRACT**

The problem of hypothesis testing for parametric information sources whose parameters are not explicitly known is considered. A new, modified version of the Neyman-Pearson criterion of optimality, where the uniform constraint on exponential rate of the false-alarm probability is replaced by a one that depends on unknown values of the parameters, is proposed. An optimal universal decision rule, based on Kullback-Leibler divergence, is developed and shown to be efficient in the sense of achieving exponential decay of both mis-detection and false-alarm probabilities for *all* values of unknown parameters, whenever such an efficient decision rule at all exists. Furthermore, necessary and sufficient conditions for the existence of such efficient universal tests are established and the best universally achievable error exponents are presented. Finally, the proposed approach is applied to several important problems in signal processing and communications and compared to the generalized likelihood ratio test.