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Hypothesis testing of quantum channel unravelings

A quantum channel can always be unraveled to an instrument. This instrument defines then a probability measure describing the repeated measurement of a quantum system. This models experiments in quantum optics. In this talk I will present results obtained with N. Cuneo, V. Jaksic, Y. Pautrat and C.-A. Pillet on the hypothesis testing between two instruments. First I will characterize the identifiable parameters of the instrument showing that the instrument is identifiable up to isomorphism and eventually only on a sub algebra. Then I will explain how the sub multiplicativity of the probability measures defined by the instruments implies that the log of the likelihood ratio between the two tested probability measures converge almost surely. That convergence then implies Stein's Lemma. Hence Neyman-Pearson tests saturate Stein's error exponents. I will then explain how, using the sub additive thermodynamic formalism borrowed from classical statistical mechanics, we show that the limit Rényi's relative entropy between the two probability measures exists and is differentiable for orders in $(0,1)$. This regularity implies the equality between all Hoeffding's error exponents at fixed rate and both Chernoff's error exponents. Again that shows associated Neyman-Pearson tests saturate these error exponents. I illustrate our results first with physically relevant examples and then with examples illustrating the sharpness of our results. I will give examples of finite and infinite Rényi's relative entropy, non analytic Rényi's relative entropy, non Gaussian central limit for the log likelihood ...