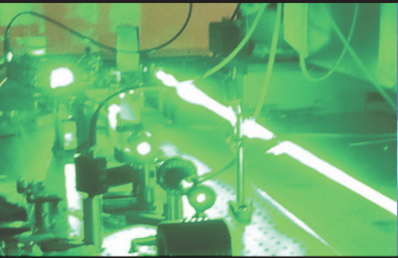
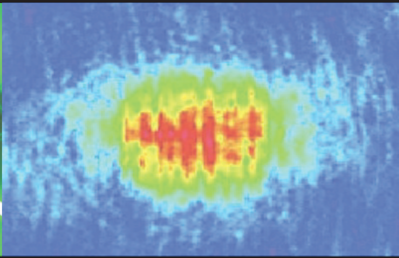
Joint UoC/FORTH AMO Seminar





25 Novemeber 2020, 16:30, Online Seminar

Quantum sequential hypothesis testing

Dr. Michail Skoteiniotis
Universitat Autonoma de Barcelona

Statistical inference - both classical and quantum - seeks to extract information about a set of pertinent parameters, $\boldsymbol{\theta}$, by sampling for a probability distribution, $p_{\boldsymbol{\theta}}(x)$, that depends on $\boldsymbol{\theta}$. The simplest inference scenario is that of binary hypothesis testing where one is asked to distinguish among two possible distributions $p_0(x)$, $p_1(x)$. The relevant figure of merit is usually taken to be the average probability of making an error. Traditional approaches ask how the average probability of error scales with the number of samples assumed fixed and given ahead of time. Sequential analysis, on the other hand, seeks to minimize the average number of samples required to achieve a given probability of error. This change of perspective results in sample efficient strategies that, in classical statistical inference, can save up to 1/2 the samples needed compared to the more standard approach.

In this talk I will present a quantum sequential analysis protocol for binary hypothesis testing. Specifically, I will derive a general lower bound on the average sample size needed in order to for two arbitrary quantum states. In case where one or both of the states are pure I will provide an explicit protocol that achieves this lower bound. Infact, for two pure states I will demonstrate how one can discriminate them perfectly using only a finite average number of samples in stark contrast to the traditional approach where perfect discrimination requires an infinite number of samples.

25 Novemeber 2020, 16:30, Online Seminar