Contribution ID: **84** Type: **Oral**

A machine learning approach to Bayesian parameter estimation

Monday, 28 September 2020 15:45 (7 minutes)

Bayesian estimation is a powerful theoretical paradigm for the operation of quantum sensors. However, the Bayesian method for statistical inference generally suffers from demanding calibration requirements, that have so far restricted its use to systems that can be explicitly modelled. In this theoretical study, we formulate parameter estimation as a classification task and use artificial neural networks to efficiently perform Bayesian estimation. We show that the network's posterior distribution is centred at the true (unknown) value of the parameter within an uncertainty given by the inverse Fisher information, representing the ultimate sensitivity limit for the given apparatus. When only a limited number of calibration measurements are available, our machine-learning based procedure outperforms naive calibration methods. Our machine-learning based procedure is model independent, and is thus well suited to a black box sensor where an explicit model is unavailable. Thus, our work paves the way for Bayesian quantum sensors that can take advantage of complex, potentially non-classical quantum states, which can significantly enhance the sensitivity of future devices.

Presenter: NOLAN, Samuel (QSTAR, INO-CNR and LENS)

Session Classification: Contributed