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Bayes' rule for quantum random variables and positive operator valued measures

A quantum probability measure is a function on a sigma-algebra of subsets of a (locally compact and Hausdorff) sample space that satisfies the formal requirements for a measure, but whose values are positive operators acting on a complex Hilbert space, and a quantum random variable is a measurable operator valued function. In this talk, we introduce a quantum analogue for the expected value of a quantum random variable relative to a quantum probability measure. We also introduce a quantum conditional expectation which results in quantum versions of some standard identities for Radon-Nikodym derivatives as well as a quantum analogue of Bayes' rule. This talk is based on joint work with Doug Farenick of the University of Regina.