

Reading seminar

Probability and statistics in quantum mechanics and quantum mechanics for probabilists and statisticians

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The aim of this reading seminar is to use usual probabilistic and statistics tools in the context of quantum mechanics. Background in quantum mechanics are not required and the main goal of this reading seminar is to put probability and statistics into concrete applications.

The mathematical formalism of quantum mechanics is well established. This appeals for different domain of mathematics : Hilbert spaces, operator algebra, functional analysis... In particular probability theory is inherent in quantum mechanics : Markov processes, martingale, limit theorem, weak convergence, parameter estimation, hypothesis testing.

Among subject that which can be studied one can mention :

- Quantum formalism for probabilists (States, unitary dynamics, spectral theorem for matrices, projective measures)
- Mathematical and physical generalisation (Completely positive maps, instruments, POVM)
- Further properties (Stinespring-Kraus decomposition, Choi matrices and rank, Perron-Frobenius theorem for positive maps, irreducible decomposition)
- Definition of quantum trajectories
- Quantum tests and parameter estimation