

Quantum Shannon theory: entropy, entanglement, communication – Syllabus

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Abstract:

Quantum information theory seeks to understand the absolute limits of information processing using quantum systems. This course will explore a variety of information processing tasks including data compression, channel coding and entanglement distillation. For each task, we will develop the necessary tools to analyse their properties and demonstrate how their rates can be characterised in terms of entropic quantities. We will also cover recent major advances in the field and discover so-called one-shot information theory which examines the rates of protocols within the non-asymptotic regime.

Lecture 1

- Compression

Lecture 2-3:

- Channel capacities (classical, quantum, entanglement-assisted, private) (degradable, anti-degradable channels)

Lecture 4:

- LOCC, entanglement distillation

Lecture 5:

- State discrimination and hypothesis testing (relative entropy)

Lecture 6:

- Data processing, tightness and recovery maps

Lecture 7-8:

- One shot info theory, AEP, Chain rule, channel discrimination