NEW CLASSES OF ENTROPIC UNCERTAINTY RELATIONS

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ABSTRACT

Historically, the most widely used quantifier of quantum uncertainty has been the variance. While variance effectively captures uncertainty in terms of fluctuations (or spread) around the mean — and is well-suited for many types of state distributions — it fails to provide a meaningful measure in certain important cases, such as multimodal or heavy-tailed distributions.

Among the various alternative (non-variance-based) measures of uncertainty employed in quantum mechanics, information entropies play a particularly prominent role. In this talk, I will explore the use of entropy power, specifically the Rényi and Tsallis entropy powers, to derive one-parameter families of information-theoretic uncertainty relations for pairs of conjugate observables in infinite-dimensional Hilbert spaces.

These families form an infinite hierarchy of uncertainty relations based on higher-order statistics, which — in principle — enable the reconstruction of the underlying information distribution by measuring the associated entropy powers. I will demonstrate improvements over traditional uncertainty relations based on variance and Shannon entropy and briefly discuss their implications and applications in quantum mechanics.

REFERENCES

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