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On Spin Entropy

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Two types of randomness are associated with a mixed quantum state: the uncertainty in the probability coefficients of the constituent pure states and the uncertainty in the value of each observable captured by the Born's rule probabilities. Entropy is a quantification of randomness, and we propose a spin-entropy for the observables of spin pure states based on the phase space of a spin as described by the geometric quantization method, and we also expand it to mixed quantum states. This proposed entropy overcomes the limitations of previously-proposed entropies such as von Neumann entropy which only quantifies the randomness of specifying the quantum state. As an example of a limitation, previously-proposed entropies are higher for Bell entangled spin states than for disentangled spin states, even though the spin observables are less constrained for a disentangled pair of spins than for an entangled pair. The proposed spin-entropy accurately quantifies the randomness of a quantum state, it never reaches zero value, and it is lower for entangled states than for disentangled states.

Recent publications:

1. Geiger, D.; Kedem, Z.M. Spin Entropy. Entropy 2022, 24, 1292. https://doi.org/10.3390/e24091292

2. Geiger, D.; Kedem, Z.M. On Quantum Entropy. Entropy 2022, 24,1341. https://doi.org/10.3390/e24101341

Biography

Davi Geiger is an Associate Professor of Computer Science at the Courant Institute of Mathematical Sciences and of Neural Science, New York University.He received the BS in Physics at PUC Rio de Janeiro, Brasil and the Ph.D in Physics and Artificial Intelligence at MIT with Professor Tomaso Poggio.Before coming to NYU, he spent three years at Siemens Corporate Research in Princeton. He has received an NSF Career award.

Zvi Kedem is a former Professor and past Chair of the Department of Computer Science at the Courant Institute of Mathematical Sciences at New York University. After earning his D.Sc. at the Technion – Israel Institute of Technology, and before joining NYU, he taught at Columbia University, MIT, SUNY at Stony Brook, and UT at Dallas. He has conducted research in a variety of areas, including Computer Graphics, Database Systems, Data Mining, Parallel and Distributed Computing and Systems, and Quantum Physics. As a principal and co-principal investigator he has obtained more than $10,000,000 in research funding and has authored and co-authored more than 50 scientific publications. He has served on funding and review panels, program committees of scientific meetings, and editorial boards of scientific journals. He has guided the dissertation research of more than 15 doctoral students and has more than 200 doctoral descendants. His professional achievements have been recognized by elections to the grade of Fellow by ACM, EurASc, and IEEE. For his lengthy volunteer work as the Editor in Chief of the ACM Computing Classification System Update Project he was recognized with the 2012 Outstanding Contribution to ACM Award.

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