

In the spotlight



No-Regret Learning and Equilibrium Computation in Quantum Games

Quantum

SUTD Authors: Wayne Lin, Georgios Piliouras, Ryann Sim, and Antonios Varvitsiotis

As quantum processors advance, the emergence of large-scale decentralized systems involving interacting quantum-enabled agents is on the horizon. Quantum versions of Nash and correlated equilibria have been proposed as solution concepts of strategic quantum interactions, but the study of how agents might reach them remains in its infancy.

In this work, we study the dynamics of decentralized, quantum-enabled agents who update their behaviors via no-regret algorithms. We first investigate network zero-sum games, showing that no-regret algorithms converge to quantum Nash equilibria in time-average. In the case of general quantum games our work leads to a novel solution concept, that of separable quantum coarse correlated equilibria (QCC), as the convergent outcome of no-regret algorithms' time-averaged behavior. Finally, we establish the existence of entangled (non-separable) QCC: these are unlearnable via the current paradigm of no-regret learning, thus opening up the question of whether improved paradigms for decentralized learning could approach such equilibria.



"We find that many results from no-regret learning in classical games carry over to quantum games, but only for the set of separable equilibria. Quantum games open up the possibility of entangled equilibria, which would require a new learning paradigm to reach."

- Wayne Lin

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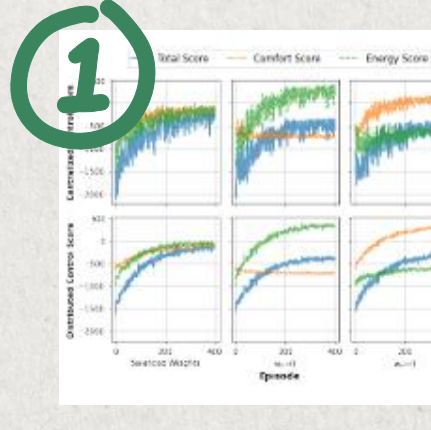
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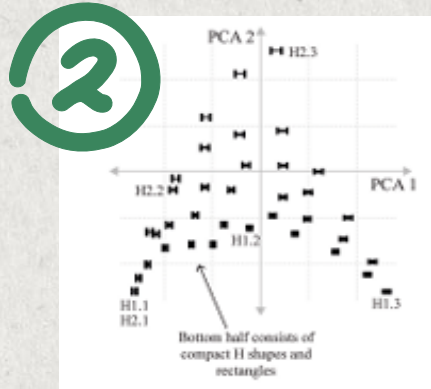
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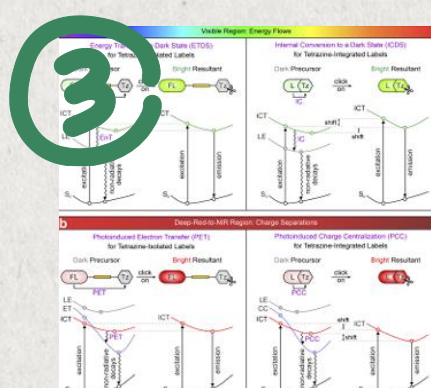
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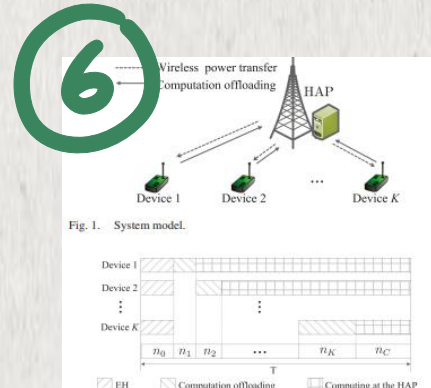
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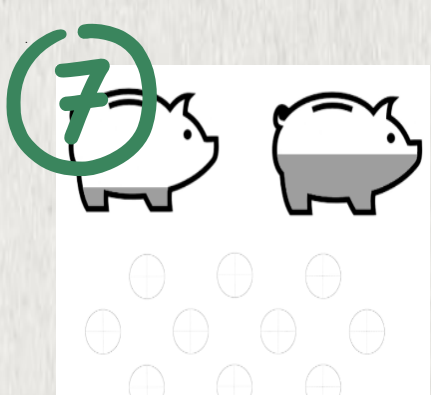
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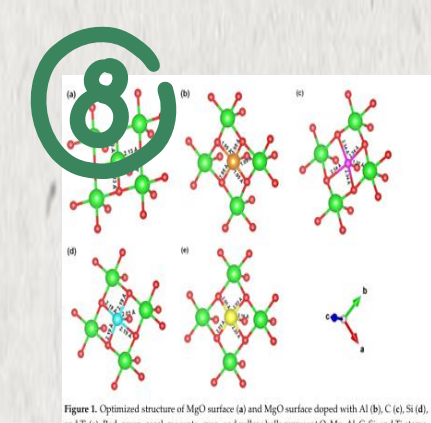
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