SEMINAR

Research Talks from the Resnick Fellows

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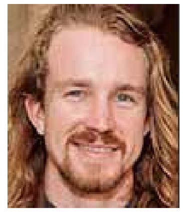
Xiaoqi Ren

Resnick Grad Research Fellow

A Market Approach to Increase Power Infrastructure Utilization in Multi-Tenant Data Centers

Despite the common practice of oversubscription, power capacity is largely under-utilized in data centers. A significant factor driving this under-utilization is fluctuation of the aggregate power demand, resulting in unused "spot (power) capacity". In this talk, I tap into spot capacity for improving power infrastructure utilization in multi-tenant data centers, an important but under-explored type of data center where multiple tenants house their own physical servers. We propose a novel market, called SpotDC, to allocate spot capacity to tenants on demand. Specifically, SpotDC extracts tenants' rack-level spot capacity demand through an elastic demand function, based on what the operator sets the market price for spot capacity allocation. We evaluate SpotDC using both testbed experiments and simulations, demonstrating that SpotDC improves power infrastructure utilization and creates a "win-win" situation: the data center operator increases its profit (by nearly 10%), while tenants improve their performance (by 1.2–1.8x on average compared to the no spot capacity case, at a marginal cost).



Sebastian Lee

Resnick Grad Research Fellow

Quantum Embedding Methods for the Better Design of Liquid Electrolytes in Lithium-ion Batteries

High-density energy storage is a key component of a renewable energy economy. Li-ion batteries are a promising candidate for this role, but their efficiency and safety is limited by liquid electrolyte decomposition at the electrodes. The complexity of these decomposition processes generally prevents detailed electronic structure. In this talk, we develop a computationally efficient wavefunction-in-density functional theory (WF-in-DFT) embedding method with the aim of studying reduction and oxidation decomposition processes with high-accuracy. First, we reduce computational cost with a mixed basis set representation of the wavefunction, resulting in the ability to model larger, more representative condensed phase systems. Here, we present a systematic analysis of possible errors introduced by this approximation in the framework of embedding. We conclude with recent work on the analytical nuclear gradient theory for projection-based WF-in-DFT embedding, which will enable us to study decomposition pathways directly, without assuming the nature of pathway intermediates.

11:00 am - NOON | Thursday, NOV. 16, 2017

Guggenheim 133 Lees-Kubota Lecture Hall

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