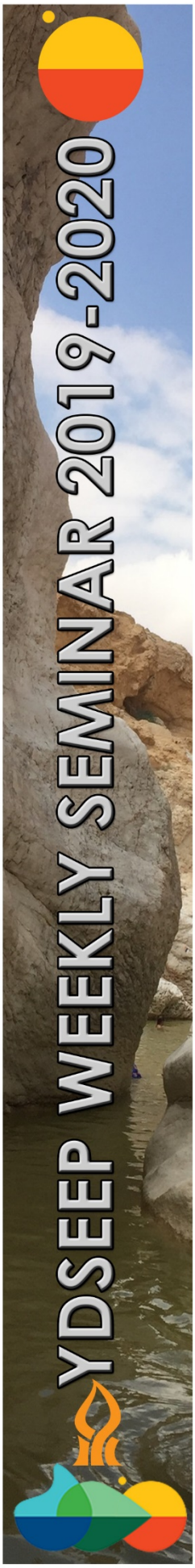

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Calculating the entropy of physical systems with Machine Learning and other stories

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Abstract:

Characterizing the entropy of a system is a crucial, and often computationally costly, step in understanding its thermodynamics. We present a novel method, termed MICE (Machine-learning Iterative Calculation of Entropy), for calculating the entropy of physical systems. Our approach is to iteratively divide the system into smaller subsystems and estimate the mutual entropy between each pair of halves. The estimation is performed with a recently proposed machine learning algorithm which works with arbitrary network architectures that can fit the structure and symmetries of the system at hand. We show that our method can calculate the entropy of various systems, both thermal and athermal, with state-of-the-art accuracy, and discuss promising future applications.

Time permitting, I will also briefly present a newly developed method to use Machine Learning for the efficient solution of nonlinear PDEs. Our method learns approximate coarse-grid representations, allowing us to integrate in time a collection of nonlinear equations at resolutions 4-8x coarser than is possible with standard finite difference methods.

Date & Location:

Tuesday, January 4, 2022, 11:00
Zoom Meeting