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Visualizing Correlations in the 2D Fermi-Hubbard Model with AI[1] EHSAN KHATAMI, San Jose State University, ELMER GUARDADO-SANCHEZ, BENJAMIN M. SPAR, Princeton University, JUAN FELIPE CARRASQUILLA, Vector Institute, WASEEM S. BAKR, Princeton University, RICHARD T. SCALETTAR, University of California Davis — The physics of strongly correlated phases of matter is often described in terms of straightforward electronic patterns which are theoretically understood using Landau symmetry breaking theory. This has so far been the basis for studying correlations in the Fermi-Hubbard model realized with ultracold atoms. In this talk, we show that artificial intelligence (AI) can provide an unbiased alternative to this paradigm. Long and short range spin correlations spontaneously emerge in filters of a convolutional neural network trained on snapshots of single atomic species. In the less well-understood strange metallic phase of the model around 18% doping, we find that a more complex network trained on snapshots of local moments produces an effective order parameter for the non-Fermi liquid phase. Our technique can be employed to characterize correlations unique to other phases with no obvious order parameters or signatures in projective measurements.

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