The proliferation of online social media and the internet of things has provided a plethora of data and algorithms that aim to predict future societal outcomes. However, providing human-interpretable explanations of the mechanisms of decision-making—making of the individuals who interact to generate these statistical patterns is difficult. Identifying causal factors important to the generation of societal outcomes helps provide a deeper understanding of social behavior.

Agent-based models “grow” artificial societies that potentially replicate emergent patterns seen in the real world. The autonomous agents are driven by rules, generalized hypotheses of human behavior. Yet, multiple hypothetical causal factors can be argued to constitute these rules. Historically, specification of agent rules has been at the modeler’s discretion. Yet, the modeled rule is often one out of a vast space of possible rules, as knowledge of individual-scale mechanisms is limited.

This dissertation introduces Evolutionary Model Discovery, a novel framework for automated causal inference through artificial societies. This framework quantifies importance of causal factors on populations of genetically-programmed agent-based models through random forest feature importance evaluation. Evolutionary Model Discovery assisted in the successful causal inference of three very different cases of human social behavior: 1) previously unconsidered factors driving the socio-agricultural behavior of an ancient ancestral Pueblo civilization are discovered, constructing a more robust and accurate version of the Artificial Anasazi model; 2) factors leading to the coexistence of mixed patterns of segregation and integration are discovered on a recent extension of Schelling’s Segregation model; 3) factors determining the prioritization of social media notifications under loss of attention due to information overload are discovered on an ensemble of a model of Extended Working Memory and the Multi-Action Cascade Model of conversation. Besides these scientific contributions, two open-source Python libraries for high-performance computing with NetLogo, EvolutionaryModelDiscovery and NL4Py, have been developed for the scientific community.

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The public is welcome to attend.