Entropic Intelligence of Surfaces and Interfaces

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Entropic intelligence is best demonstrated by the GO matches between AlphadGo and Lee Sedol from March 9-15 in 2016. It sent shock waves over the world on how artificial intelligence can beat human intelligence in the fields of intuitive, creative and strategic thinking [1, 2], by data statistical and numerical techniques. Although of AlphaGo's powerful number and policy crunching abilities, the decisions it made are not necessarily consistent with physical laws, which may constrain its applications to areas where the rules and targets are well defined like driverless cars and mine-hunting dogs. In this research, we aim to explore physics-based intelligence to aide in surface and interface engineering research. This new paradigm of combined artificial and physical intelligence is expected to release the real power of artificial intelligence for numerous impactful applications like control of biofilm formation and drug release.

Entropy, as a typical thermodynamic property, is widely applied in the study of nature intelligence [3, 4]. Many nature intelligent processes are already explained, at least partially, by entropy principles [3]. In particular, an equation to connect intelligence and entropy maximization, is reported [5] by Wissner-Gross of MIT, by which a causal generalization of entropic forces is used to simulate two defining behaviors of human- tool use and social cooperation. Besides these two not so natural but contrived simple systems, the present speaker has for the first time independently demonstrated that maximizing causal entropy has correspondence to real physical systems like water wetting, metal corrosion and materials stretch [6-9]. In this presentation, these entropic intelligence of surface and interfaces will be reviewed at first. Opportunities in surface and interface research, by using combined artificial and physical intelligence approaches, will thus be highlighted and discussed.

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