Selected Abstracts

Sam Epstein*

December 3, 2024

On Anomalies

Anyone can attest to the fact that statistical outliers are common in the outputs of systematic methods that produce datapoints. However it may come as a surprise that using algorithmic randomness, one can prove such outliers have to occur in datasets. The anomaly score used is a universal lower computable test, where the probability is over natural numbers, infinite sequences, or computable metric spaces. The larger the sample, the larger the outlier in the dataset.

Entropy Synchronization

Two separate and isolated physical systems evolving over time cannot have thermodynamic entropies that are in synch. This is true for two systems in the same room or even spread across the Milky Way galaxy. Thermodynamic entropy is measured algorithmically and the systems need not be computable. Systems that are in synch have negative infinite entropy or infinite mutual information with the halting sequence, where both properties are considered to be unphysical.

Semi-Classical Subspaces

Partial signals and partial information cloning can be obtained on quantum states in semi-classical subspaces. Complete and no signals/cloning can be obtained from quantum states in classical and purely quantum subspaces, respectively. The wavefunction collapse from measurements can cause transitions from purely quantum to semi-classical and then classical subspaces. Quantum operations cannot cause such transitions.

Kolmogorov Derandomization

If the existence of an object can be proved using the probabilistic method, then upper bounds on its Kolmogorov complexity can be proved as well. This result has been applied to many problems such as Graph-Coloring, k-SAT, Max-Cut, etc. Game Derandomization states if a simple probabilistic player wins a certain naturally defined game with high probability, then there is a simple deterministic player that can win the game.

*samepst@jptheorygroup.com