A Debut for Self-Modifying Infinite-Time Turing Machines

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In the 1930s, Turing and von Neumann independently proposed models of (finite-time) computation with a notion of "shared memory," that is, a common storage source for programs and their data. Through this mechanism, these models allow for programs which are able to modify their own instructions mid-execution.

To our knowledge, no direct attempts have been made to extend these ideas to the setting of infinitary computability, wherein computations are of potentially transfinite length. In this talk, we propose a generalization of Hamkins and Lewis' infinite-time Turing machine which allows for self-modifying programs, and make the intriguing demonstration that our new model is computationally equivalent to the original model in several different ways. Our results and arguments are seen to nicely parallel those from the classical finite-time setting. We argue that this analogy provides further evidence that the infinite-time Turing machine is the natural model for infinitary computability.