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Quantifying the Extent and Intensity of Adaptive Evolution

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Abstract

Evolvability is the capacity to create new adaptations, and especially new kinds of adaptations, through the evolutionary process. Evolvability is important both as a theoretical issue in biology and as a practical issue in evolutionary computation. But it is difficult to study evolvability, in part because it is difficult to objectively and feasibly quantify evolvability in a general enough way to compare it across different evolving systems.

This paper is intended as an incremental step toward solving the problem of quantifying evolvability. The progress here is only incremental because I do not address the problem of quantifying evolvability per se; rather, I address the related problem of quantifying the degree to which a system exhibits adaptive evolution. This is a step in the right direction, though, for two reasons. First, since evolvability is the capacity to evolve new adaptations, measuring a system's adaptive evolution can tell you something about its evolvability. Second, since the method presented here is objective, feasible, and facilitates the quantitative comparison of adaptive evolution across a wide variety of different evolving systems, it could spread those same virtues to the study of evolvability. This paper explains a method for measuring adaptive evolution and then outlines how the method can be applied in the study of evolvability.