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Reconstructing the behavior of walking fruit flies GORDON BERMAN, WILLIAM BIALEK, JOSHUA SHAEVITZ, Princeton University — Over the past century, the fruit fly *Drosophila melanogaster* has arisen as almost a lingua franca in the study of animal behavior, having been utilized to study questions in fields as diverse as sleep deprivation, aging, and drug abuse, amongst many others. Accordingly, much is known about what can be done to manipulate these organisms genetically, behaviorally, and physiologically. Most of the behavioral work on this system to this point has been experiments where the flies in question have been given a choice between some discrete set of pre-defined behaviors. Our aim, however, is simply to spend some time with a cadre of flies, using techniques from nonlinear dynamics, statistical physics, and machine learning in an attempt to reconstruct and gain understanding into their behavior. More specifically, we use a multi-camera set-up combined with a motion tracking stage in order to obtain long time-series of walking fruit flies moving about a glass plate. This experimental system serves as a test-bed for analytical, statistical, and computational techniques for studying animal behavior. In particular, we attempt to reconstruct the natural modes of behavior for a fruit fly through a data-driven approach in a manner inspired by recent work in C. elegans and cockroaches.

Gordon Berman
Princeton University

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