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How to catch a falling fruit ANDREW MARANTAN, LAKSHMINARAYANAN MAHADEVAN, Harvard Univ — A variety of fish engage in complex hunting behaviors involving catching airborne prey falling to the surface of the water. In principle this requires that the fish develop internal models describing both the falling prey and its own motion relative to that prey. However learning such models is complicated by the fact that the fish must also account for noise in optical measurements and the refraction occurring at the air/water interface. Inspired by experimental observations, we describe how one such species (Brycon guatemalensis) might feasibly overcome these obstacles and learn a model accurate enough to catch falling fruit. Instead of learning a model for how the fruit falls and a model for how it moves in the water and a model accounting for refraction, we argue that the fish could instead learn one approximate linear model relating a set of measured inputs to a set of measured outputs valid in a limited domain of initial conditions. The fish could then make its control decisions based on the outcome predicted by this combined linear model. We also discuss how the fish can leverage neural transformations of raw data to learn a model with a larger domain of validity and yet more sensitive to noise due to nontrivial Jacobians arising from the neural transformations.

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