University of Zurich[UZH]

Department of Economics – Neuroeconomics Seminar

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Efficient value-based choices between two or more alternatives

Diffusion models have been hugely successful in predicting choices and reaction times for perceptual decisions, for which they have in many cases also been shown to implement the optimal decision strategy. They also provide a good behavioral match for value-based choices, but lacked the theoretical guarantees they enjoyed for perceptual decisions. In particular, why would we expect a model designed for a single source of ambiguous perceptual evidence to be able to handle choices between two valued items that are extrinsically not ambiguous? To address this question we derived the optimal decision strategy for such choices, and find it - curiously - to again be implementable by diffusion models, but with a twist: decision boundaries ought to collapse over time, and to depend on the overall reward rate. Furthermore, diffusion models cease to be optimal under some circumstances, such as diminishing marginal returns. Extending the same model to choices between more than two alternatives yields a significantly more complex decision strategy. Fortunately, this strategy turns out to be well-approximated by race models with normalization and an urgency signal, both of which are frequently observed in neural data. Such normalization has previously been assumed to counteract a limited neural dynamic range, and to cause choice defects. We instead show that it is an integral component of efficient perceptual and value-based decisions, among two and more alternatives.