## ERM 9 ?.....

## A Spiking Neural Network Model for Categorization Tasks | Sophie Jaffard

In cognition, response times and choices in decision-making tasks are commonly modeled using Drift Diffusion Models (DDMs), first introduced by Roger Ratcliff in the late 1970s. DDMs describe the accumulation of evidence for a decision as a stochastic process, specifically a Brownian motion, with the drift rate reflecting the strength of the evidence. However, DDMs lack a learning mechanism and are limited to tasks where participants have prior knowledge of the categories. To bridge the gap between cognitive and biological models, we propose a biologically plausible Spiking Neural Network (SNN) model for decision-making that incorporates a learning mechanism. This model is provably close to the DDM, which has repeatedly demonstrated its predictive accuracy for reaction times and choices in cognitive experiments. Our results show that the DDM, one of the most widely used models in cognitive science, can be derived from a network of spiking neurons governed by a local learning rule. Furthermore, we designed an online categorization task, accessible at https://3ia-demos.inria.fr/mel/en/, to evaluate the model's predictions. By analyzing participants' reaction times and choices in this task, we show the utility of our SNN model for studying decision-making processes. This work provides a significant step toward integrating biologically relevant neural mechanisms into cognitive models, fostering a deeper understanding of the relationship between neural activity and behavior.

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