A Comparison of Probabilistic Population Code and Sampling-Based Code in Neural State Estimations

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Submitter SiQi Zhou

Affiliation University of Toronto

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Presentation Abstract Summary When driving or playing sports, despite the presence of non-deterministic factors, the brain is required to reliably estimate the positions or velocities of objects to plan for subsequent actions. In the literature, with Bayesian as the mathematical framework and probabilistic population code (PPC) as the neural representation model, neural circuits for computations such as multi-sensory cue integration and odour identification have been discussed; however, less attention has been given to comparisons with alternative neural representations, such as the sampling-based code, especially, for inference problems that are time-variant in nature. In this work, with the motivation of exploring neural probabilistic inferences and specific focus on inferences of time-varying quantity estimations, plausible neural circuits derived based on the PPC and sampling-based code are examined. Based on numerical comparisons, it is found that, with less constraints on the form of probabilistic functions being represented, the sampling-based code is an efficient alternative to the PPC for modelling neural approximate Bayesian inferences in estimation problems.

Co-author Information

* Presenting Author

First Name	Last Name	Affiliation	E-mail
SiQi *	Zhou *	University of Toronto	siqi.zhou@robotics.utias.utoronto.ca

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