

Neural-inspired Sensors Enable Sparse, Efficient Classification of Spatiotemporal Data

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Abstract:

Winged insects perform remarkable aerial feats in uncertain, complex fluid environments. This ability is enabled by sensation of mechanical forces to inform rapid corrections in body orientation. Curiously, mechanoreceptor neurons do not faithfully report forces; instead, they are activated by specific time histories of forcing. We find that, far from being a bug, neural encoding by biological sensors is a feature that acts as built-in temporal filtering superbly matched to detect body rotation. Indeed, this encoding further enables surprisingly efficient detection using only a small handful of neurons at key locations. Nature suggests smart data as an alternative strategy to big data, and neural-inspired sensors establish a paradigm in hyperefficient sensing of complex systems.