

How neural manifolds change with learning

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Abstract

I will describe results showing that neural responses in the hippocampus have a low-dimensional hyperbolic geometry and that their hyperbolic size is optimized for the number of available neurons. It was also possible to analyze how neural representations change with experience. In particular, neural representations continued to be described by a low-dimensional hyperbolic geometry as the animal explored the environment but the radius increased logarithmically with time. This time dependence matches the maximal rate of information acquisition by a maximum entropy discrete Poisson process, further implying that neural representations continue to perform optimally as they change with experience. I will also discuss how and why these results generalize to other levels of biological organization including viral evolution and cell differentiation processes.

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