

Structure vs Randomness in Context-dependent Computations

Speaker

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Understanding how network function constrains neural connectivity is a central challenge in neuroscience. An influential approach is to train neural networks with gradient descent on cognitive tasks and characterize the resulting connectivity. A key limitation is that the resulting structure depends on the details of the training procedure. In this presentation I will introduce a complementary normative approach based on the maximum entropy principle for network connectivity, independent of any particular learning algorithm. Applying this framework to context-dependent input-selection tasks, we found that maximizing entropy under task constraints leads to the emergence of populations of neurons, each defined by its pattern of gain modulation. This maximum entropy connectivity matches both qualitatively and quantitatively the structure of networks trained with gradient descent across different learning regimes. Our results suggest that the interplay between task constraints and entropy maximization may provide a fundamental principle for understanding the relationship between structure and function in neural networks.



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