The Representation of Prediction Error in Auditory Cortex.

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Abstract:

To survive, organisms must extract information from the past that is relevant for their future. How this process is expressed at the neural level remains unclear. We address this problem by developing a novel approach from first principles. We show here how to generate low-complexity representations of the past that produce optimal predictions of future events. We then illustrate this framework by studying the coding of 'oddball' sequences in auditory cortex. We find that for many neurons in primary auditory cortex, trial-by-trial fluctuations of neuronal responses correlate with the theoretical prediction error calculated from the short-term past of the stimulation sequence, under constraints on the complexity of the representation of this past sequence. In some neurons, the effect of prediction error accounted for more than 50% of response variability. Reliable predictions often depended on a representation of the sequence of the last ten or more stimuli, although the representation kept only few details of that sequence.

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