Readings in Neuroinformatics

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Abstract

The current understanding of the primary visual cortex (V1) is largely
dominated by ideas such as the distinction between simple and complex cells
or ocular dominance and orientation columns. Models which are based on
this can make good predictions as long as parameters such as input stimuli
or choice of recorded neurons are kept within a restricted range. They don't
describe the full variety of neurons present in V1 and fail under real-world
stimuli such as natural images. The theories developed then often have a
narrow focus on data and don't explain functional and computational as-
pects. They also don't account for the vast interconnectivity present in
cortex. Here we take a closer look at the limitations of such traditional no-
tions and under what requirements valid findings are possible. We present
a solution for each one of five problems with the current view of V1. In par-
ticular, we show that the fraction of neurons in V1 with a reliable functional
account is about 12-16% and that it can be increased by measures such as
the use of chronically implanted electrodes. We argue for the use of natural
stimuli instead of reduced geometrical abstractions such as bars, spots and
gratings. Also, we point out the need for further investigation of top-down
effects. With the overview we give, further examinations of V1 are directed
towards more diverse and true to life experimental paradigms. It is intended
to make way for new, broader theories that include the complex relationship
to other brain areas.

249 words.