Compressive spatial summation in human visual cortex.

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Abstract:

Neurons within a small (a few cubic millimeters) region of visual cortex respond to stimuli within a restricted region of the visual field. Previous studies have characterized the population response of such neurons using a model that sums contrast linearly across the visual field. In this study, we tested linear spatial summation of population responses using blood oxygenation level-dependent (BOLD) functional MRI. We measured BOLD responses to a systematic set of contrast patterns and discovered systematic deviation from linearity: the data are more accurately explained by a model in which a compressive static nonlinearity is applied after linear spatial summation. We found that the nonlinearity is present in early visual areas (e.g., V1, V2) and grows more pronounced in relatively anterior extrastriate areas (e.g., LO-2, VO-2). We then analyzed the effect of compressive spatial summation in terms of changes in the position and size of a viewed object. Compressive spatial summation is consistent with tolerance to changes in position and size, an important characteristic of object representation.

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