A Model of Self-organizing Head-Centered Visual Response in Primate Parietal Areas

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Abstract

We investigate how head-centered visual responses in parietal areas V6 (parietal occipital area) and LIP (lateral intraparietal area) may self-organize through a bioligally plausible learning mechanism depending on temporal coherence of eye in head movement dynamics and local synaptic learning rules. We find that V6 head-centered neural responses do successfully self-organize, however head-centered responses in LIP fail to develope and this failure is found to be attributable to the classical planar eye position modulation neurons found in LIP and througout parietal areas. Planar and Sigmoidal gain fields are found to cause persistent difficulty in developing proper head-centered responses due to their their substantial spatial overlap in the eye position domain, which causes continous overgeneralization in the learning process. This sheds new light on how head-centered neural responses may self-organize and be computed, and contradicts the widely held assumption due to previous classical models like Zipser & Andersen that . We discuss in detail the short comings of previous investigations in this regard, and find that the critical short ocming is that past work has not taken self-organization seriously and hence ...

Author Summary

Introduction

The most familiar representation of visual space is the eye-centered visual represenatation, abundant in many primate brain areas, encode visual space in the the retinal reference frame. However, visuospatial behaviour such as saccading or reaching, requires transforming these representations into reference frames where they are compatible with the behaviour in question. Take reaching for example, this may require representing visual targets and motor commands in the same refernce frame, so that motor error vector may be computed for the appropriate action (cite anderson papers). Alternatively consider having to perform two consecutive saccades to two extinguished visual targets, requires the ability to make the appriroite ...

A potential substrate for such a