kigor@eri.harvard.edu
http://igoresha.virtualave.net/Work/SfN02

DIVERSITY OF RESPONSES TO GRATINGS IN V1 OF ALERT MONKEY

Igor Kagan, Moshe Gur, D. Max Snodderly

Overlap Index (OI) - a measure of activating regions' spatial overlap and symmetry

Overlap Index is calculated according to the following formula (Schiller et al. 1976):

$$OI = \frac{0.5(INC_w + DEC_w) - sep}{0.5(INC_w + DEC_w) + sep} \quad (1)$$

where INC_w and DEC_w is the respective width of increment and decrement activating regions (AR) and sep is the separation between centers of these regions. The distribution of OI in V1 of alert monkeys is bimodal, with a gap between simple and complex cells ($OI_{simple} \leq 0.3$ and $OI_{complex} \geq 0.5$ (Kagan et al. 2002, Fig. 1).

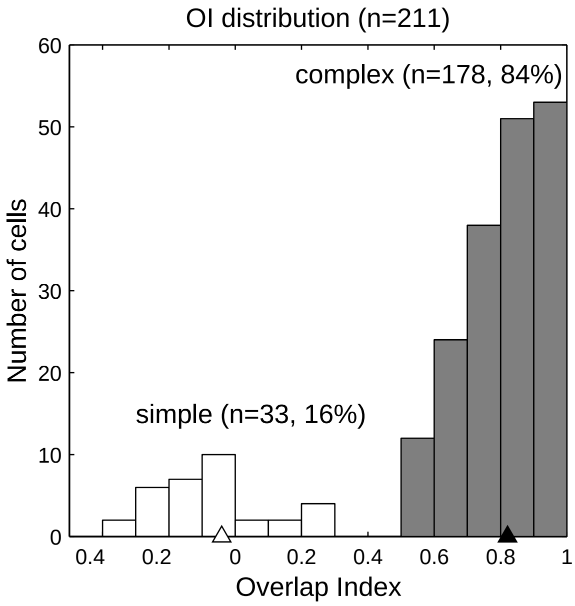

Figure 1: *Upper panel:* OI distribution. Open bars - simple cells, filled bars - complex cells (n=211). Bin width 0.1.

Relative modulation (RM)

The relative modulation (RM) of the response to a drifting grating was calculated as the ratio of the first harmonic (F1) to the mean firing rate (F0) with baseline firing rate subtracted (De Valois et al. 1982):

$$RM = \frac{F1}{F0 - F_{base}} \quad (2)$$

Most complex cells show significant F1 component, and a subset of complex cells has RM > 1 (Fig. 2). RM is not correlated with the degree of overlap of ARs, indicating that the spatial organization of receptive fields can not reliably be predicted from RM values (Kagan et al. 2002).

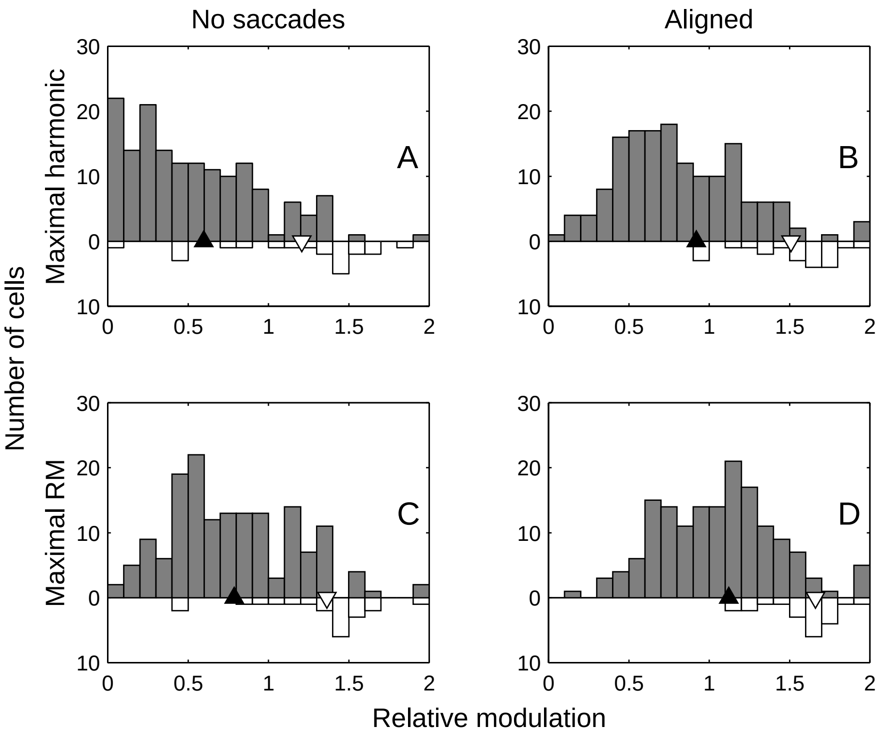

Figure 2: Relative modulation distributions for different stimulus conditions and analysis modes. Complex cells (n=156) are represented by dark bars, simple cells (n=21) by light bars. Left column: "no saccades" analysis mode. Right column: "aligned" analysis mode. Top row: RM distributions for stimulus conditions eliciting the maximal harmonic F0 or F1. Bottom row: RM distributions for stimulus conditions producing maximal RM.

S transform

The S transform (ST, Stockwell et al. 1996) is a extension of the short time Fourier transform (STFT) and the Wavelet transform (WT). ST reveals frequency variations over time by localizing a signal with frequency-adapted Gaussian scaling windows.

References

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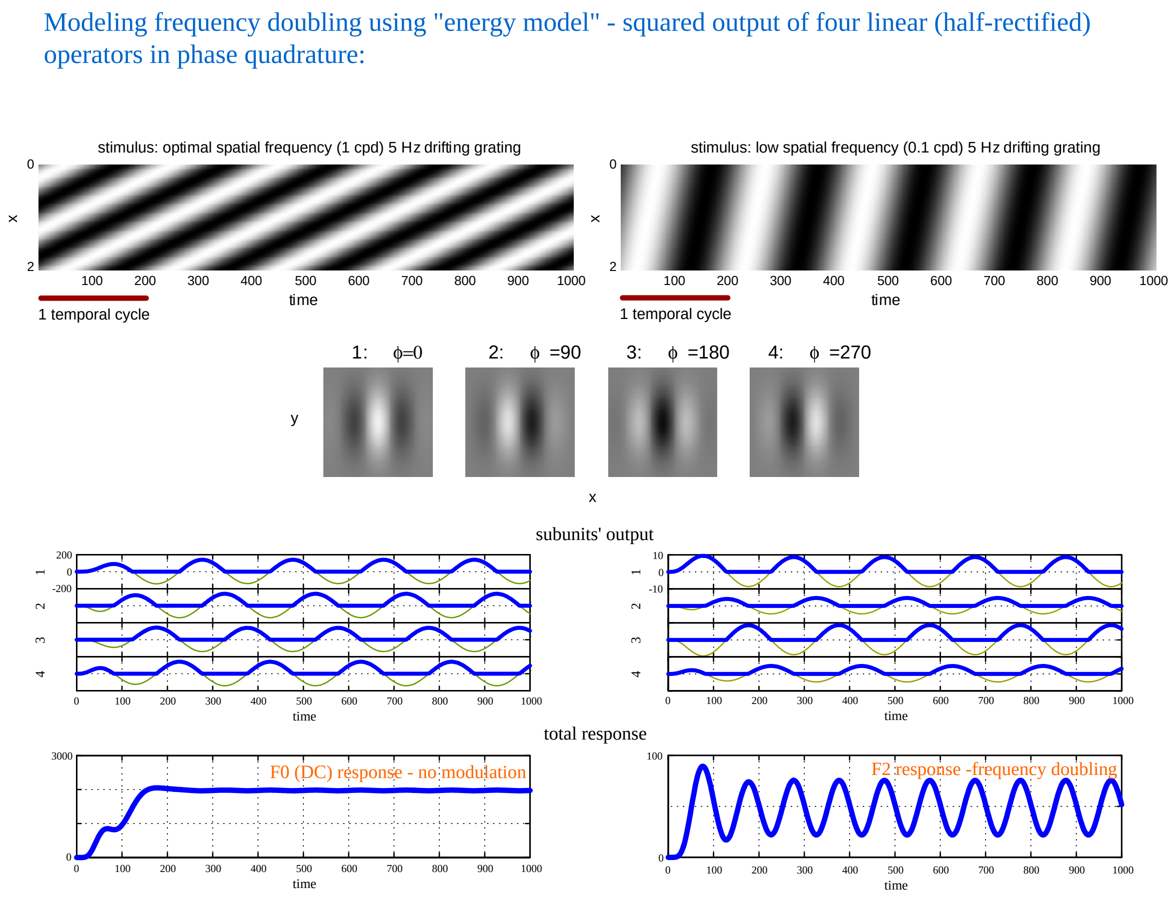

Figure 3: DC response (F0) and frequency doubling (F2) in model energy operator cell as function of spatial frequency of the drifting grating.

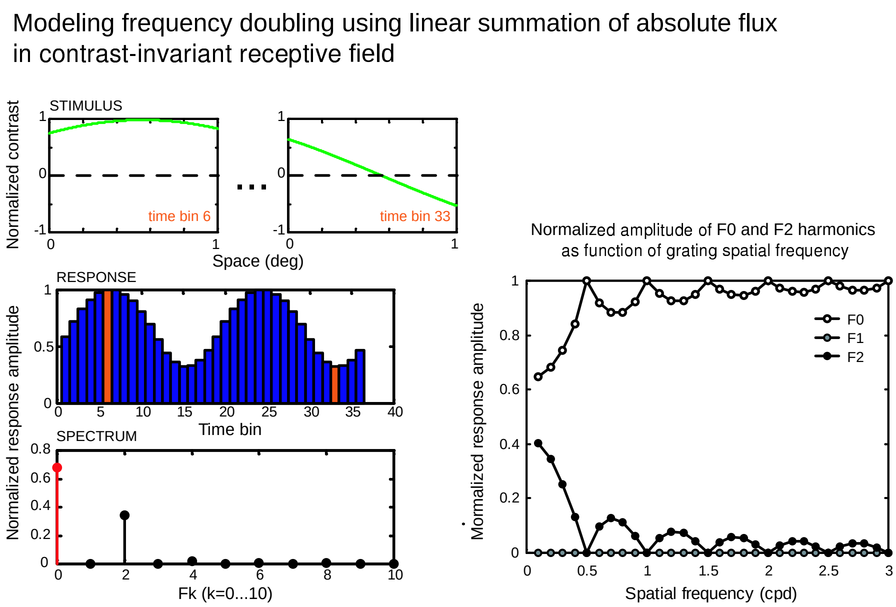

Figure 4: Frequency doubling in contrast-invariant model cell in response to drifting grating of a very low spatial frequency.