Contrast gain control in macaque area MT

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NYU and HHMI
Carandini et al. (1997)
Retinal image

Other V1 cells

Linear operator

Normalization

Output nonlinearity

Simoncelli and Heeger (1999)
V1 receptive fields

~1-3 degs

MT receptive fields

~3-10 degs
Normalization in V1 only
Normalization in V1 only

Normalization in both
Normalization in V1 only

Normalization in MT only

Normalization in both
Normalization in V1 only

Normalization in both
Contrast

Normalization in V1 only

Normalization in both

Response (ips)

Contrast
Normalization in V1 only

Normalization in MT only

Normalization in both
Normalization in MT only

Normalization in V1 only

Normalization in V1 and MT

Normalization in MT only

0-2600 ms
0-200ms

Response (ips)

Contrast

0.001 0.01 0.1 1

Response (ips)

Contrast

0.001 0.01 0.1 1
0-200ms

Response (ips)

Contrast
0-200ms

Response (ips)

Contrast

0-200ms
0-200ms

Contrast

Response (ips)
0-200ms

Response (ips) vs. Contrast

Graph showing the relationship between response time (ips) and contrast for the 0-200ms time range.

Graphs depict data points and trends indicating how response time changes with contrast over the specified time range.
Normalization in MT only

Normalization in V1 only

Normalization in V1 and MT

Normalization in MT only

0-2600 ms
Normalization in MT only
Normalization in V1 and MT
Normalization in V1 only
0-1500 ms
Normalization in V1 only
Normalization in V1 and MT
Normalization in MT only

0-1000 ms
Normalization in MT only

Normalization in V1 only

Normalization in V1 and MT

0-500 ms

Normalization in MT only
Normalization in MT only

Normalization in V1 only

Normalization in V1 and MT

0-200 ms
Normalization in MT only

Normalization in V1 only

Normalization in V1 and MT

0-100 ms

Normalization in MT only
Simoncelli and Heeger (1999)