Edge statistics in natural versus laboratory images

Implications for understanding lateral connectivity in primary visual cortex with respect to animal environments

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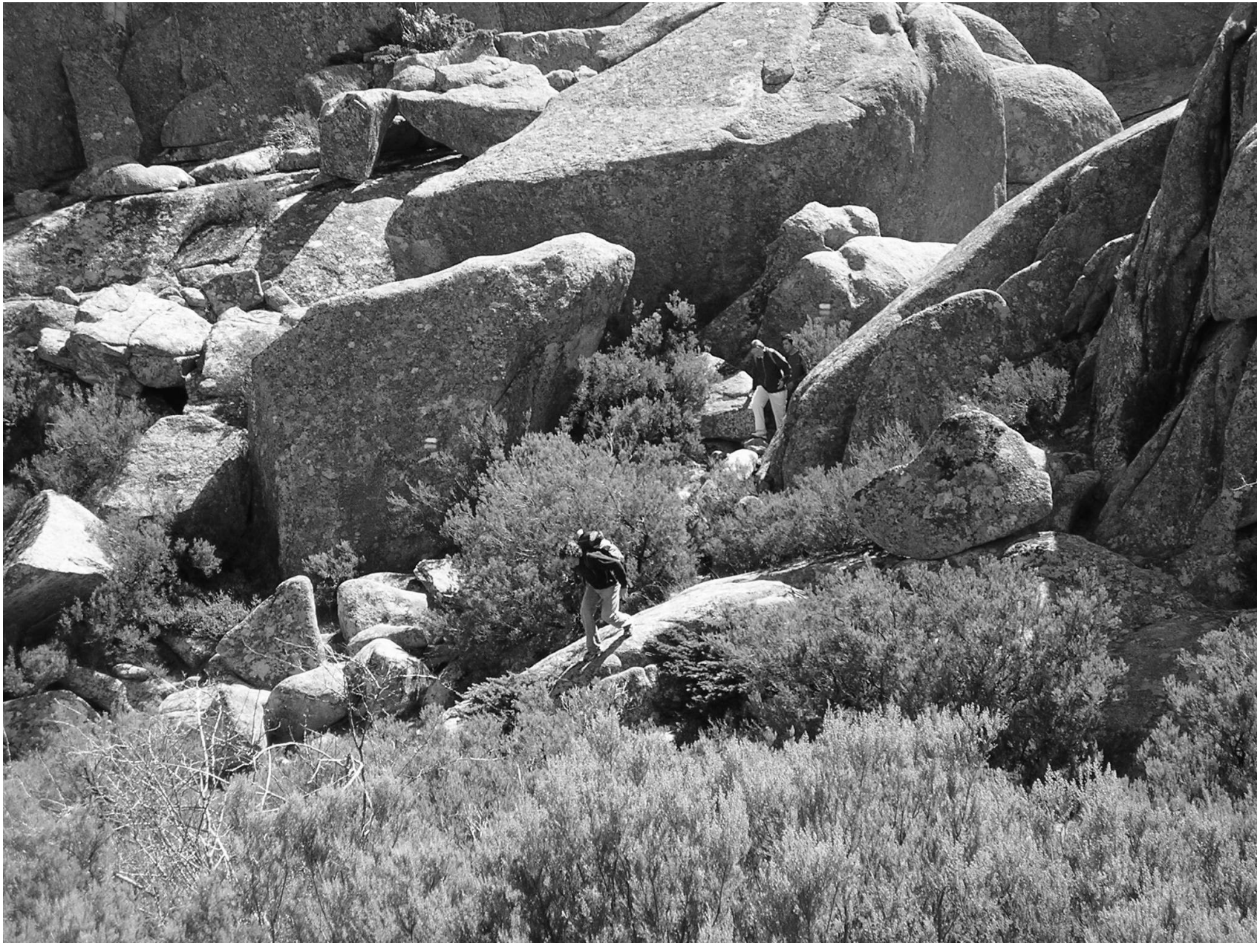
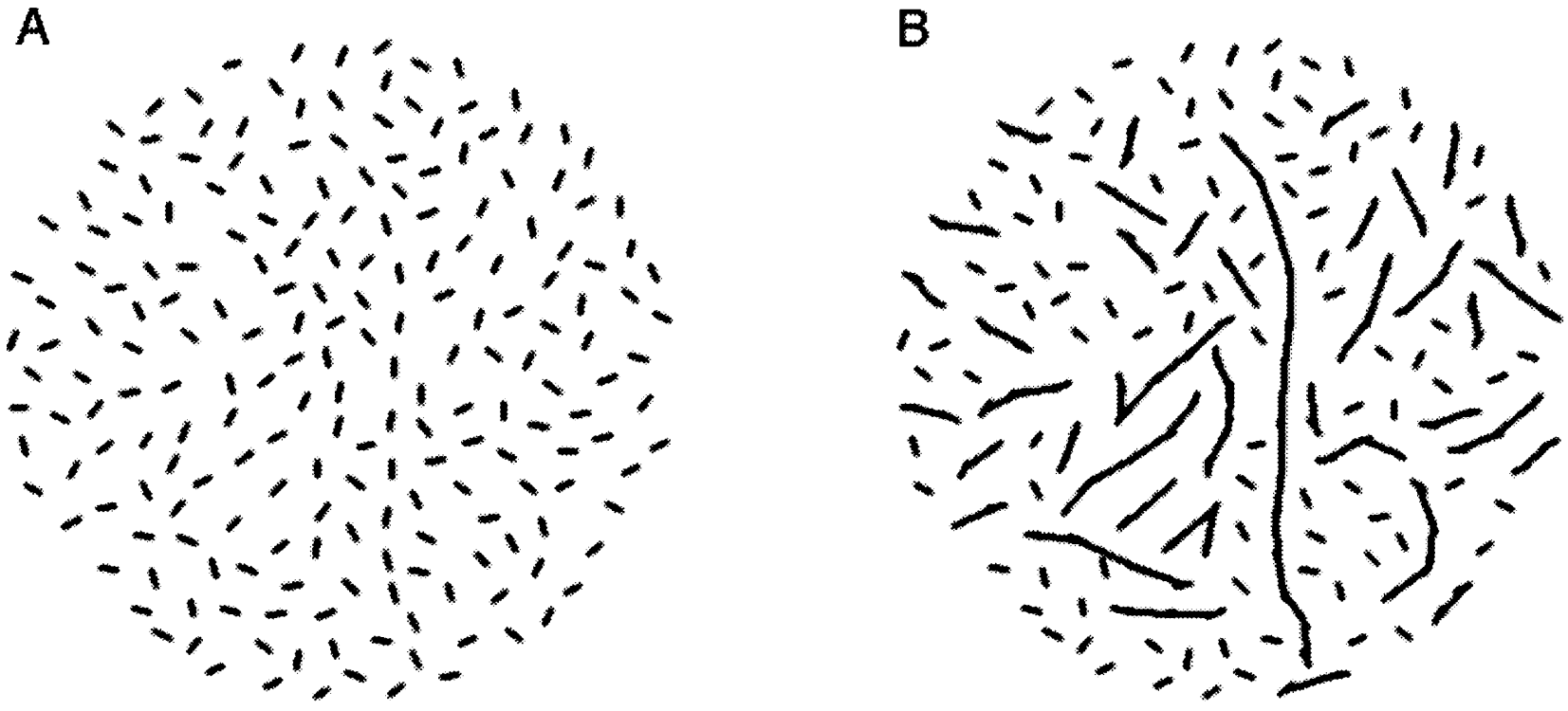
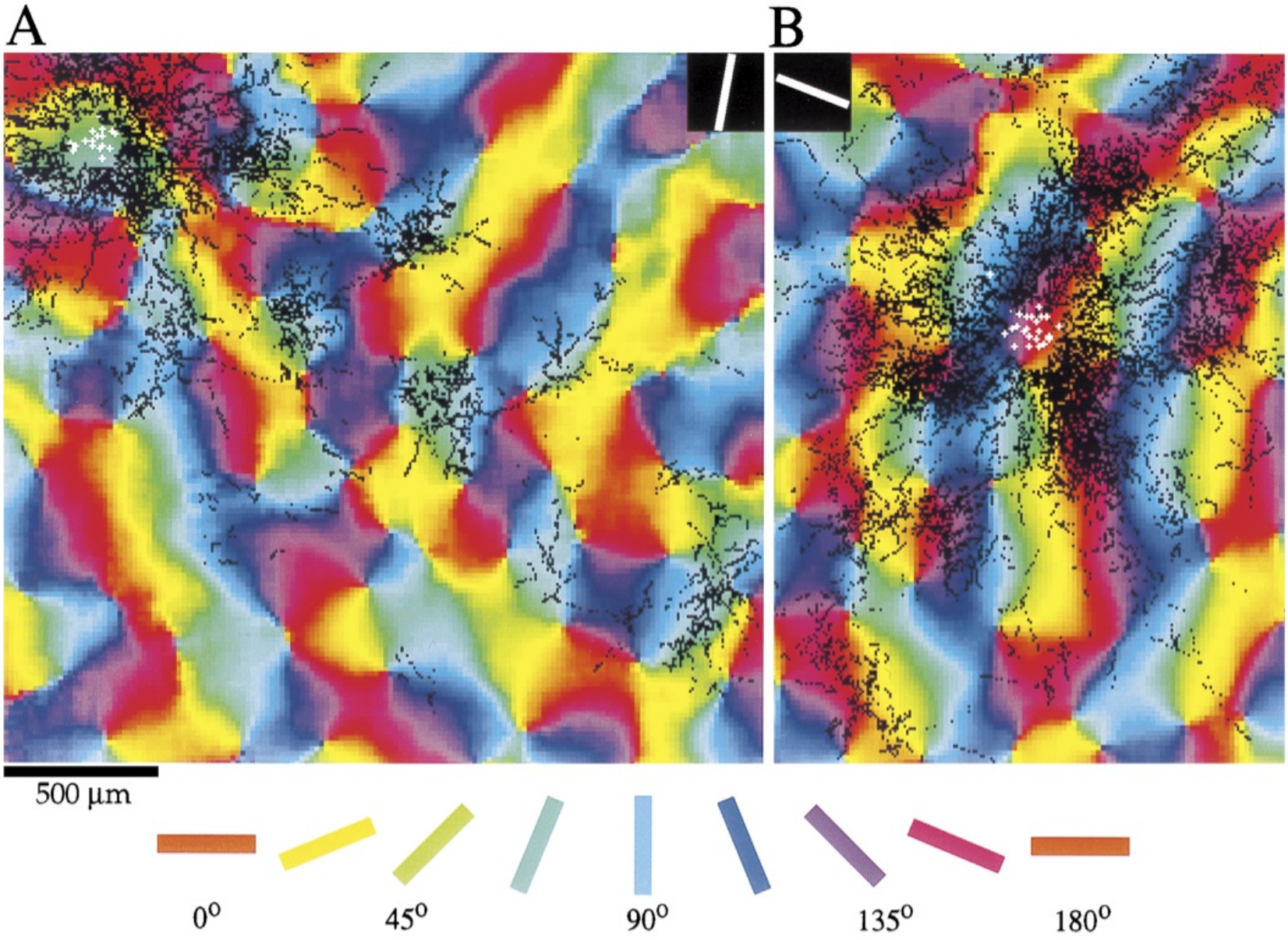
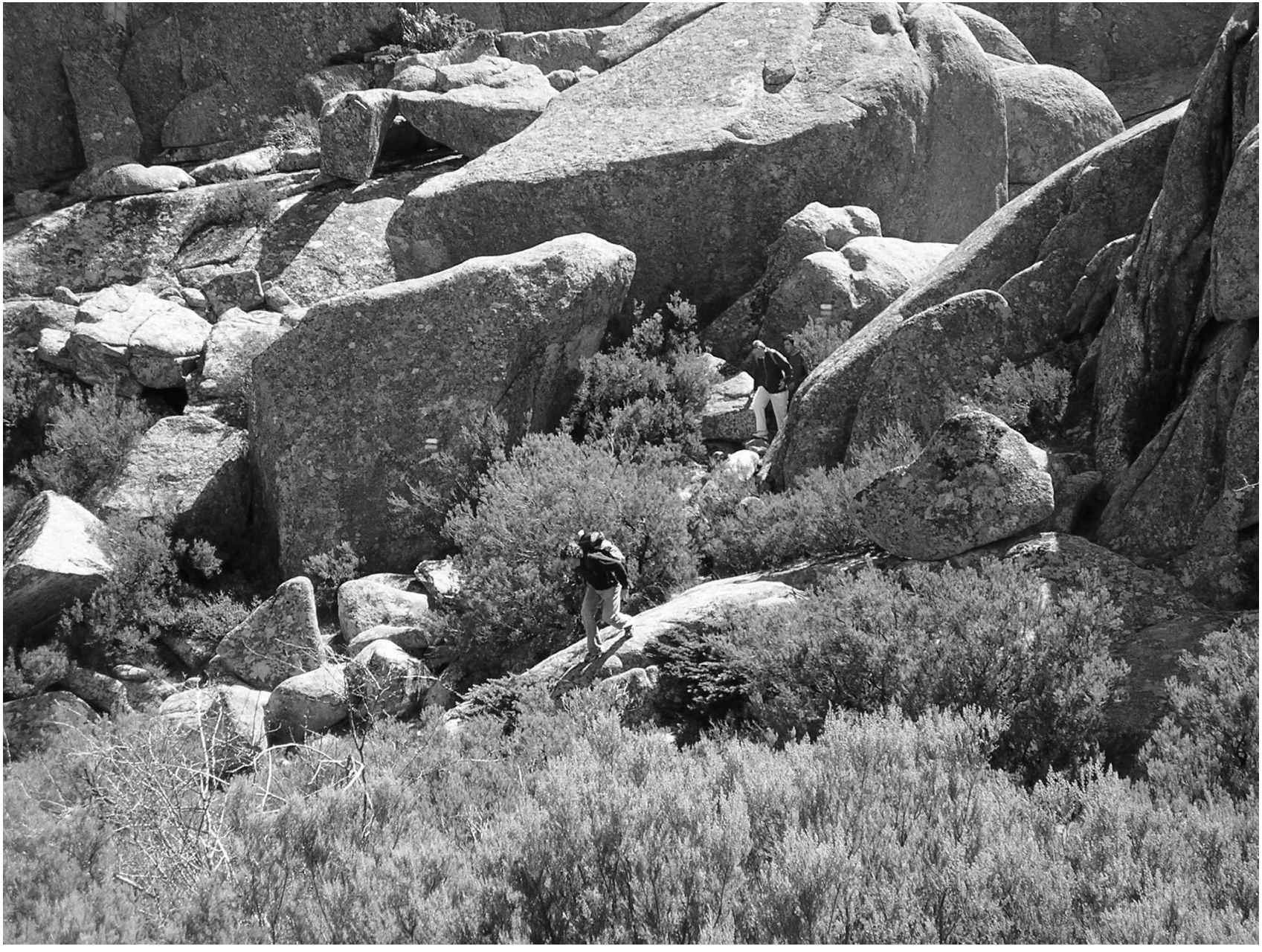




(Geisler et al., 2001, Vision Research)



(Bosking et al, 1997, Journal of Neuroscience)



Outline: Edge statistics in natural versus laboratory images

Introduction: linking neural structure to natural scenes

- Geisler et al, 2001
- Bosking et al, 1997
- Problem statement

Method: detection of edges

- Geisler et al, 2001
- Log Gabor representation / Sparse coding

Results: natural vs. laboratory images

- Some examples of edge extraction
- Second-order statistics
- Quantitative difference using classification

Take-home message

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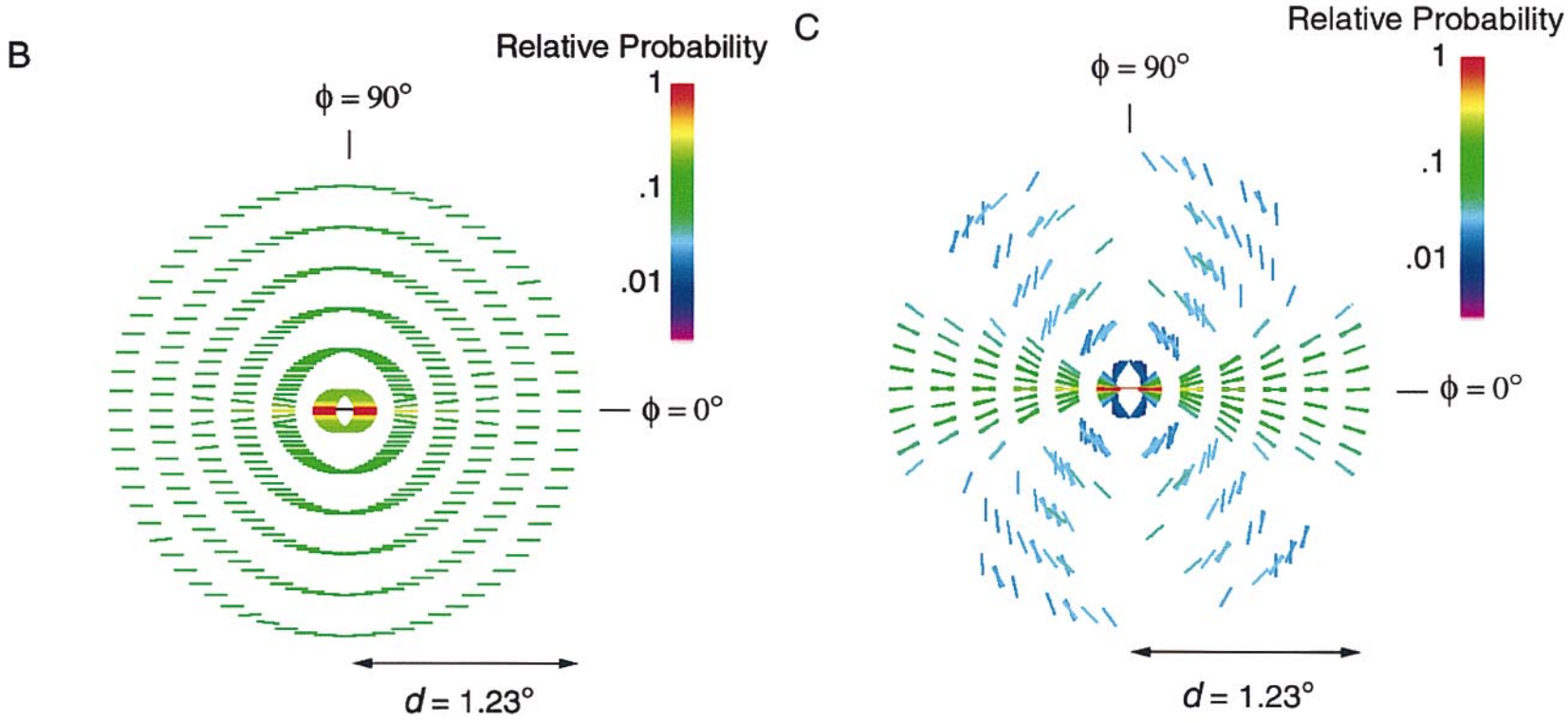
Geisler et al, 2001



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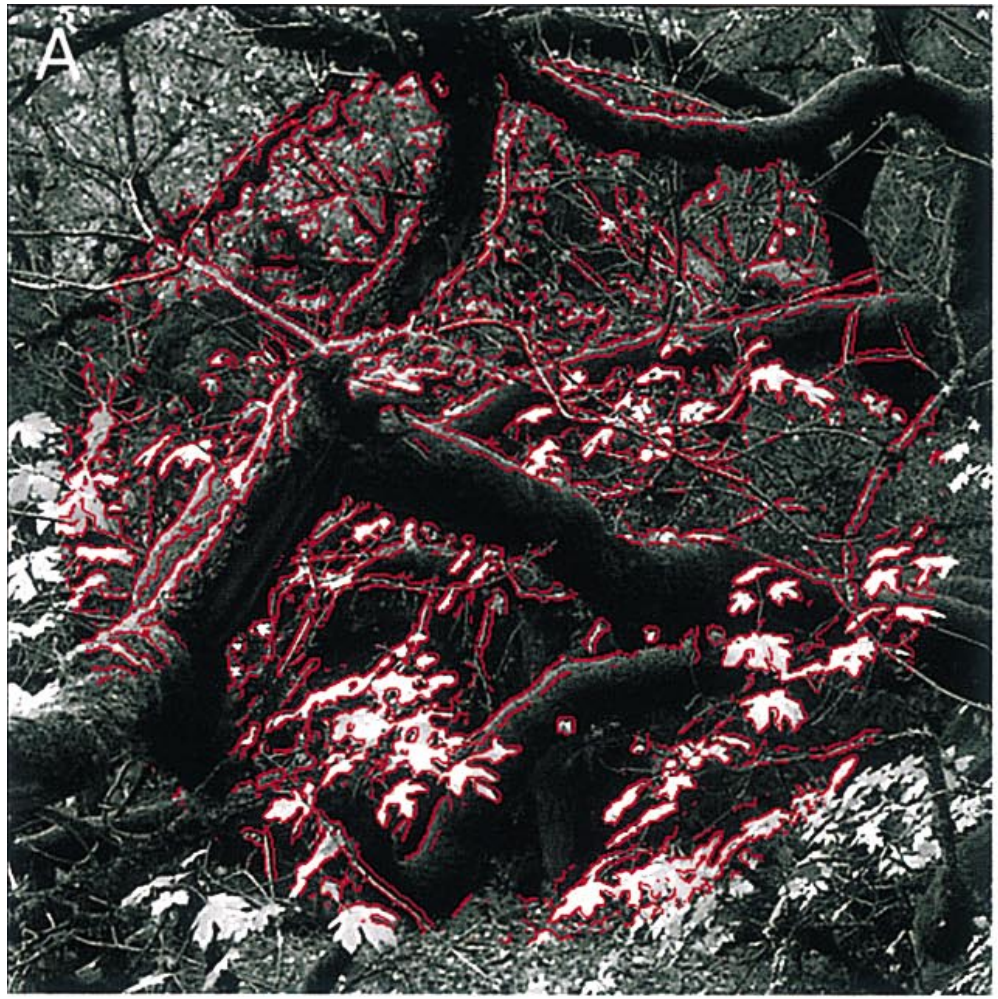
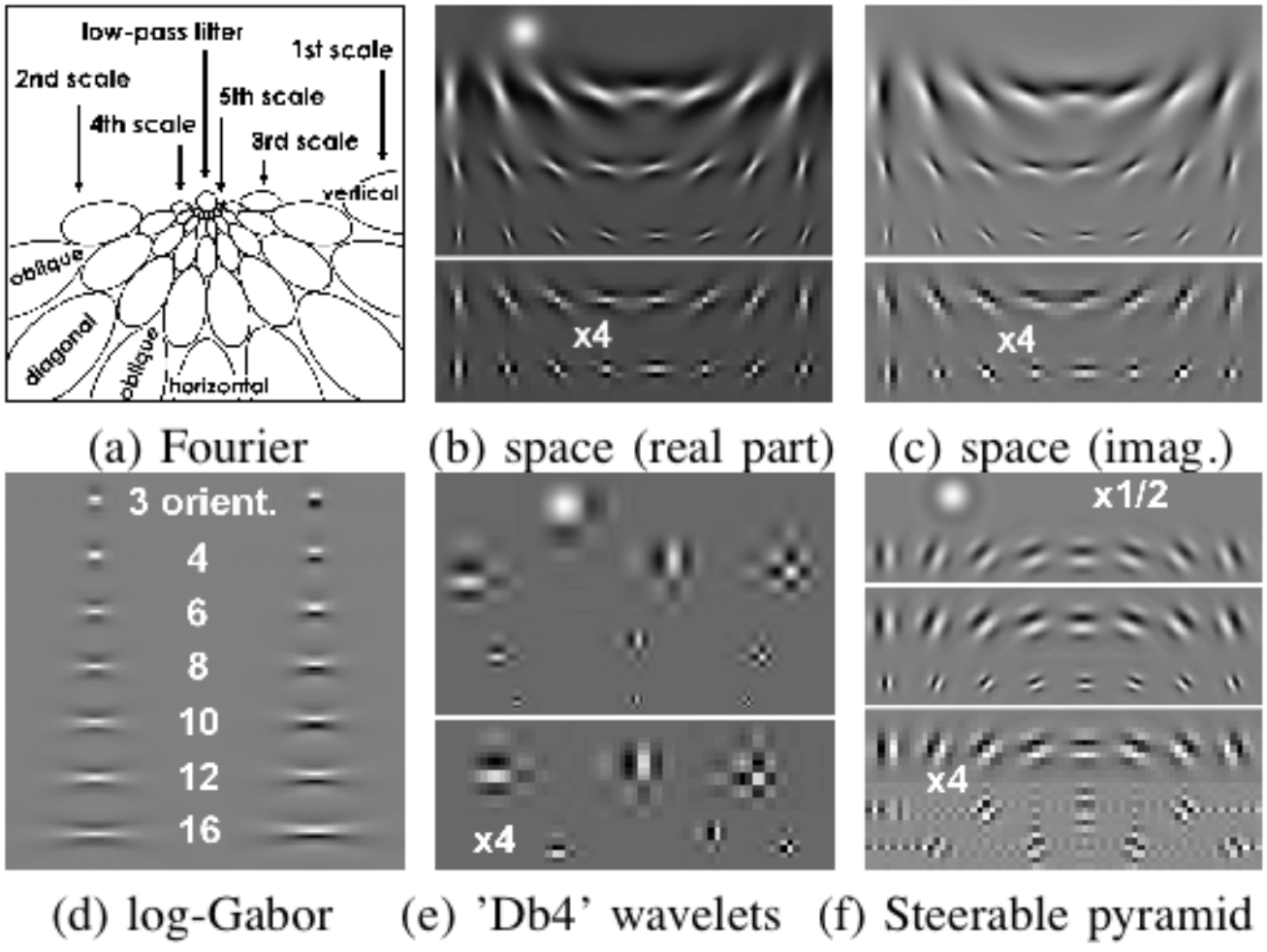
Geisler et al, 2001



(Geisler et al., 2001, Vision Research)

Log Gabor representation / Sparse coding



(a) Fourier (b) space (real part) (c) space (imag.)

(d) log-Gabor (e) 'Db4' wavelets (f) Steerable pyramid

(Fischer et al, 2007, International Journal of Computer Vision)

(Perrinet, 2010, Neural Computation)

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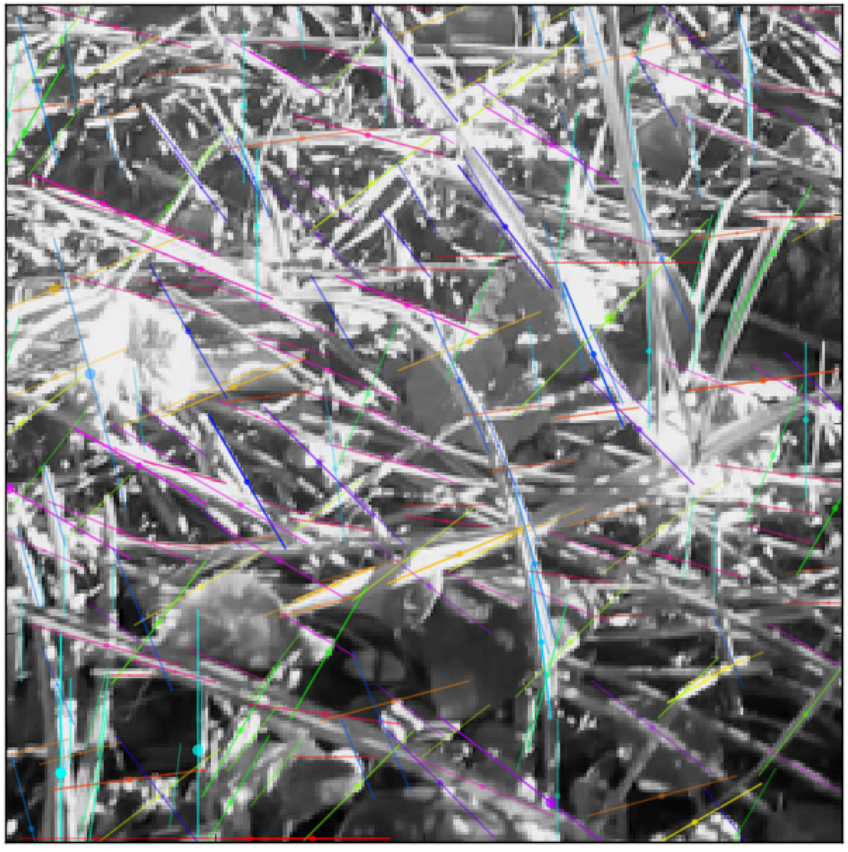
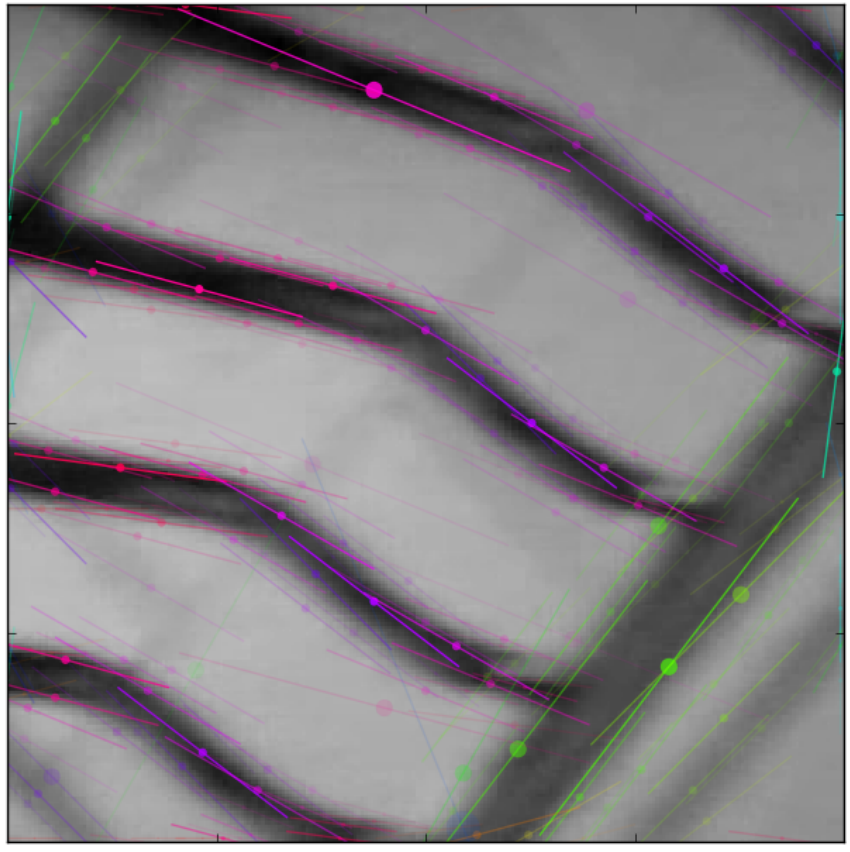
Some examples of edge extraction



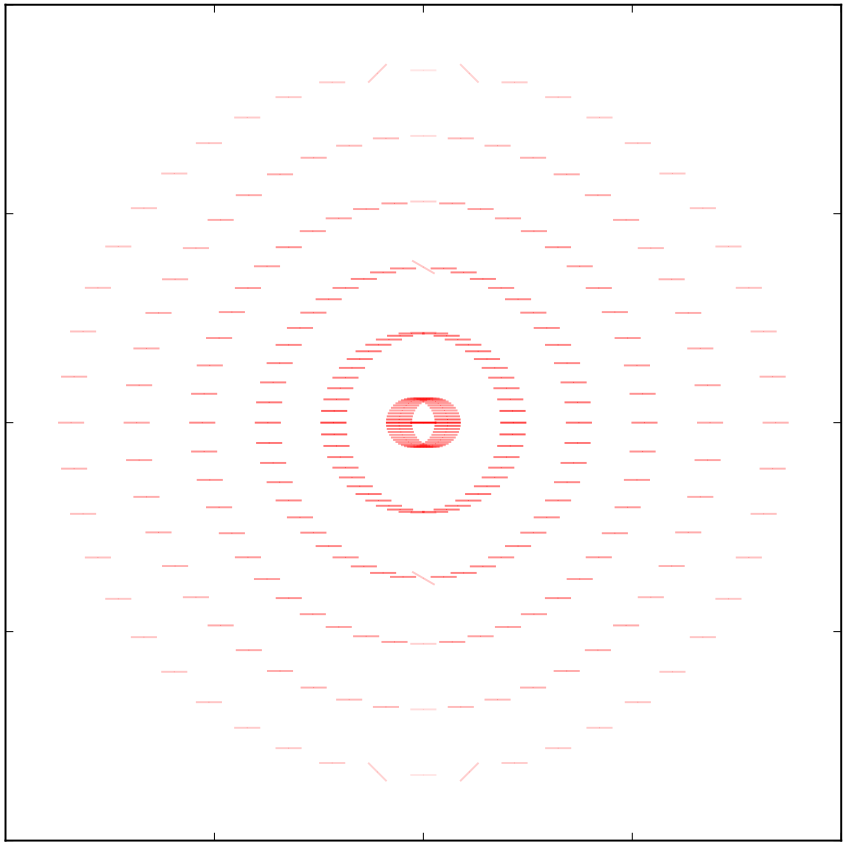
Natural



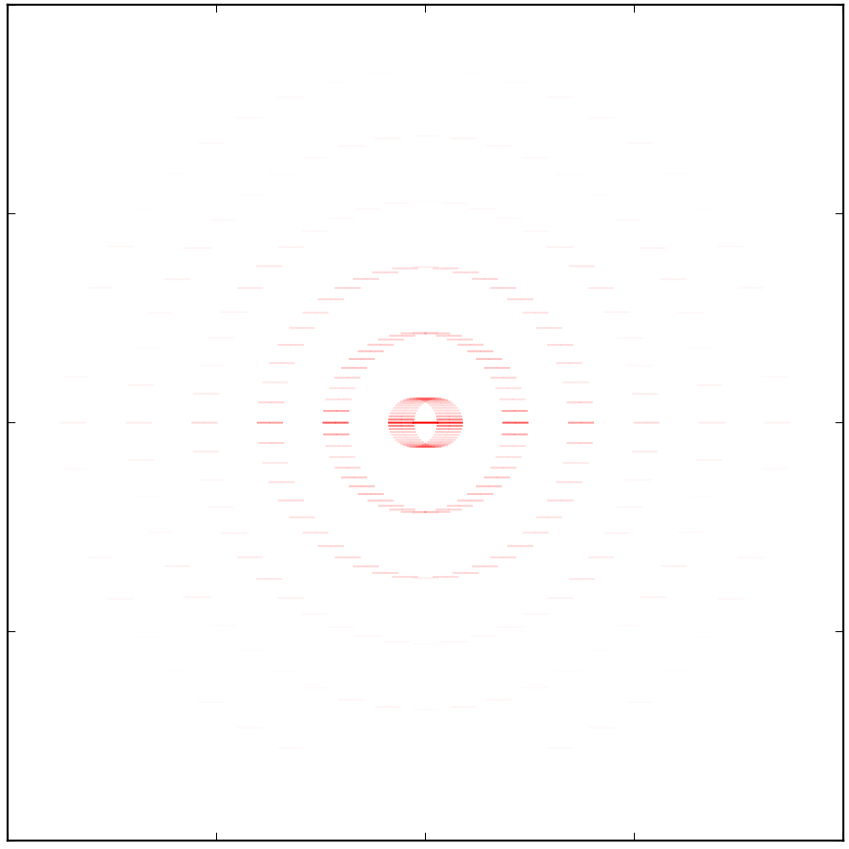
Laboratory

Second-order statistics

$$\arg\max_{\theta} p(d, \phi, \theta, \sigma | \pi_0)$$



Natural



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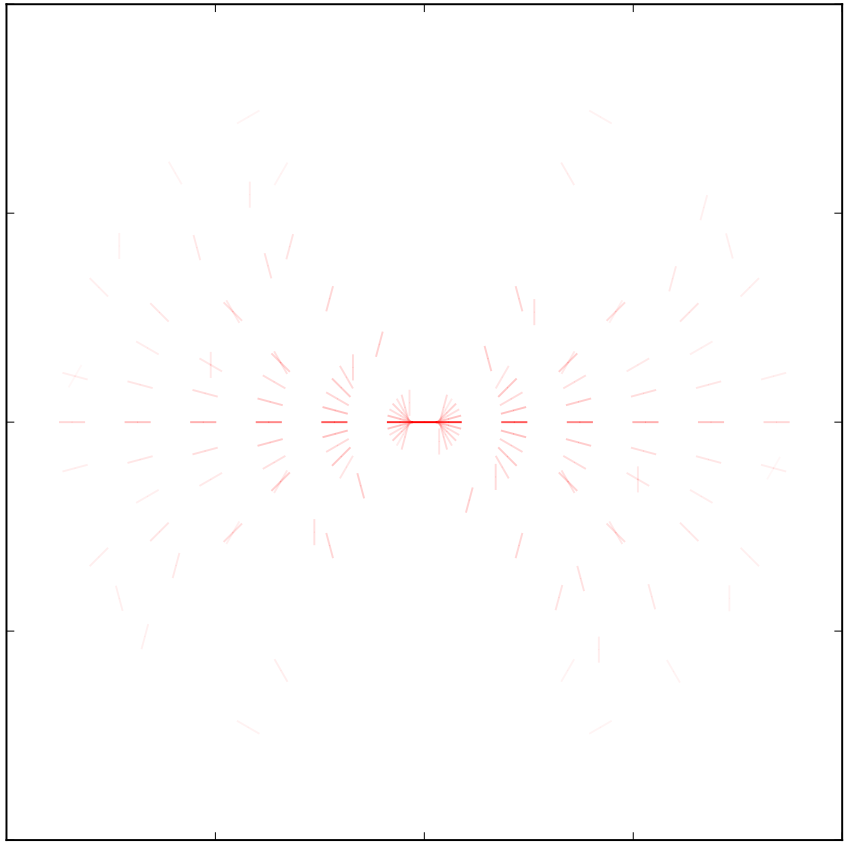
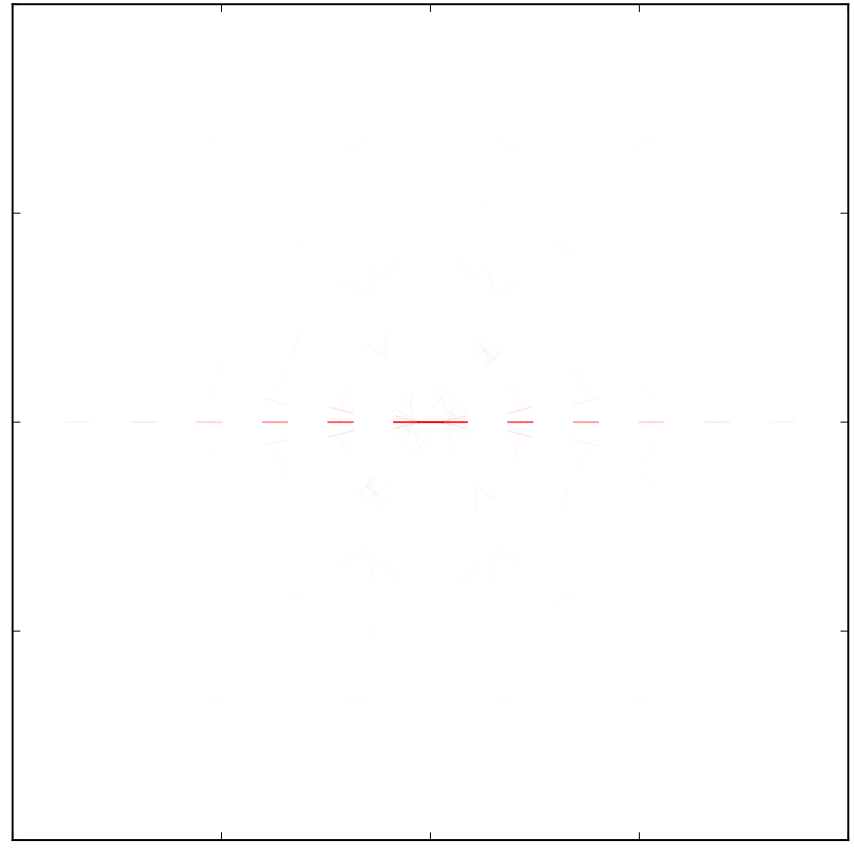
Second-order statistics

$$\arg\max_{\phi} p(d, \phi, \theta, \sigma | \pi_0)$$



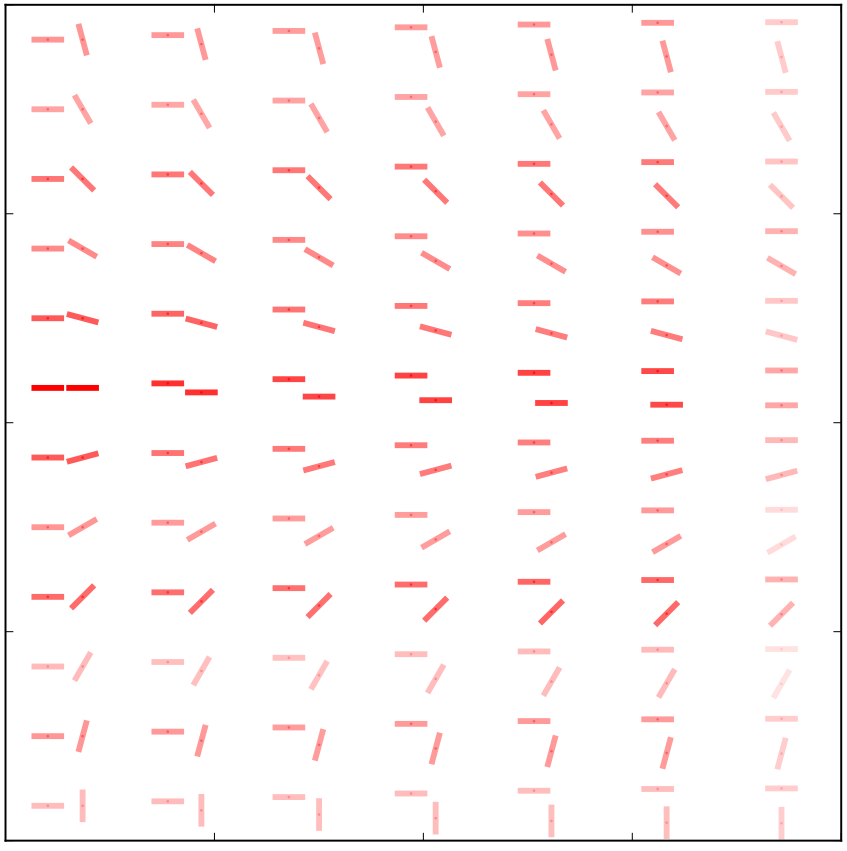
Natural



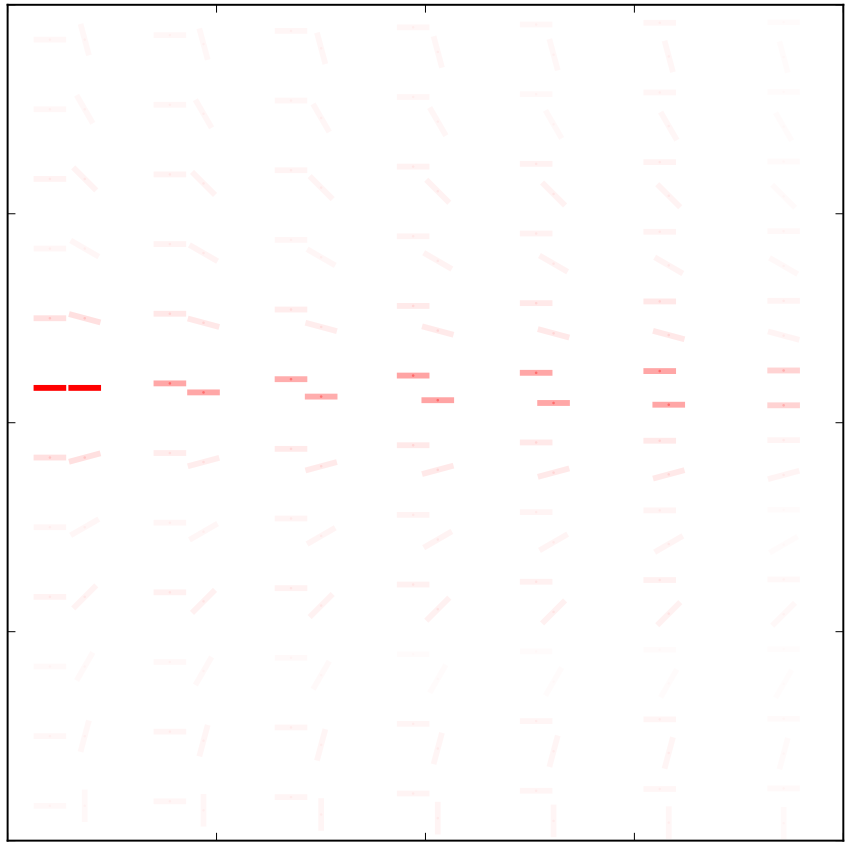
Laboratory

Second-order statistics

$$p(d, \phi, \theta, \sigma|\pi_0) \approx p(d, \sigma|\pi_0)p(\theta, \phi|\pi_0)$$

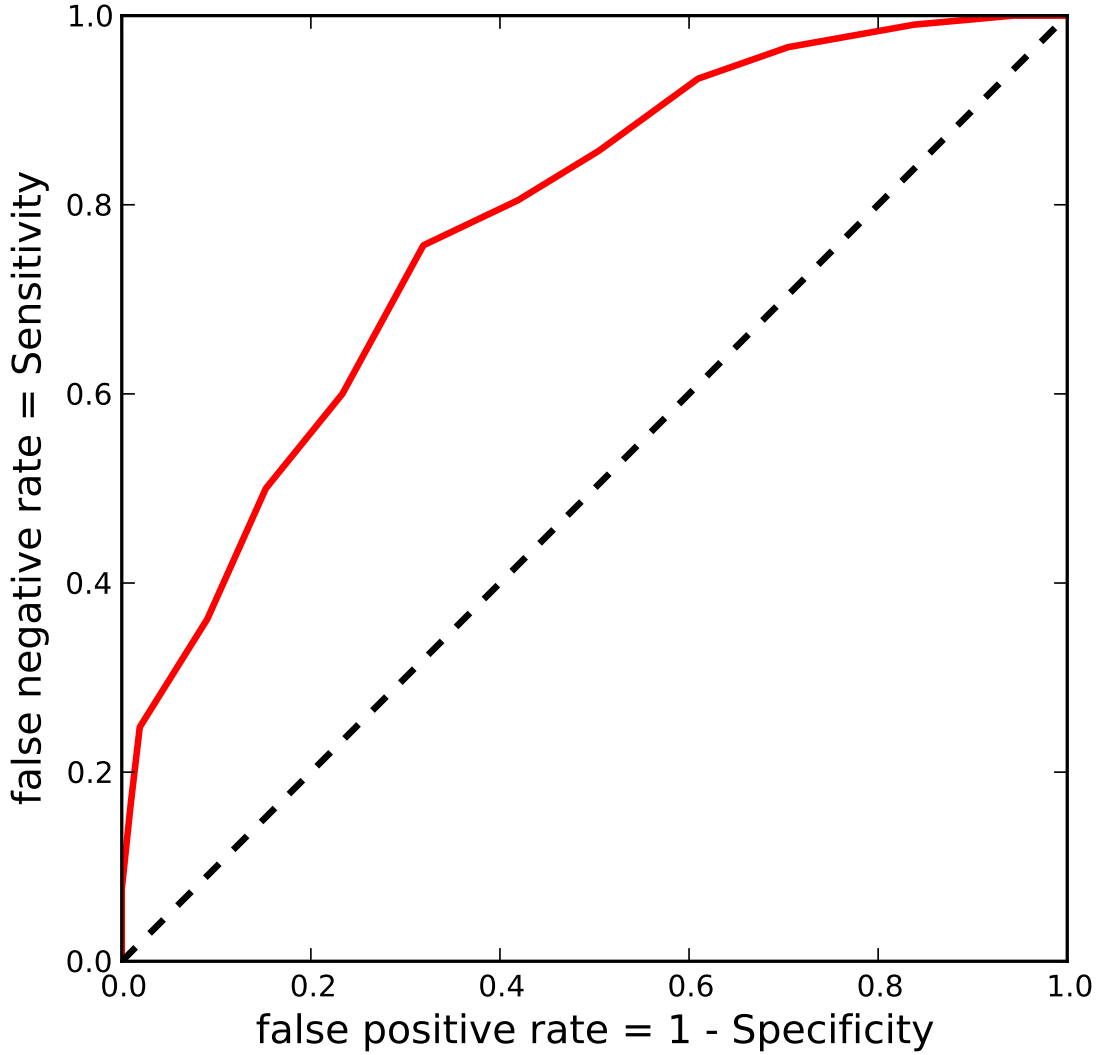


Natural



Laboratory

Quantitative difference using classification



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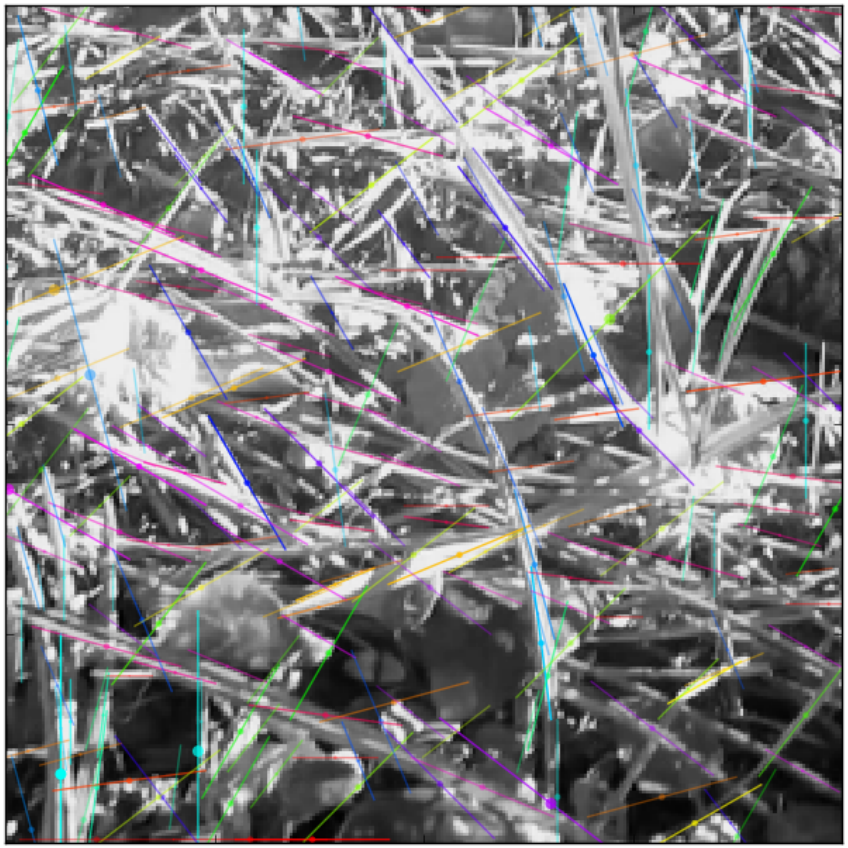
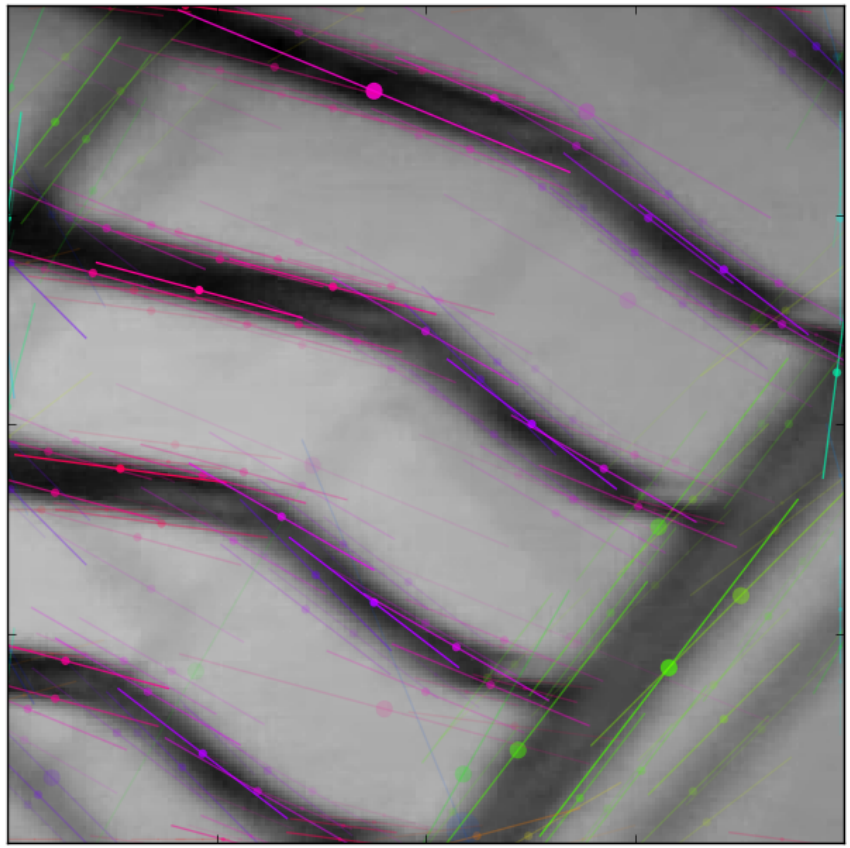
Summary



Natural



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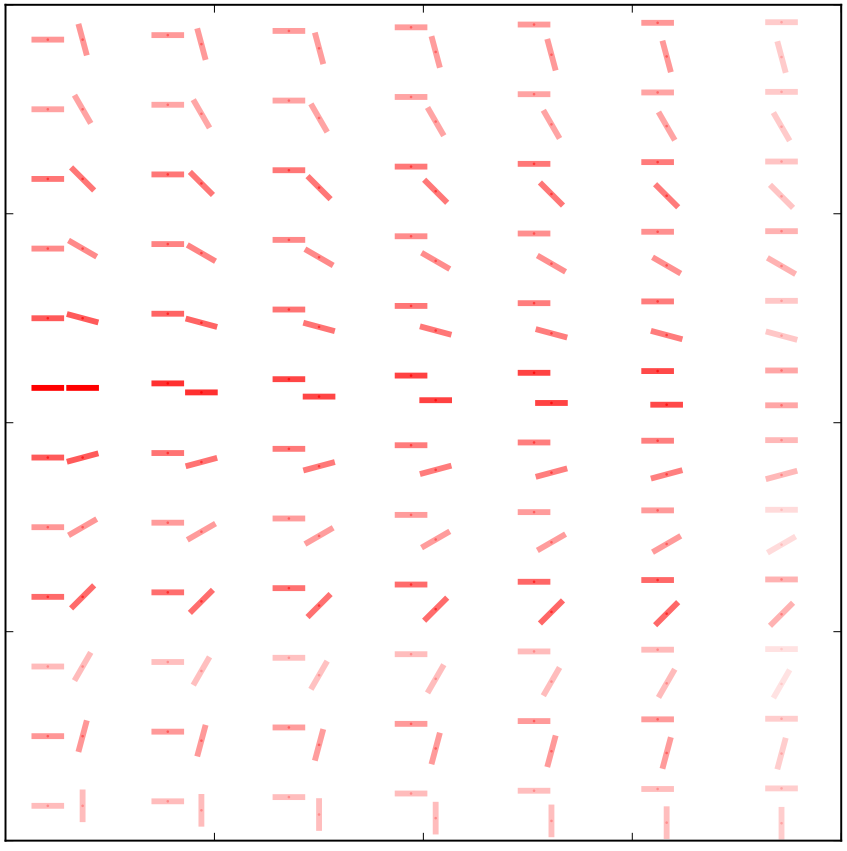
Summary

$$p(d, \phi, \theta, \sigma|\pi_0) \approx p(d, \sigma|\pi_0)p(\theta, \phi|\pi_0)$$



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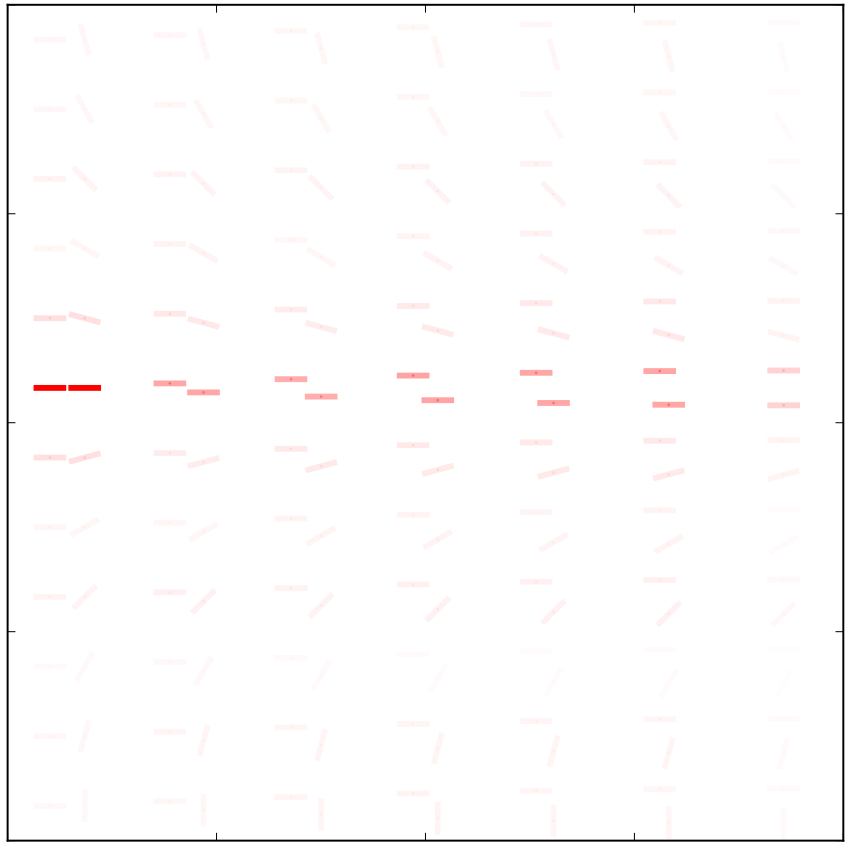

Laboratory

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