1. INTRODUCTION

- Points of maximum curvature have been suggested to contain crucial information about shape (Attneave, 1954; Biederman, 1978).
- Previous studies on object recognition have shown different conclusions regarding the importance of specific object features, such as convexities, concavities and intermediate parts.
- Some studies found evidence for a predominant role of convexities, whereas others favored concavities or intermediate parts.
- Carlson et al. (2011) suggested a sparse object coding scheme in midlevel visual cortex based on regions of acute convex and concave curvature.
- The noise shape was composed of the same shape twice within a trial.
- The phase of the RF components was scaled & positionally jittered.

2. AIMS

The aims were:
1) To measure shape recognition for unfamiliar random shapes
2) To compare the contribution of convexities, concavities and intermediate points of the shape
3) To test various Models that predict the observed patterns of results

3. METHODS

The shapes were composed of the sum of two different radial frequency RF-components with random phases segmented to remove all but variable lengths of contour centred on the feature of interest.

3. RESULTS

- Results show that for very short (dot-sized) segments lengths, performance was significantly higher for convexities than for either concavities or intermediate points.
- Performance for convexities remained constant as a function of segment length, and... although performance improved with segment length for concavities and intermediate points to only reached convexity performance at the longest lengths tested.
- This suggests that the longer segment lengths for concavities and intermediates enable an easier interpolation of points of convex curvature maxima, which might be used to recognize the shape.
- No significant differences between concavities and intermediate points were found.
- No significant differences between the different shapes.
- Performance is scale-invariant.
- Results suggest that for this class of closed shapes, shape is encoded from the positions of convexities, rather than from positions of either concavities or intermediates.

5. Rubber Band Model

The Model assumes that the shape is encoded by extracting the location of both convexities and concavities or intermediate points and combines these points by straight lines to form a coarse polygonal Model Shape (i.e., putting a rubber band around these points / red shapes in Figure).

The hypothesis is that the resulting Model Shape captures/decompose the presented smooth Test Shape more accurately when concavities are presented and predicts poorer, but similar descriptions for convexities and intermediate features.

Each Model prediction was calculated for 1000 shape (Mean ± SEM)

Model description:
- For each point between the Model Shape and Test Shape is scaled to convexities first to concavities and intermediate points.

Results:
- the model does not capture the observed data
- the Model predicts a similar performance for all shape features
- the Model does not predict the observed data

6. Conclusion

Shapes are encoded from the positions of convexities, rather than from positions of either concavities or intermediates.

References


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