Group beats Trend!?
Testing feature hierarchy in statistical graphics

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Abstract

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1 Introduction and background

Intro to lineups (Buja et al., 2009; Majumder et al., 2013; Wickham et al., 2010; Hofmann et al., 2012)

The change to lineups we make is to introduce a second target to each lineup. We then keep track of how many observers choose any one of the two targets (to assess the difficulty of a lineup), and additionally we record how often observers choose one target over the other one. This is information that we can use to evaluate how strong the signal of one target is compared to the other one.

A further extension of this testing framework are the use of color (in a qualitative color scheme), the use of shapes, and additional density lines - we anticipate that all of these features are going to emphasize the clustering component. On the other hand, regression lines should emphasize any linear trends in the data.

2 Design Choices

Perceptual kernels (Çağatay Demiralp et al., 2014)

3 Generating Model

We are working with two models M_C and M_T to generate data for the target plots. The null plots are showing data generate from a mixture model M_0. We made sure that data from the clustering model M_C shares the same correlation with the null data, while data from model M_T exhibits a similar amount of clustering as the null data.

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3.1 Cluster Model

1. Generate cluster centers along a line, then generate points around the cluster center.
   Algorithm:
   Parameters N points, K clusters, q cluster cohesion

   (a) Generate cluster centers $(c_{xi}, c_{yi}), i = 1, ..., K$:

      i. Generate c_x a permutation of $\{1, ..., K\}$, c_y a permutation of $\{1, ..., K\}$

      ii. if $.25 < \text{Cor}(c_x, c_y) < .9$ keep c_x, c_y, otherwise, re-generate.

   (b) Scale cluster centers; mean and SD are constant for a given choice of K: $\bar{c} = K(K+1)/2$, $Var(c) = \frac{K(K+1)(2K+1)}{6} - \frac{K^2(K+1)^2}{4}$

   (c) Determine group size: $g \sim Multinomial(K, p)$ where $p = p_1 / \sum_1^K p_{1i}$ where $p_{1i} \sim N(\frac{1}{K}, \frac{1}{2K^2})$

   (d) Generate points around cluster centers:

      i. $x_i^* = c_{xg_i} + e$, $e_i \sim N(0, q)$

      ii. $y_i^* = c_{yg_i} + e$, $e_i \sim N(0, q)$

   It may be reasonable to draw q from a distribution of some sort.

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