Saccadic Biases

Alasdair D. F. Clarke, Matthew J. Stainer

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Abstract

More bias modelling! Cause who can be bothered running actual experiments?

HERE IS SOME STUFF TO SEE IF I EXIST!

1 Introduction

Improve on last year's [Clarke and Tatler, 2014] effort. More sophisticated biases. And some examples of how to use biases for improved data analysis.

2 Methods

2.1 Datasets

2.2 Pre-processing

Generally, there are some things we want to consider:

- Normalise fixation positions relative to image frame.
- Boot-strapping?
- Merge datasets or model individually?
- Remove intial fixation? (from all analysis??)

And specifically for the Flow analysis, there are some further things we may want to do:

- What about trasforming the data so that it is unbounded: $x' = \frac{x}{1-x}$?
- Mirroring the data (where relevant)... left = right and up = down?

3 Biases

We will model and discuss saccadic flow, coarse-to-fine, and left v right.

3.1 Saccadic Flow

Saccadic flow can be thought of as a generalisation of the central bias. Instead of computing the distribution of all saccadic endpoints in a dataset, we look at the distribution of saccade endpoints given the start points. So for a saccade from (x_0, y_0) to $(x_1, y1)$ we want to model $p(x_1, y_1|x_0, y0)$ This is illustrated in 1.

Figure 1: Empirical example of saccadic flow from blah dataset.

3.1.1 Modelling

We will model saccadic flow using multivariate skew-t distributions [Azzalini, 2015]. The multivariate skew-normal distribution [Azzalini and Dalla Valle, 1996] is given by:

$$\phi(z;\lambda) = 2\phi(z)\Phi(\lambda z) \tag{1}$$

for $z \in \mathbb{R}$. I think.

Trying to model how the parameters change over space is going to be tricky though (see Figure 3)

3.1.2 Results

3.1.3 Discussion

3.2 Coarse-to-fine

People make shorter saccades over time. Include $1/f$ dynamics?

3.3 Left v Right

Initially more fixations to the left half of the image [Nuthmann and Matthias, 2014].

4 Using Biases for Better Analysis

We will use the the central bias [Clarke and Tatler, 2014] and *saccadic flow* in some different contexts to see what biases can do for vision research. :p

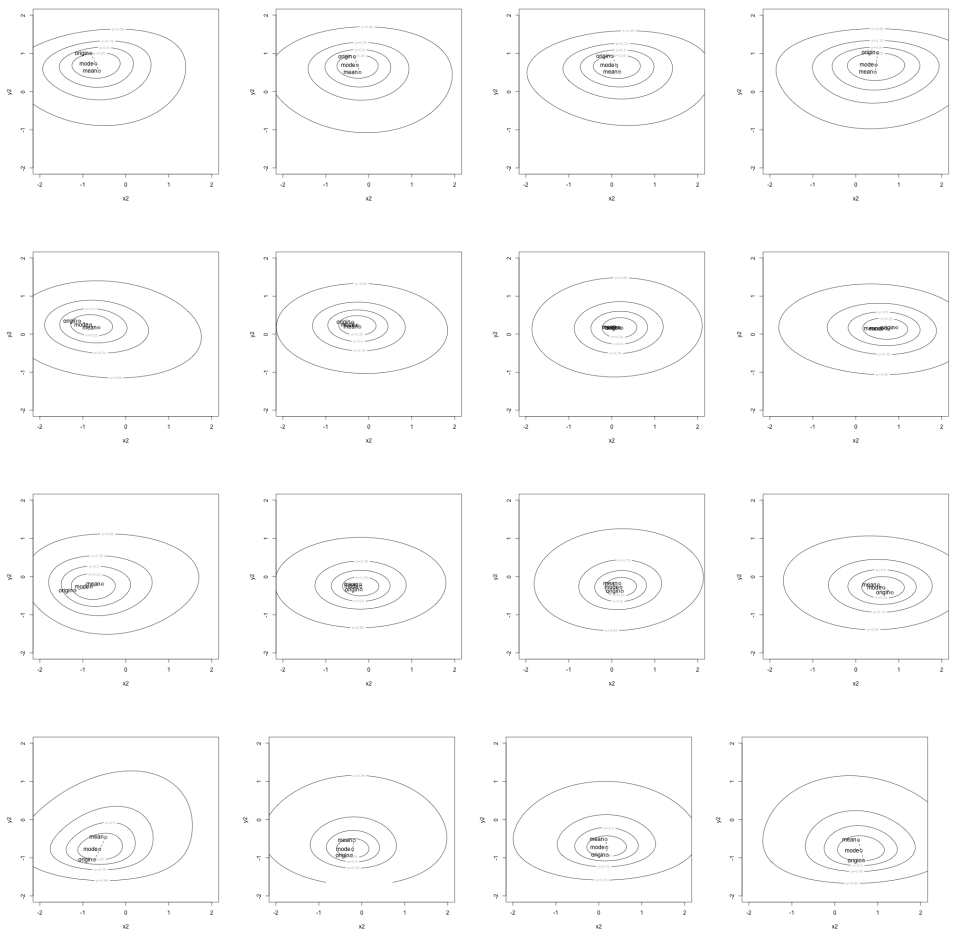

Figure 2: Multivariate skew-normal distributions fitted to fixation location, by saccade start point.

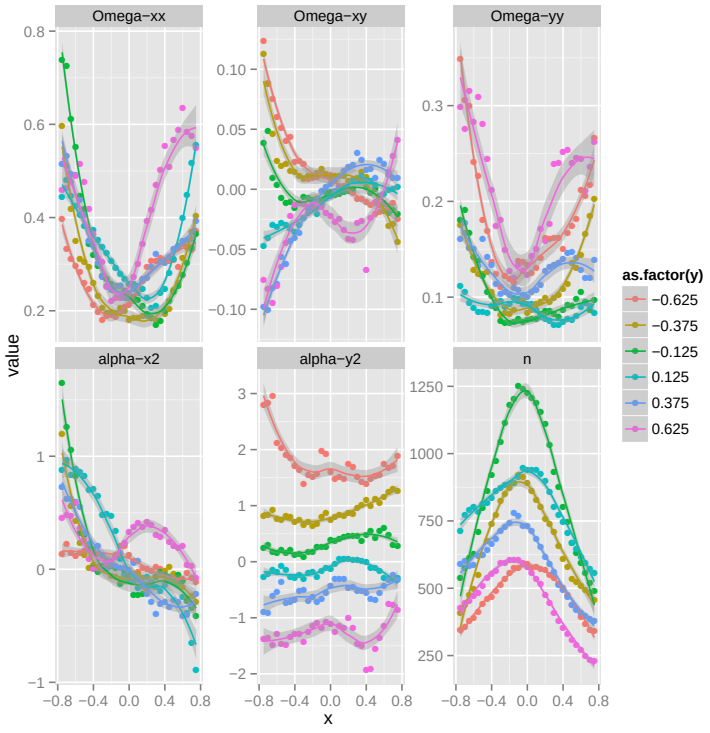

Figure 3: Multivariate skew-normal parameters over space.

4.1 Attentional Landscapes

Or do we call them hotspot maps?

4.2 ROC Analysis

Example of using our models rather than shuffle approaches.

4.3 Flow and Coarse to fine

To what extent does saccadic flow account for coarse-to-fine dynamics

4.4 Inverse Yarbus

Do these biases allow us to improve inverse yarbus performance?

4.5 Salience

Does salience explain the less likely saccades?

5 Discussion

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References

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