SHORT TECHNICAL NOTE

A new simplified manual tour, with examples in mathematica

Alex Aumann[a], German Valencia[a], Ursula Laa[b], Dianne Cook[c]

[a]School of Physics and Astronomy, Monash University; [b]Institute of Statistics, University of Natural Resources and Life Sciences, Vienna; [b]Department of Econometrics and Business Statistics, Monash University

ABSTRACT
Something here

1. Introduction

From a statistical perspective it is rare to have data that are strictly 3D, and so unlike in most computer graphics applications, the more useful methods for data analysis show projections from an arbitrary dimensional space. These are dynamic data visualizations methods and are collected under the term *tours*. Tours involve views of high-dimensional (p) data in low-dimensional (d) projections. In his original paper on the grand tour, Asimov (1985) provided several algorithms for tour paths that could theoretically show the viewer the data *from all sides*. Prior to Asimov's work, there were numerous preparatory developments including **?**'s PRIM-9. PRIM-9 had user-controlled rotations on coordinate axes, allowing one to manually tour through low-dimensional projections. It is impractical to impossible to steer through all possible projections, unlike Asimov's tours which allows one to quickly see many, many different projections. After Asimov there have been many, many tour developments, as summarized in Lee et al. (2021).

One such direction of work develops the ideas from PRIM-9, to provide manual control of a tour. Cook and Buja (1997) describes controls for 1D (or 2D) projections, in a 2D (or 3D) manipulation space, allowing the user to select any variable axis, and rotate it into or out of or around the projection through horizontal, vertical, oblique, radial or angular changes in value. Spyrison and Cook (2020) refines this algorithm and implements them to generate animations.

Manual controls are especially useful for assessing sensitivity of structure to particular elements of the projection. There are many places where it is useful. In exploratory data analysis, where one sees clusters in a projection, can some variables be removed

CONTACT Alex Aumann. Email: aaum0002@student.monash.edu, German Valencia. Email: german.valencia@monash.edu, Ursula Laa. Email: ursula.laa@boku.ac.at, Dianne Cook. Email: dicook@monash.edu
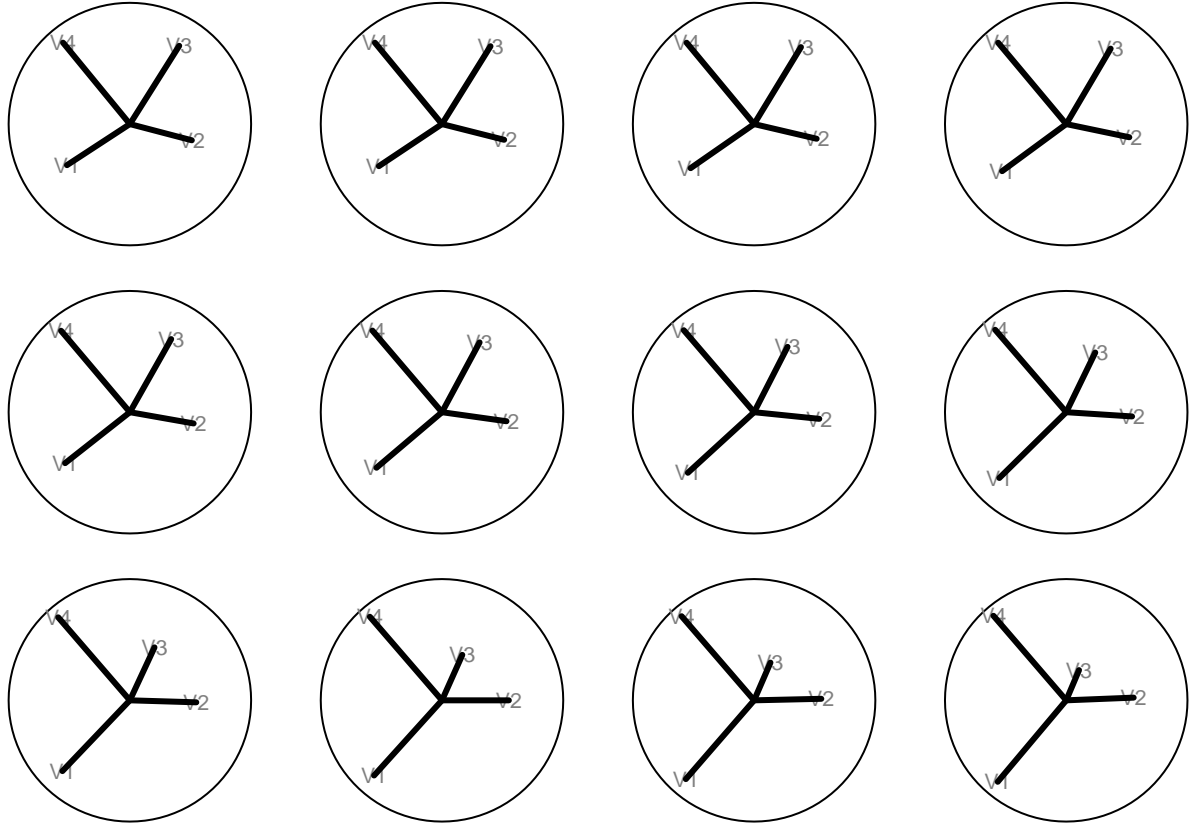
Figure 1. Sequence of projections where V3 contribution is changed.

from the projection without affecting the clustering. For interpreting models, one can reduce or increase a variable's contribution to examine the variable importance. These controls can also be used to interactively generate facetted plots (**?**), or spatiotemporal glyphmaps (**?**).

2. Manual tour

2.1. *Background*

2.2. *New definition*

3. Implementation

4. Applications

5. Discussion

Acknowledgements

Supplementary material

The source material and animated gifs for this paper are available at

References

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