Evaluation of the thesis by Filip Dechterenko

Even though scan patterns (or scanpaths) have been studied extensively using fixations recorded from static stimuli such as images, there has been much less work investigating scan patterns, in particular comparisons thereof, using data recorded from dynamic scenes such as videos.

The main part of work in the evaluated thesis concerns the comparison of groups of scan patterns, i.e., time series of gaze coordinates. Contributions include comprehensive comparison of previous methods for scan pattern comparison, new methods to compare differences between groups of scan patterns, and the use of machine learning techniques to predict and model eye movements in Multiple Object Tracking (MOT) tasks. In addition, questions concerning eye tracking methodology are addressed (effect of wearing glasses) and knowledge about eye movements in static stimuli are extended to dynamic stimuli (eye movement asymmetries).

The first chapter gives a clear introduction to the field, and covers the relevant background. Even though MOT is introduced and investigated in its own right, the chapter would benefit from a clearer motivation to why MOT is critical for scan pattern comparison (Chapter 1.7). *Why would a single moving dot not suffice as stimuli?*

Chapter 2 evaluates existing methods for scan pattern comparisons. Simulated data are used to point out strengths and weaknesses in the metrics. While it is valuable to see how the metrics behave, it may be difficult to understand what conclusions could be drawn based on the results of the simulations**.** *What conclusions can be drawn and why was the Correlation distance selected in the end?* Moreover, some recent references seem to be missing (se e.g., Anderson el al., 2015). Some motivation about the inclusion criteria of the selected measured would be welcomed.

The third and main chapter of the thesis covers significance testing for groups of scan patterns. The chapter begins with addressing the question of whether a participant changes her eye movements when taking off her eye glasses (within-subject comparison). The chapter continues with the proposal of new methods for scan pattern comparison between groups, and builds on the work by Feusner & Lukoff. The new methods were applied to real data from two experiments. Of course, the results can only tell you that there is a difference, but not the nature of the difference, something many researchers probably are interested in. *How should researchers interpret the results? What is a large/small difference?*

Finally, machine learning is used to predict and model eye movement in MOT. This black box approach showed better performance compared to current models. *There are many different machine learning tools, why was this particular approach chosen?*

Overall, the thesis reads well and has a coherent structure. In particular, I like the strong methodological focus of the thesis. The results and argumentation are generally easy to follow and appropriately presented. The methods developed in the thesis are relevant to the research community, and I appreciate the effort to make source code publically available.

I would put some extra effort in going through all the figures and making sure that the font size is sufficiently large to be readable, the font style is similar throughout the thesis, and that the figures are appropriately annotated. There are also some repeated text in the thesis (e.g., p 92).

Since the above issues are minor, I recommend accepting his thesis in its current form and awarding him a title of a doctor of philosophy (Ph.D).

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References

Anderson, N. C., Anderson, F., Kingstone, A., & Bischof, W. F. (2015). A comparison of scanpath comparison methods. *Behavior research methods*, *47*(4), 1377-1392.