Predicting an Observer's Task using Multi-Fixation Pattern Analysis

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Alfred Yarbus's seminal experiments demonstrated that human fixations vary according to a person's objectives (Yarbus, 1967). This suggests that we may be able to infer a person's task (or mental state) from their eye movements alone using techniques from machine learning. We call this approach Multi-Fixation Pattern Analysis (MFPA). Recently, Greene et al. (2012) created a Yarbus-like replication study in which observers were shown scenes and had to answer questions about those scenes. However, their MFPA algorithm failed to successfully infer the tasks given to their observers. They concluded that the Yarbus result may be incorrect. We reanalyzed their data using their analysis methodology that trained classifiers using data from all subjects, and found that more powerful algorithms can make this inference (Kanan et al., 2014). We then performed a within-subjects analysis and found that we could also infer the task given to subjects with a version of their algorithm. This finding is consistent with previous work indicating that regularities in scanpaths are idiosyncratic (Noton & Stark, 1971). We also used our algorithms to infer the image being viewed by an observer and their identity. Subsequently, we designed an eye tracking study in which observers had to make six different judgments about faces, and we gathered data from 24 subjects. Using MFPA, we were able to infer the task given to the subjects at levels above chance, indicating that humans have distinct scanpaths for these tasks.

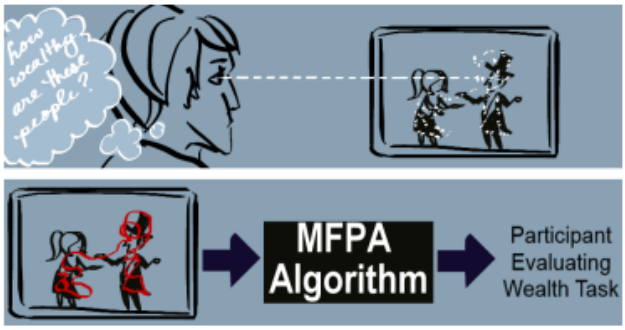

Figure 1. MFPA algorithms take a scanpath's time-series features as input and use them to make inferences about a person solely from their eye movements.

References

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