GazeVis: An Eye-Tracking Visualization Towards Predicting User Distraction

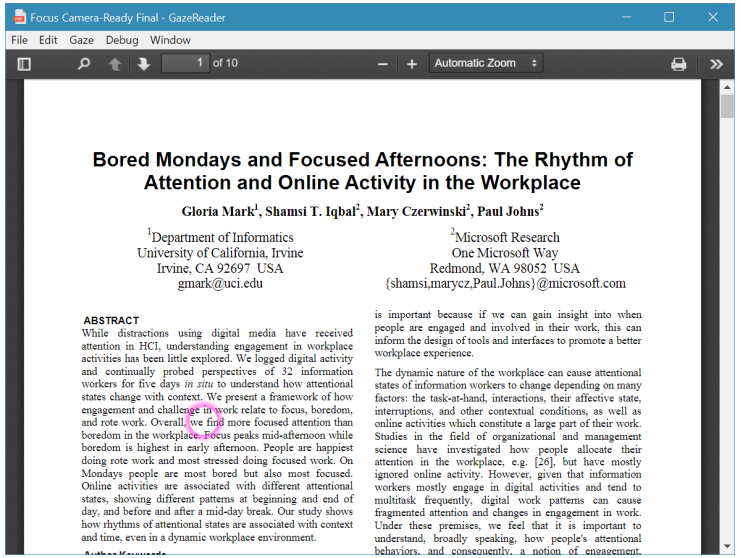
Jan Pilzer, Shareen Mahmud, Vanessa Putnum

Introduction

- GazeVis is a visualization of eye-tracking data collected from an application called GazeReader (developed in another course).
- GazeReader's interface is able to track a user's gaze pattern, as well as self interruptions while users are participating in a reading activity.

Motivation

- Reading tasks
  - Reading research papers for courses
  - Requires concentrated reading
  - Self-interruptions occur
- Self-interruptions
  - Switching applications (to a non-reading related activity)
  - Looking away



In order to prevent this from happening, we need to understand when is a user likely to self-interrupt.

Data Collection

- Fixations
  - Count, Duration
- Saccades
  - Duration, Length, Angle
- Tagged Interruption
  - Loss of focus of the Reader application

```
2017-11-12T01:06:21.913Z|FIXATIONDATA|369.73,715.79;17.47%,8.83%;<TEXT_LINE>
2017-11-12T01:06:21.915Z|FIXATIONEND|332.62,721.53;11.03%,35.74%;<TEXT_LINE>
2017-11-12T01:06:21.915Z|HEAD|6.08,107.60,702.73;-0.27,0.19,-0.07
2017-11-12T01:06:21.918Z|GAZE|357.64,718.33;15.37%,20.74%;<TEXT_LINE>
2017-11-12T01:06:21.933Z|GAZE|326.13,723.11;9.91%,43.14%;<TEXT_LINE>
2017-11-12T01:06:21.938Z|HEAD|6.08,107.60,702.73;-0.27,0.19,-0.07
2017-11-12T01:06:21.986Z|HEAD|6.08,107.60,702.73;-0.27,0.19,-0.07
2017-11-12T01:06:32.174Z|BLUR|
2017-11-12T01:06:32.175Z|ACTIVE|GazeReader.exe;Dialog
2017-11-12T01:37:11.421Z|REASON|distraction
2017-11-12T01:37:11.440Z|FOCUS|
2017-11-12T01:37:11.449Z|GAZE|872.82,534.01;4.50%,7.96%<TEXT_LINE>
2017-11-12T01:37:11.453Z|GAZE|871.96,532.24;2.08%,-0.34%<TEXT_LINE>
2017-11-12T01:37:11.456Z|GAZE|871.53,528.94;0.06%,97.28%;<TEXT_LINE>
2017-11-12T01:37:11.458Z|FIXATIONDATA|871.52,532.08;0.85%,-1.09%<TEXT_LINE>
2017-11-12T01:37:11.462Z|FIXATIONDATA|871.00,529.17;-0.04%,98.36%;<TEXT_LINE>
2017-11-12T01:37:11.467Z|FIXATIONDATA|871.55,524.30;0.06%,75.53%;<TEXT_LINE>
```

Predicting Self-Interruptions

1. Segment readings into Normal Reading, t seconds before an Interruption, and Invalid
2. Split Normal Reading into chunks of t seconds
3. Compare Normal chunks to Interruption chunks

Data Cleansing

Problem: **Varying Data Quality**

Solutions:

- Inspect and verify quality of data.
- Manually exclude low-quality regions

GazeVis: What can you do?

Inspect	Normal Reading, t seconds before an Interruption, and Invalid time chunks
Mark	Interactively mark areas that are invalid
View	Predictions of time chunks to be classified as Normal Reading or t seconds before an Interruption
Run	Prediction once finished cleaning

Demo


GazeVis
PREDICT
Fixation Count per Second
Normal Reading
Reading before Interruption
Invalid Data
Reading 1
Reading 2
Reading 3
Reading 4
Reading 5
Reading 6
Reading 7

Analysis

System	GazeVis
What: Data	Readings: Time series data of fixation events, and tagged interruptions
Why: Tasks	Analyze gaze pattern, Locate problematic data, Query cleansed data with prediction
How: Encode	Sparklines and Steplines for the fixation events, Area marks to color reading segments by type, List
How: Facet	Partition into two views with same encoding, overview-detail.
How: Reduce	Brush a sparkline area and zoom in
Scale	24 Readings, 100+ interruptions

Future Work

- Improved automatic cleaning
- Additional zooming in the predict view for inspecting segments, their associated features, and classification
- Better, more advanced prediction algorithms
- Navigation tour of the interface

Questions?