GaRSIVis: Improving the Predicting of Self-Interruption during Reading using Gaze Data

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cs.ubc.ca/labs/imager/tr/2018/garsivis github.com/Hirse/GaRSIVis



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Introduction

Our Vision:

Preventing self-interruptions during reading by analyzing gaze data.

- Self-interruptions
 - Reader initiated task switches, non reading related
 - Account for half of all interruptions and are more disruptive *Czerwinski et al. 2004, González and Mark 2004*
- Prevention
 - Self-interruptions are more disruptive than other interruptions *Katidioti et al. 2016*

Contributions

- GaRSILogger: Gaze Reading Self-Interruption Logger
 - A reading application connected to an eye tracker
 - Logs gaze data and self-interruptions

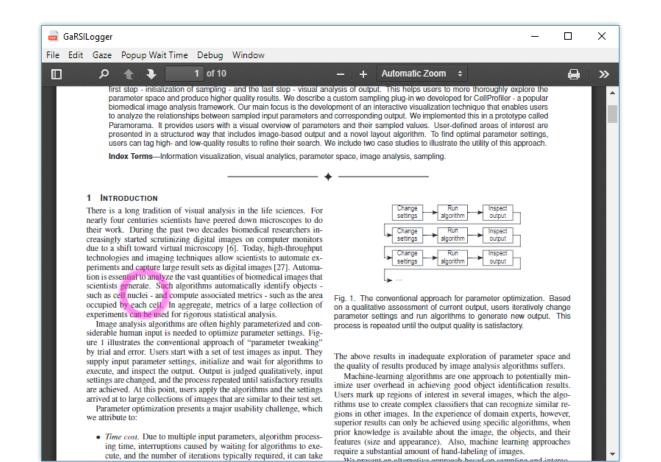
- GaRSIVis: Gaze Reading Self-Interruption Visualizer
 - A visualization front-end for gaze data cleansing
 - A prediction back-end to run as data improves
 - Relies on data collected by GaRSILogger





GaRSILogger

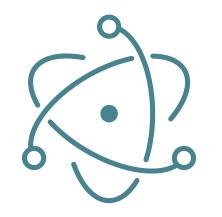
- A PDF viewer application
- Logging gaze data
 - Fixations
 - Raw Gaze
 - Head Position
- Tagging self-interruptions
 - 1. Application switches
 - 2. Absence of Gaze



GaRSILogger: Implementation



- Eye tracking using a Tobii Eye Tracker 4C (\$150)
- GaRSILogger is implemented as an Electron application rendering PDFs using PDF.js





github.com/Hirse/GaRSIVis

GaRSILogger: Data Collection

- Data collection of "natural reading"
- 24 reading sessions across 8 people
- PDF of readers' choice

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 2017-11-12T01:37:11.440Z|FOCUS| 2017-11-12T01:37:11.449Z|GAZE|872.82,534.01;4.50%,7.96%<TEXT_LINE>

- Reading sessions split into segments of three types
 - Normal reading
 - Before a self-interruption
 - Invalid (for our analysis)

You didn't look at the screen for a while.

Please tell us what you were doing by selecting the option that comes closest.

Reading related

I had to make a note, look up a term, or translate a word.

Interruption

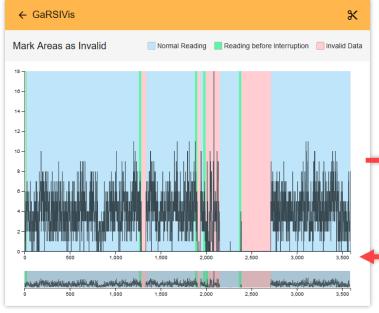
I was interrupted by a notification, a call, or another person.

Distraction

I distracted myself by checking social networks, reading articles, or my phone.

GaRSIVis

- A visualization front-end for gaze data cleansing
- A prediction back-end to run as data improves



Data Cleansing

GaRSIVis	PREDICT
Fixation Count per Second	ding 🧧 Reading before Interruption 📒 Invalid Data
Reading 1	
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Reading 3	www.witemarcharthala sistering the fight
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Reading 5	and the second state of the second state of the second state and second states at the second
Reading 6	
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Reading 7	
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Overview

Prediction Results

← GaRSIVis			CHUNK SIZE
Prediction Results	Predicted As Normal	Reading Reading before	ore Interruption 🦳 Incorrect
Avg. Accuracy: 61%	Avg. Precision: 2%	Avg. Recall: 50%	Chunk Size: 5 seconds
Reading 1	Accuracy: 84% Pr	recision: 4% Recall: 50%	~
Reading 2	Accuracy: 56% Pr	ecision: 3% Recall: 33%	^
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han and and some		مام بالمرب المحاسبة المسالية	Fixation Duration
			Saccade Duration
-			Saccade Length
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GaRSIVis: Overview

- Sparklines showing fixation count per second
- Color to encode reading segments

GaRSIVis			PREDICT
Fixation Count per Second	Normal Reading	Reading before Interruption	linvalid Data
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GaRSIVis: Overview

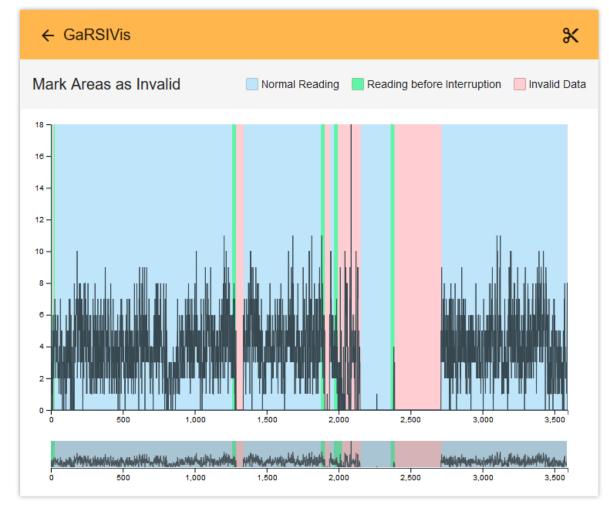
- Sparklines showing fixation count per second
- Color to encode reading segments

Fixation Count per Second



GaRSIVis: Data Cleansing

- Navigate from the overview list of readings to analyze a single reading
- Brush and Zoom for detailed
 inspection and annotation
- Mark an area as invalid to exclude from further analysis



GaRSIVis: Prediction Results

- Invalid segments of data removed
- Detailed analysis of prediction features
- Colors represent predicted label
- Misclassifications are tagged by small tick marks in gold

← GaRSIVis	CHUNK SIZE			
Prediction Results	Predicted As Normal Reading Reading before Interruption Incorrect			
Avg. Accuracy: 61%	Avg. Precision: 2% Avg. Recall: 50% Chunk Size: 5 seconds			
Reading 1	Accuracy: 84% Precision: 4% Recall: 50%			
Reading 2	Accuracy: 56% Precision: 3% Recall: 33%			
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GaRSIVis: Implementation

Front-End

- Angular as base framework
- Angular Material for design and components
- D3.js rendering SVG for visualization

Back-End

- Python WebSocket Server
- Prediction with scikit-learn
- Logistic Regression Classifier

github.com/Hirse/GaRSIVis







Preventing self-interruptions during reading before they occur.

Next steps:

- Assisted automatic data cleansing
- Comparison of classifiers
- Improved prediction model

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