An Experiment Data Analysis Framework:
Evaluating Interactive Information Behavior with R

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useR!

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Overview

1. Introduction / Background / Rutgers
2. System framework
   - Experiment System
   - Analysis System
3. Context evaluation with the framework
4. Screenshots
5. Current State (Demo) and future plans
Introduction / Background

- Information Science / Information Retrieval
  - Traditionally: Matching search request to documents
    - Query as search unit
    - Context-free search
    - Performance measure: Relevance
  - Integrating Interaction as part of the search process
    - Task as search unit
    - User’s information interaction (central) part of search process
    - Developing models that explain usefulness of content

- Need for more effort for context model evaluation
  - Initial activity in IRIX workshops and IIiX conferences (3rd time this year in New Brunswick)
  - PooDLE project @ Rutgers
The PooDLE Project
http://comminfo.rutgers.edu/imls/poodle

- **Goal:** a personalization assistant to support contextualized (i.e. personalized) information retrieval

- **Questions** we address:
  - Determination of significant contextual factors
  - Implicit identification of values of factors
  - Determination of interaction effects amongst factors
  - Construction of a computational framework for taking account of context factors and their interactions
  - Creation and Evaluation of a personalization prototype

- **What we do:**
  - Experiments (information seeking for different tasks)
  - Observing users’ interactive search behavior
  - Collect feedback on usefulness from their saved pages
  - Analyze data to find behavioral correlates of contextual features and predict usefulness based on behaviors
Technical challenges / requirements

- Large data sets
  - \( \sim 1+ \) GB of textual log data / experiment
  - \( \sim 1x \) GB of video log data / experiment

- Processing Speed of models / test / visualizations
- Flexibility (many possible models/combinations)
- Support
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  - Integration with Java (JRI)
  - Data access (RJDBC)
  - Data processing
    - Data manipulation
    - Numerical processing
    - Libraries
Overview

1) Experiment System

- Experiment system for designing and conducting interactive experiments in realistic application environments
- Analysis system for integrating and analyzing results from experiments

2) Analysis System

- Web User Interface (with Researcher Management and Data Visualization)
- Event Representation
  - Eye tracker
  - Experiment Interactions
  - Keyboard/Mouse, Web
- Model Representation (Java + R)
  - Segments
  - Models
  - User Decisions
  - Reading Behavior
- Configurable Event Reader Interface
- JRI Interface
- DB Interface (JDBC/RJDBC)

- Experiment DB
- Log files

- Event Database
- Model Database
Main features

• Integrating behavioral experiment logs and user feedback
  - Unified representation (event data)
  - Single timeline
    ▪ Synchronization of events in
    ▪ Error recovery

• Modeling on events in
  - Segmentation (semantic categorization) of events
  - Hypothesis testing and learning
Logical elements:

- Events
Logical elements:

- Events
- Segmentations
Logical elements:

- **Events**
- **Segmentations**
- **Models**
How does the framework support context evaluation?

- **Modularity**
  - Capture the context you need
  - Analyse selective contextual effects and their interactions

- **Extensibility**
  - Add own events, read them from own log files
  - Add own segmentations and models (written in R)
  - Adapt framework-based models to your needs

- **Data is separated from segmentations / models**
- **Data and models can be accessed as service and shared among researchers**
Screenshots (1) - Importing Data
Screenshots (2) – Model Selection
Screenshots (3) – Model Info & Features

General Info
Name: ScreenRegionSegmenter
Type: edu.rutgers.poodle.models.ScreenRegionSegmenter
Description: Segments Tobii eye fixations into screen regions defined by the researcher.

Model Input Features
<table>
<thead>
<tr>
<th>#</th>
<th>Feature name</th>
<th>parameter1</th>
<th>parameter2</th>
<th>parameter3</th>
<th>parameter4</th>
<th>parameter5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Screen Region name</td>
<td>x1</td>
<td>y1</td>
<td>x2</td>
<td>y2</td>
<td></td>
</tr>
</tbody>
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Screenshots (3) – Model Info & Features

Data Imports
Models

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</table>

Add Model Features

Create Feature: Screen Region

Save
name: querybox x1: 100 y1: 100 x2: 500 y2: 200

Save
name: content x1: 100 y1: 201 x2: 1000 y2: 1000
Screenshots (4) – Model Results
Screenshots (4) – Model Results
Current State and Future Work

- Context models for the prediction of usefulness

- Software
  - Experiment System prototype completed and will soon be available as open source from http://sourceforge.net/projects/piirexs
  - Analysis System will be released as open source in Fall 2010.

- Demo (on request)

- Feedback?
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Additional Slides
Definitions

• What is an event?
  - Unique, single, and smallest unit of activity
  - Marking one point in time (no time span)
  - Synchronized in one time system
  - Simple and no hypothesis
  - Typed by origination (logging source) and categorized in simple sub-types (e.g. mouse move, keystroke)
Definitions

• **What is a segmentation?**
  - Categorizes events in semantic groups
  - Pre-conditions event data for modeling
  - Segmentation is a categorization model; many can co-exist and operate on one event data set
Definitions

- **What is a model?**
  - Defines one or more hypothesis
  - Generates secondary data from events
  - Independent from events
  - Can be based on segmentation
What to do with Models?

- Models can be chained

- Models can re-use other models (Templates/Pattern)

- Models can be adapted or extended