**Literature Review Notes (from Evernote)**

***Introduction***

* What the idea behind this document is
* How it is structured

***Sections***

*Interaction*

*Engagement*

*Sequential Data Mining (or other data mining-type techniques?)*

***Longitudinal analysis of low-level web interaction through micro behaviour***

* A remote capture solution is developed, using a well-established solution as a foundation, to record data on a high-traffic website continuously for two years.
* The data that is collected is low-level; mouse movements (in the form of coordinates), mouse clicks, keystrokes, etc.
* In their analysis, they group the large amounts of interaction data into a temporal perspective.
* They find that rather than users interacting the website quicker as they become more familiar that users actually have increased periods of mouse inactively. Furthermore, the users also spend more time on the website as they become more familiar.
* In this paper, the capture solution presented in [UsaProxy] is modified to allow deployment by adding JavaScript code to the web pages rather than requiring users to set their browser to re-route all connections through a proxy server.

***Understanding users in the wild***

* They find that there is no need to collect specific information about users, such as their disabilities, as their problems can be identified through emerging behaviours in the experiments.
* *Group these two together.*

***Combining mouse and keyboard events with higher level desktop actions to detect mild cognitive impairment***

* A fully-fledged, desktop application with the aim of trying to detect mild cognitive impairment in older computer users through their interactions with the computer is presented in this paper.
* They monitor operating system events (deleting files through dragging to the recycling bin), web browser extension, and application monitoring (internet explorer, outlook, and word).
* They do collect mouse interactions but the complexity is reduced to mouse drags and phases (time periods between clicks).

***Combining data mining and text mining for detection of early stage dementia: the SAMs framework***

* More detail is provided in this paper as to the type of data/events that are collected. The desktop logger collects events in; word, outlook, file system, mouse, keyboard, and user interface systems. Potentially providing some insight into the type of events that can, or even should – in this context, be collected. Various web-based events are also captured.
* *Group these two.*

***Engagement: What is it, and how can we measure it?***

* They present a broad review of measuring and defining user engagement in a range of scenarios.
* The focus is on the reaction of users and to try and understand what engagement means with regards to initial reactions to media-based content.
* They find that that if the audience is emotionally invested in the content then their levels of engagement with the content is subsequently high.

***Measuring and defining the experience of immersion in games (might be confusing to write this one up)***

* The paper investigates if immersion can be defined quantitatively through three specific experiments. Participants switching from an immersive to non-immersive task, changes in participants eye movements during an immersive task, and the effect of an externally imposed pace of interaction on immersion and affective measures.
* They find that immersion can be measured subjectively, through questionnaires, and objectively, through task completion and eye movements.
* They define three features of immersion; lack of awareness of time, loss of awareness of the real world, and involvement and a sense of being in the task environment.
* They apply Spearman’s Rank-Order correlation on the mouse click data (the mean number of mouse clicks vs the mean number of fixations in the non-immersive condition).

***Knowing the user’s every move – user activity tracking for website usability evaluation and implicit interaction***

* This paper defines the UsaProxy – a monitoring system for web-based interactions. It modifies HTML pages by adding JavaScript tracking code before they are delivered to the client, this is done through requesting the users to re-route all of their connections through a proxy server. The code collects data on mouse movements, keyboard input, along with other common interaction metrics.
* This is the system that Aitor’s work builds from.

***Evaluating accessibility-in-use* & *Coping tactics employed by visually disabled users on the web***

* In this paper [evaluating], they isolate the problematic situations faced by users with visual impairments and the tactics they use to attempt to overcome issues while browsing the web. Once these tactics are identified they are considered as behavioural markers to indicate problematic situations with the assumption that these markers infer an issue the user is having. They develop several algorithms and package them together into a web-usage monitoring tool to automatically detect issues while users are using the web.
* This paper [coping] goes into more detail about the tactics discussed in [evaluating]. It also expands on previous analysis by going deeper into the coping tactics the users use; how they react to problems, do they give up or carry on.

***WevQuery: Testing hypotheses about web interaction patterns***

* A scalable system to query user interaction logs that allows designers to test their hypotheses about user behaviour is presented in this paper.
* It’s the combination of the work from Markel and Aitor.
* A graphical user interface allows the users to graphically define queries to run on interaction data (mouse clicks, etc.) stored in a MongoDB instance.

***Using machine learning to infer reasoning provenance from user interaction log data: based on the data/frame theory of sense making***

* In this paper, the authors successfully attempt to infer the reasoning behind analysts’ decision making from low-level user interaction logs.
* They detail some information about their data processing techniques; converting features to numeric expressions and a set of categorical labels to a set of integers (worked for Random Forest and Hidden Markov Models (scale-invariant models) but not SVM, so integers were standardised to have a mean of zero and a variance of one).
* They tested their models against a control model (no information classifier) and provided the baseline for their models to beat.

***Your mouse reveals your next activity: towards predicting user intention from mouse interaction***

* The authors of this paper aim to predict user intention from mouse movements, clicks, and positioning (as well as other features). They focus on understanding what the user intended when they triggered an interaction and predicting the type of the next action.
* They build two classification models; a probability model and a machine learning (SVM) model.
  + The probability model uses previous *k* activities of a user to predict the next activity and a second (probability) model considers the time duration of the previous *k* activities.
  + The SVM model is trained on the *k* most recent user activities, the time duration of those activities, and descriptive statistics about the mouse interactions within a set window *W*.
* In their results, they find that both model types have similar performance in their experiments and to achieve the maximum accuracy – for predicting future interactions from historical actions – the combination of both models, in to a multimodal approach, achieves the best results (an average accuracy of 69%).
* In terms of variable values, they test a range of different values for both *k* and *W* and conclude that neither can be too large, the best value for *k* is 3 and when increasing the value of *W,* they find that it introduces a lot of noise.

***A grammar-based approach for modelling user interactions and generating suggestions during the data exploration process***