Recommendation and Collaboration through Implicit Identification in Social Context

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In the field of e-learning, the identification of difficult and/or interesting parts of learning text can be useful feature for various tasks like rewriting the text, showing the student where to focus or offering help. However, methods, that acquire this information from inputs obtained by directly interacting with the user (explicit user feedback), for example by asking him to subjectively rate his comprehension, can lead to distraction in the learning process and require that users participate voluntarily.

In our work, we track implicit feedback/implicit interest identifiers including user scrolling, e.g. to which portion of text has user scrolled and what time he spent there (read wear [1]). Using statistical approach and taking intersections and overlays of timed viewports collected from many users over many page views into account, we can determine which part is the most time-consuming and therefore interesting or difficult. With enough users, details about various parts of scrollable content can be obtained very precisely, even with a precision of single words. Another basic important data consist of mouse clicks (click heatmaps) and mouse movement (flowmaps).

As in any method dealing with time based user action tracking, there is a possibility that user is pursuing different activities during evaluated time periods. While with mouse interaction it is evident that while those actions occurred, user has been truly working with content, in passive actions like scrolling to a part of content and viewing the displayed content for a period of time, we cannot determine directly from action (e.g. viewing/reading) itself whether user is working with tracked content nor even whether he is present at the computer. We try to resolve this by using camera pointed towards the user and employing two-level physical user tracking: (a) face tracking, where physical presence of user at the computer is detected and (b) eye tracking, where user gaze is evaluated. Both methods allow leaving out time periods when user is not directly using computer or in the case of eye tracking (where possible by the quality of used camera) even when he is using the computer, but he is working with different parts of screen and not with the displayed content. Readily available

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solutions allow gaze tracking with enough accuracy for content (even text) evaluation even with low-cost commercially available webcams [3], therefore apart from enhancement of the spent time evaluation we also account the gaze location as an interest indicator.

Together with scrolling and mouse interaction, we assign to each word, picture and similar atomic fragments of content:

- Gaze samples – detected periods of gaze falling onto this fragment.
- On-screen time – how long has been user viewing screen with this fragment.
- Mouse interaction – clicks, selections for copying or annotating, continuous selecting (typically used as reading position aid), mouse-over events, etc. related to this fragment.

Based on these data, we calculate an attention index for each fragment similarly to attention time in [3]. Attention index of larger blocks is sum of attention indexes of its child fragments. These data are then used for document summarization and recommendation, document review recommendation and possibly even translated back to scrolling via content-adapted assistance to scrolling [2].

Subsequently, readily available data of user's active fragments of content can not only be used for content fragments identification and recommendation, but also in a social context. By augmenting the displayed content with indication of active fragments of other users, we provide users with information how are they doing in comparison with others. We are also hoping to increase user collaboration by providing ordinary user messaging augmented with indication of where each user (friend) currently works (reads) in the same content. This gives the user an option to contact those friends who are currently thinking about the same portion as he has problem with. As the user asks friends learning the same part, he is not distracting them away from their current study and he also obtains better advice.

While the main evaluation platform is ALEF (Adaptive LEarning Framework) system, one of the possibilities we consider for implementation is through Adaptive Proxy which would also readily bring this concept to open space (Web).

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References

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