Analysing User Gaze on the Web

Patrik HLAVÁČ*

Slovak University of Technology in Bratislava
Faculty of Informatics and Information Technologies
Ilkovičova 2, 842 16 Bratislava, Slovakia
patrik@hlavac.sk

In our research, we propose a method for reading detection from gaze data. Eye tracking devices provide irreplaceable information about a user's gaze. An important part when working with web educational system is the information about the extent with which the user is interacting with the environment. We can distinguish the following conditions: whether the user is present; whether the user is watching; whether the user is reading; whether the user is learning. These tasks relate to each other and are gradually shifting the level of complexity to the problem of detecting reading and determine the status of learning. Our algorithm takes into account user's fixation data and maps their coordinates onto single word elements. These are then processed with respect to their relative word distance. Rule-based solution works by considering the sequences in the order of their occurrence. Unlike studies that calculate distance in points that eyes moved around the screen, we consider the distance of words in the vector.

Whilst existing solutions are based on tracking user behavior using peripheral devices such as mouse and keyboard [1], actual options offer us direct tracking of user gaze and focus block of content on the website. Thus, it can improve the accuracy of the information in the user model.

One of the first uses of reading detection was tracking the reader's interest in levels [3]. Number of readings of the word suggests its importance in understanding the text. Tokens that correspond to individual actions were defined. Due to gaze movement and direction, the performed actions were rated and the amount of the accumulated points determined whether it is read or only scrolled through the text.

A newer method is reading detection method independent on content [2]. The detection is performed on the basis of the characteristics observed saccades of the eye. It compares the information about the speed and direction of eye saccade. It determines whether it is a reading comprehension, or passing the text by using SVM classifier.

Along with information of interaction with the words we create a vector model for user content within a domain. Document Reading Model represents all instances of scanned words with records of properties and characteristics of the current session.

---

* Supervisor: Marián Šimko, Institute of Informatics and Software Engineering

Spring 2015 PeWe Workshop, April 11, 2015, pp. 107–108.

These contain the calculated value of the reading interest for single words along with the total number of fixations and length of viewing words. The obtained information is used to analyze user's reading and possible adaptation.

By viewing the text as a continuous vector of words, which the reader is trying to understand, we can still analyze fixation, eye saccades and their derivatives, and it allows us to separate from the spatial information.

Each word is stored in its original sequence in the list with attributes for each word, creating a model. Since reading is a sequence of successive fixations, the proposed algorithm is based on increasing the variable of user interest.

We consider the following variable of reading interests (RI), which maintain the current state of reading intensity. The sequence of fixation determines the variable growth, or penalty. While reading nearby words, RI is increasing and marking passed words with actual RI value. Variable storing Updating value (UV) indicates how the RI will change due to activity among words. The base value will be further selected according to results from experiments, but it is based on the level of words approach, so it is subtracting the position index of the current word and the previous word in the vector, to determine the specific distance between words.

In order to evaluate our detection method, a user study with volunteers was made. To obtain a dataset of user sessions we chose eight articles written in popular science style, containing 313 words in average. Articles are drawn in paragraphs, where from each we deduce issue mapping the content of paragraph. We use Tobii TX300 Eye Tracker with Tobii Studio software for collecting gaze data. This device provides us with approx. 850 000 gaze data rows per user session.

Detecting genuine reading is a challenge and a prerequisite for accurate modelling of the user, e.g. in adaptive systems. This paper provides insight into the current state of research and using of the eye tracker to detect reading.

Extended version was published in Proc. of the 11th Student Research Conference in Informatics and Information Technologies (IIT.SRC 2015), STU Bratislava, 163-168.

Acknowledgement: This contribution was created with the support of the Ministry of Education, Science, Research and Sport of the Slovak Republic within the Research and Development Operational Programme for the project University Science Park of STU Bratislava, ITMS 26240220084, co-funded by the ERDF.

References

[1] Atterer, R., Schmidt, A.: Tracking the interaction of users with AJAX applications for usability testing. In: Proceedings of the SIGCHI conference on Human factors in computing systems. ACM, 2007. pp. 1347–1350.

[2] Biedert, R., et al.: A robust realtime reading-skimming classifier. In: Proceedings of the Symposium on Eye Tracking Research and Applications. ACM, 2012. pp. 123–130.

[3] Campbell, C.S., Maglio, P.P.: A robust algorithm for reading detection. In: Proceedings of the 2001 workshop on Perceptive user interfaces. ACM, 2001. pp. 1–7.