Universal Eye-Tracking Based Text Cursor Warping

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Eye tracking systems are about to become mass market (at least we all hope that ...). Investigate how we can improve real world document interaction: edit support.

Implemented cursor placement / pointing system using OCR techniques.

Runs on Windows, when user presses hot key: searches for salient regions around gaze position, performs virtual click at found position.

Evaluation in realistic test environment shows: for some users dramatic speed up compared to keyboard / mouse, if used properly (num. of reposition attempts).

Available at lightning.text20.net (open source, BSD license).

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1. Motivation

• Assume we have a low-fi eye tracking device at home or at work. How can we make text editing more efficient?
• Especially coding requires many relocations of cursor position: high manual overhead, and document does not change at all ...
• Can’t we make use of gaze position; robustly and cross application? Simple „use gaze pos“ won’t work, due to non-linearity of edit grid (hit the wrong line and your cursor position is placed far away)

2. System Overview / Architecture

• Technically implemented as Windows application. Runs in background, monitors raw gaze data and keyboard events.
• Upon the press of a hot key: Take screenshot around current gaze pos., perform analysis / OCR for salient regions (see image below)

3. Experiment

• Created virtual working environment, w. two document classes: „code“ & „plain text“
• Conducted three studies: algorithm selection study, usability study, performance study.
• In the selection study we tested which saliency method works best. Using synthetic gaze data we found out that OCR method provided best results
• For the usability study and performance study we created a virtual work environment (see image to the right) that presented edit tasks and provided either the OCR method or a dummy method for comparison. Various timings and interaction metrics were recorded.

4. Evaluation

• Usability study: 11 participants asked to use two warping tools (double blinded as A / B to both experimenter and subjects). Performed multiple edits in environment and rate methods.
• Overall OCR clearly identified over dummy: “For my daily work I would prefer to have OCR / dummy in ...
• Performance study: 8 users, solve tasks as quickly as possible (compare Fig. 1, left scale). For some participants gaze repositioning was dramatically faster (several hundred ms), others were better with keyboard / mouse.
• Investigating the differences: Performance strongly correlated with num. of attempts to reposition w. gaze. Best strategy: reposition once w. eye tracking, then use keyboard / mouse

5. Conclusion & Outlook

• Implemented cross application text cursor warping tool
• Open source, feel free to download and test it yourself
• Interesting extension would be icon saliency detection
• However, ideally we would like to have native operating system & application support for this …