Winklick:♂ A Faster Algorithm for Detecting Eye Movement with Mobile Devices

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Eye tracking systems are one of most common ways to help patients overcome their physical disabilities and communicate with other. However, the common drawback most eye trackers have is that unaffordable external hardware is required and the setup is complicated. Thus I developed Winklick system which can trace pupil movements and detect eye blinks to generate every single touch event using only a single smart phone which everyone can easily use. Winklick is based on the relative coordinate system simplifying the structure of the entire algorithm. To reduce the influence of light source, histogram equalization algorithm is used. Also, user's face and eyes are detected through Haar Cascade classification so that Winklick system can actively cope with the user's movements. Flood-fill algorithm is used on the thresholded binary image to remove recognition error factors such as eyelashes and hair. Through mathematical classification and analysis of eye structure, I induced five major variables of eye features to identify the location of the pupil and to detect user blinking. For example, detecting average brightness of eye area is more accurate to trace horizontal movements than detecting the height of eye area. Also, because human eyelids are fluid and different for each person, horizontal pupil movements are detected with k-means unsupervised machine learning algorithm on the input dataset of users eye features. Using this system, a letter is written in every 2.45 seconds on average 4.3 times faster than the existing eye tracking system. I believe that Winklick will encourage people who have difficulty getting information to create new things and enable people whom society once considered to be disabled to change our world.

Awards Won: