Eyescores: an open platform for secure electronic data and photographic evidence collection in ophthalmological field studies

In ophthalmological studies, the need to take photographs as evidence introduces additional complications to fieldwork. A recent report[1] highlighted the usefulness of smartphones in the collection and grading of photographic evidence of trachoma. We have recently considered the wider potential of portable computerised equipment to integrate the recording and management of trachoma photographs with field data and biological specimens.

While the overall resolution of smartphone cameras increases rapidly, an outstanding issue with smartphone photography is the phenomenon of shutter lag, a significant time interval between actuation and the recording of an image. Shutter lag is associated with image blurring as the subject or camera may have moved out of focus by the time of image recording. Recently released smartphones such as the HTC One X and Samsung Galaxy S3 are robust against shutter lag, but are currently the exceptions in a telephony market that has responded slowly to the problem. Light Field Photography (LFP) technology (http://www.lytro.com) has the potential to eliminate blurring and increase the amount of information available to the researcher. LFP cameras generate images that can be viewed and analysed on multiple focal planes. With portable LFP cameras as yet untested in a medical setting and with shutter lag a continuing problem for smartphone cameras, we continue to view digital single lens reflex (SLR) photography as the gold standard for trachoma studies. Smartphone applications such as Epicollect[2] and OpenDataKit (http://www.opendatakit.org) have made attempts to integrate electronic data capture with photographic evidence, but while smartphones may be convenient for photographic purposes, a previous study found that Netbooks may be superior to smartphones for high-quality electronic data collection[3] and our own experiences support this.

With these issues in mind, we developed 'Eyescores', a flexible, open and modifiable software/hardware platform for the collection and management of data, bio-samples and photographs in trachoma and other ophthalmological field studies. Integral to the system is the use of an Eye-Fi memory card (EYE-FI Inc. Mountain View, California, USA) in a digital SLR camera. This inexpensive (~$50) hardware device is used to create a local wi-fi connection between any camera with a secure digital (SD) memory slot and a netbook computer. Eyescores allows data transfers, watermarking and renaming of photograph image files in real time with almost zero user involvement. Eyescores is customisable, minimises user involvement in data entry and validates data using the powerful language of regular expressions. Data is stored in customisable formats and is automatically backed up to external solid-state USB hard drive. Eyescores performs on-the-fly encryption of subjects' personal data using openSSL (secure sockets layer) protocols (http://www.openssl.org). This makes the transfer of data files by email, cloud server or other similar electronic connections a secure and practical option for data management and sharing between sites. From the point of collection, Eyescores data is fully protected against loss or theft of the computer.

We trialled Eyescores on 93 samples from The Gambia which had been surveyed using paper forms 2 years previously. We found good accordance between the two data sets and being satisfied with the outcome of our trial, we have now fully deployed Eyescores in our ongoing trachoma field studies in Tanzania. Since February 2012 we have collected more than 800 samples without significant incident or error and with zero missing data.

Eyescores is written in the programming language Perl. It runs on very low-specification hardware, is cross platform and is reasonably simple to install. Support is available from the authors if you wish to implement Eyescores. This software is released under the GNU General Public License. To download Eyescores in its current beta version or to view examples of the data output, please visit http://chrissyhroberts.lshtm.ac.uk/eyescores/

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