

# Producing and Reading Annotations on Paper Documents: a geometrical framework for eye-tracking studies

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## Abstract

The printed textbook remains the primary medium for studying in educational systems. Learners use personal annotation strategies while reading. These practices play an important role in supporting working memory, enhancing recall and influencing attentional processes. To be able to study these cognitive mechanisms we have designed and built a lightweight head mounted eye-tracker. Contrary to many eye trackers that require the readers head to stay still, our system permits complete freedom of movement and thus enables to study reading behaviors as if they were performed in everyday life. To accomplish this task we developed a geometrical framework to determine the localization of the gaze on a flattened document page. The eye tracker embeds a dual camera system which synchronously records the reader's eye movements and the paper document. The framework post-processes these two video streams. Firstly it performs a monocular 3D-tracking of the human eyeball to infer a plausible 3d gaze trajectory. Secondly it applies a feature point based method to recognize the document page and estimate its planar pose robustly. Finally it disambiguates their relative position optimizing the system parameters. Preliminary tests show that the proposed method is accurate enough to obtain reliable fixations on textual elements.