



Abstract: WeLineation

STAPLE-Based Crowdsourcing for Image Segmentation

Malte Jauer¹, Saksham Goel², Yash Sharma², Thomas M. Deserno¹

¹Peter L. Reichertz Institute for Medical Informatics of TU Braunschweig and
Hannover Medical School

²Indian Institute of Technology Bombay
malte-levin.jauer@plri.de

WeLineation [1] is a web-based platform supporting scientists of various domains to obtain segmentations, which are close to ground truth (GT) references. A set of image data accompanied by a written task instruction can be uploaded, users can be invited or subscribe to join in. After passing a guided tutorial of pre-segmented example images, users can provide segmentations. The Simultaneous Truth and Performance Level Estimation (STAPLE) algorithm generates estimated ground truth segmentation masks and evaluates the users performance continuously in the backend. As a proof of concept, a test-study with 75 photographs of human eyes was performed by 44 users, collecting 2060 segmentation masks with a total of 52826 vertices along the mask contour. The number of inexperienced users required to establish a reliable STAPLE-based GT and the number of vertices the user's shall place were investigated [2]. Between 27 and 37 segmentation masks were obtained per image. Requiring an error rate lower than 2%, same segmentation performance is obtained with 13 experienced and 22 rather inexperienced users. More than 10 vertices shall be placed on the delineation contour in order to reach an accuracy larger than 95%. In average, a vertex along the segmentation contour shall be placed every 81 pixels. The results indicate that knowledge about the users segmentation performance can reduce the number of segmentation masks per image, which are needed to estimate reliable GT. Therefore, gathering user performance parameters during a crowdsourcing study and applying this information to the assignment process is recommended. In this way, benefits in the cost-effectiveness of a crowdsourcing segmentation study can be achieved.

References

1. Goel S, Sharma Y, Jauer ML, et al. WeLineation: crowdsourcing delineations for reliable ground truth estimation. Proc SPIE. 2020;11318. (in press).
2. Jauer ML, Goel S, Sharma Y, et al. STAPLE performance assessed on crowdsourced sclera segmentations. Proc SPIE. 2020;11318. (in press).