

A Smart Annotation Tool for Surgical Images

Efficient Generation of Semantic Segmentation Data

Bachelor's or
Master's Thesis

Context

Semantic Segmentation is a per pixel classification of images (e.g. *pixel [184, 553] belongs to class liver*) and an essential component in cognitive robots for surgery. Deep Learning approaches for semantic segmentation outperform more traditional approaches, but require substantial amounts of training data. Generating this training data, consisting of input images and ground truth annotation masks, is costly as highly trained medical personnel annotates complex scenes in a labor intensive processes.

Annotating surgical images with tools such as the one shown in Figure 2 is frustrating, because the available tools were not developed for the domain of cognitive surgical robots, but autonomous driving. Drawing polygons is tedious as there are very few straight lines, and color based algorithms, such as watershed, fail because the contrasts are low and most objects are reddish.



Figure 1: © Paul Kinsella

Goal

Create a surgical annotation tool that fits the domain of surgical images to reduce the cost of annotating surgical images.

Possible approaches include, but are not limited to

- a new manual tool (for example fitting geometric shapes to the scene)
- an algorithmic tool (for example based on designed image features)
- a tool that utilizes a previously trained segmentation model (generating annotation proposals)
- a Reinforcement Learning based tool, that learns the annotation process through interaction

Task Summary

- Survey the state of the art in tools for pixel-wise image annotation and analyse related work to this topic
- Design a novel annotation tool in close contact with our surgical users from Heidelberg University Hospital
- Deploy the new tool in our web based annotation framework
- Evaluate the tool in close collaboration with surgical experts from Heidelberg University Hospital.

Concrete plans will be worked out together with your individual knowledge and preferences.

Your Profile

Motivated student of computer science, electrical engineering, physics, mathematics, or mechanical engineering with an interest in **computer vision or deep learning**. Prior knowledge in both fields is not necessary, but advantageous. Solid programming skills and very good English or German language skills are required. Interested in research between theory and practice in an interdisciplinary team.

Contact

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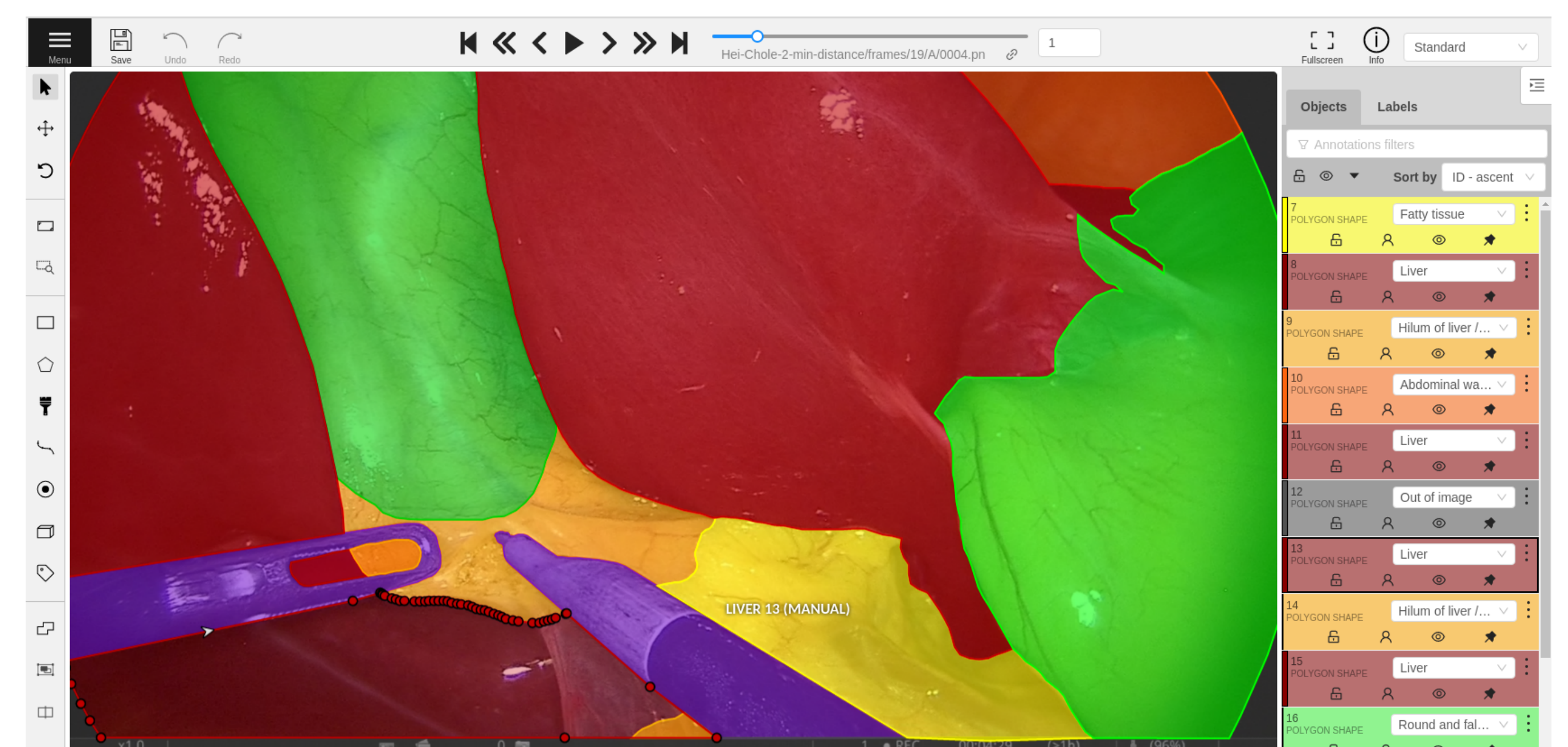


Figure 2: Computer Vision Annotation Tool (CVAT)