



The Annotation Exchange Format for Images (AXFI)

Overview

Image annotation and segmentation is an important analytic process in many scientific, technical, and commercial fields. Nonetheless, there are few standard formats for describing and representing image annotations, and those which do exist tend to be used in specific, relatively narrow contexts.¹ This is not a new observation; Daniel L. Rubin *et. al.*, in 2007, note that:

Images contain implicit knowledge about anatomy and abnormal structure that is deduced by the viewer of the pixel data, but this knowledge is generally not recorded in a structured manner nor directly linked to the image. [Moreover,] the *terminology* and *syntax* for describing images and what they contain varies, with no widely-adopted standards, resulting in limited interoperability. The contents of medical images are most frequently described and stored in free-text in an unstructured manner, limiting the ability of computers to analyze and access this information. There are no standard terminologies specifically for describing medical image contents — the imaging observations, the anatomy, and the pathology. [N]o comprehensive standard appropriate to medical imaging has yet been developed. A final challenge for medical imaging is that the particular information one wants to describe and annotate in medical images depends on the *context* — different types of images can be obtained for different purposes, and the types of annotations that should be created (the “annotation requirements” for images) depends on that context. For example, in images of the abdomen of a cancer patient (the context is “cancer” and “abdominal region”), we would want annotations to describe the liver (an organ in the abdominal region), and if there is a cancer in the liver, then there should be a description of the margins of the cancer (the appearance of the cancer on the image). (http://cedarweb.vsp.ucar.edu/wiki/images/d/d9/R_19.pdf, pp. 1-2).

These challenges inspired **AIM** (the “Annotation and Image Markup” project), which “provides a solution to the ... imaging challenges [of]: No agreed upon syntax for annotation and markup; No agreed upon semantics to describe annotations; No standard format ... for annotations and markup” (<https://wiki.nci.nih.gov/display/AIM/Annotation+and+Image+Markup+-+AIM>). However, **AIM** itself has not been widely adopted outside the specific field of cancer research and cancer-oriented image repositories.

¹Current formats include AIM (Annotation and Image Markup), CVAT XML (CVAT is the Computer Vision Annotation Tool), DICOM-SR (Digital Imaging and Communications in Medicine Structured Reporting), PASCAL VOC XML (Pattern Analysis, Statistical modelling and Computational Learning Visual Object Classes), and COCO JSON (Common Objects in Context).