A DICOM-Embedded Annotation System for 3D Cross-Sectional Imaging Data

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Introduction

- Annotation of imaging data, especially in 3D cross sectional imaging, remains a pain point for AI researchers
  - Few common storage standards
  - Few free user-friendly annotation tools and visualization methods
  - Standard programmatic visualization tools are typically unfavorable
    - Programmatic tools like Matplotlib, Jupyter Notebook, and CSV are not suited for 3D
- Improvement of annotation and visualization techniques is crucial long-term for AI model development.
  - Scarcity of quality public data is becoming the major bottleneck to advanced performance

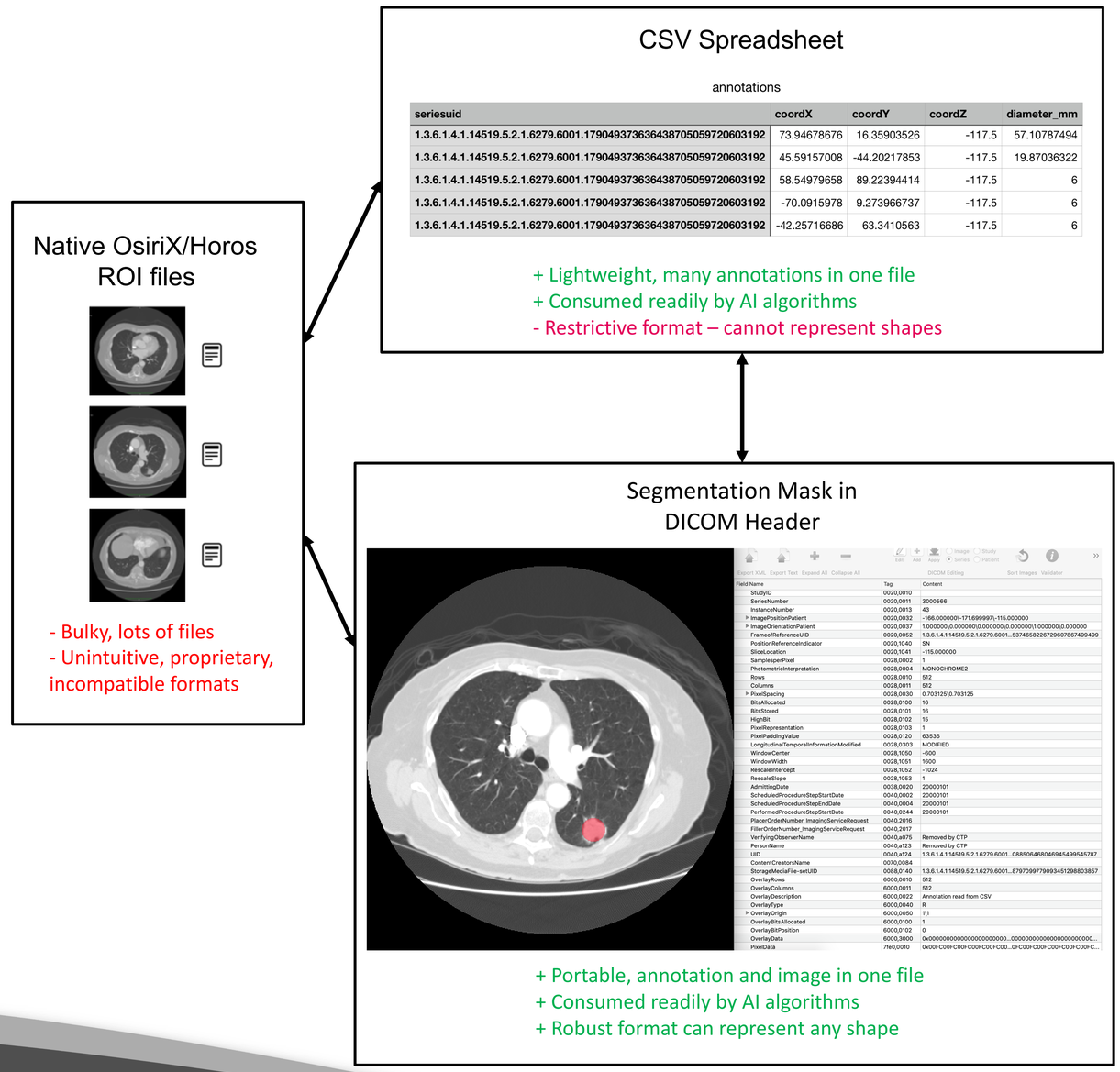
Goals

Create a standardized DICOM-embedded data annotation and visualization workflow usable by radiologists and computer vision researchers.

1. Use a python-compatible DICOM viewer such as Horos / OsiriX to draw annotations.
2. Embed annotation directly as a segmentation mask in the DICOM header to maximize compatibility.
3. Export annotations to point-and-radius CSV format used by the LUng Nodule Analysis 2016 (LUNA) challenge usable by computer vision researchers.[1]
4. Create a reverse pipeline for visualizing machine predictions

1. https://luna16.grand-challenge.org/Home/

Flow



How To Use

For radiologists generating data:

1. Draw annotation using Horos
2. Open pyOsiriX (tool for executing python code in Horos)
3. Run the export_roi.py script.

For engineers visualizing machine predictions:

1. Locate predictions CSV file
2. Open pyOsiriX
3. Run the import_from_csv.py script.

Discussion

A widely compatible DICOM-native annotation pipeline with strong support for data visualization was created to facilitate computer vision projects involving 3D cross-sectional data.

Effective annotation and visualization are among the most important factors towards successful deep learning model development. Our tool supports all annotation shapes, including oval, rectangular, polygon, and penciled ROIs. Leveraging the DICOM header overlay tags makes data visualization intuitive and compatible with most DICOM viewers. Our pipelines bridge between radiologist annotations in DICOM viewers and machine learning friendly formats to generate larger datasets, ultimately facilitating radiological machine learning research.

Find our source code at:
https://github.com/bdrad/pyOsirixScripts