

# SlicerTrack: an open-source research toolkit for target tracking verification in 3D Slicer

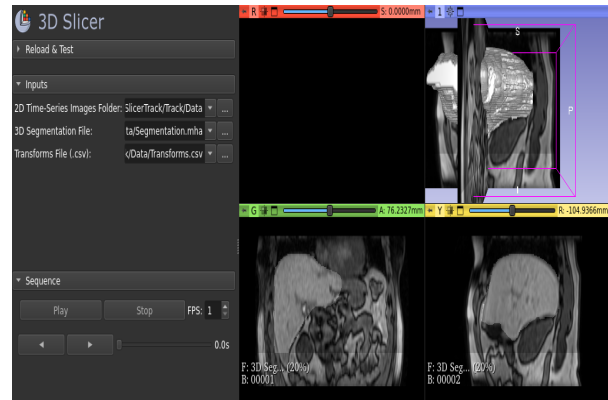
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**Introduction:** As global research efforts are made to further advance the state-of-the-art in image-guided medical interventions, image processing tools supporting such research are further needed. 3D Slicer is one of these tools, and provides powerful functionality supporting medical image informatics, segmentation, and registration [1]. However, 3D Slicer lacks a dedicated and dynamic method of presenting the results of tracking a region of interest (ROI) within a set of medical images. This paper presents an extension to 3D Slicer to replay cine 2D images while depicting the overlay of the ROI. This tool is intended to be used for the development, visual verification, and performance comparison of methods for ROI motion tracking.

**Methods:** We used 3D Slicer to develop the SlicerTrack extension, for visualizing the tracking results of a ROI as it moves through a set of cine 2D images. 3D Slicer was chosen due its abundant documentation, its established culture of open-source extension development, and its popularity within the medical image computing space. 3D Slicer provides a Python API for easy extension development, as well as an extension development wizard which provides boiler-plate code leveraging the Python API. This code was modified and extended for the development of SlicerTrack. The extension was developed in adherence to 3D Slicer's "Observer MVC" architecture [2], which is represented by the MRML nodes (model), the GUI (view), and the logic (controller). The extension was tested by visually confirming that the overlay was accurately tracking the ROI during playback.

**Results:** SlicerTrack accepts three inputs from the user: a set of cine 2D images, a 3D segmentation of the ROI, and transformation data in CSV format. The transformation data is a list of translations which represents the registration



**Fig. 1.** SlicerTrack playback still (ROI shown in light gray)

results of the ROI from each 2D cine image to a 3D reference image. It is used to align the 3D segmentation against the 2D images. Users can press "Play" to begin the alignment playback, and the overlay of the 3D segmentation is shown. The user is able to pause at any moment and to go to the previous or next image as needed. A FPS input box is provided to allow the user to change the playback speed. The SlicerTrack extension has been made available on Github [3].

**Conclusion:** SlicerTrack is an open-source toolkit for visualizing target tracking results. It enables researchers to evaluate the efficacy and performance of tracking methods. It provides various areas of medicine with a tool for tracking the region of interest (ROI) within medical images with ease.

## References:

- [1] Pieper et al. IEEE Cat No. 04EX821 (2004).
- [2] Pieper, S. National Alliance for Medical Image Computing. (2008).
- [3] Laboratory for Translational Medicine. <https://github.com/laboratory-for-translational-medicine/SlicerTrack>. (2022).