

AI-based Segmentation in 3D Slicer

Sonia Pujol, Ph. D Brigham and
Women's Hospital , Escola de Medicina
de Harvard Boston. MA

Manual vs AI-powered Segmentation

As imagens médicas têm sido tradicionalmente segmentadas manualmente, o que é um processo demorado que requer esforço intensivo de radiologistas e está sujeito à variabilidade inter-reader.

Manual vs Segmentação por IA

Na última década, a segmentação de imagem tem sido alimentada pelo desenvolvimento de algoritmos de aprendizagem profunda (por exemplo, nnUNet pelo Centro Alemão de Pesquisa de Câncer (DKFZ)/Helmholtz Research).

As ferramentas de segmentação alimentadas por IA podem reduzir o tempo de segmentação e proporcionar resultados mais reproduzíveis.

Terminologia

A is an AI algorithm that was trained to perform a specific task (e.g. brain tumor segmentation model).

The Weights of an AI model are small numbers that determine how much importance the model gives to different image features.

During the Training phase, a Model learns patterns from data labelled by experts and adjusts its weights to improve its predictions.

During the Validation/Test phase, the model is evaluated on a separate set of data not used during the Training phase.

During Inference, the model is applied to new datasets to perform the specific task it was trained for.

3D Slicer AI Workshop

This tutorial focuses on running inference tasks using various pretrained AI models for automated segmentation of anatomical and pathological structures.

MONAIAuto3DSeg Slicer extension

This tutorial uses the pre-trained models of the MONAIAuto3DSeg Slicer extension.

The tool is designed to work on laptops or on average desktop computer without a GPU.

MONAIAuto3DSeg Slicer extension

Multiple modalities Support (CT, MRI).

Multiple anatomies (head, thorax, abdomen, pelvis, etc.).

Multiple pathologies (tumor, hemorrhage, edema).

Slicer AI Tutorial: Segmentation

Tasks

Segmentation Task #1: Prostate.

Segmentation Task #2: Brain Glioma.

Segmentation Task #3: Whole Body Segmentation.

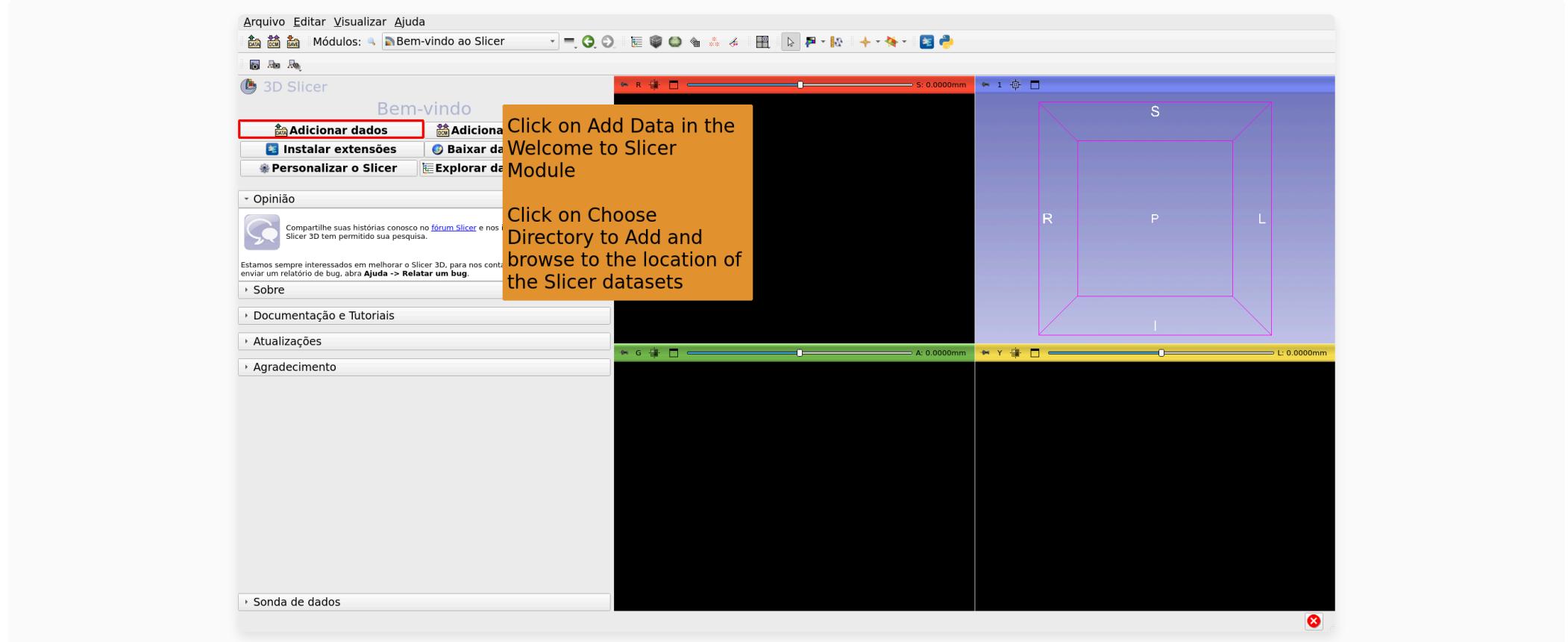
AI Segmentation Task #1: Prostate

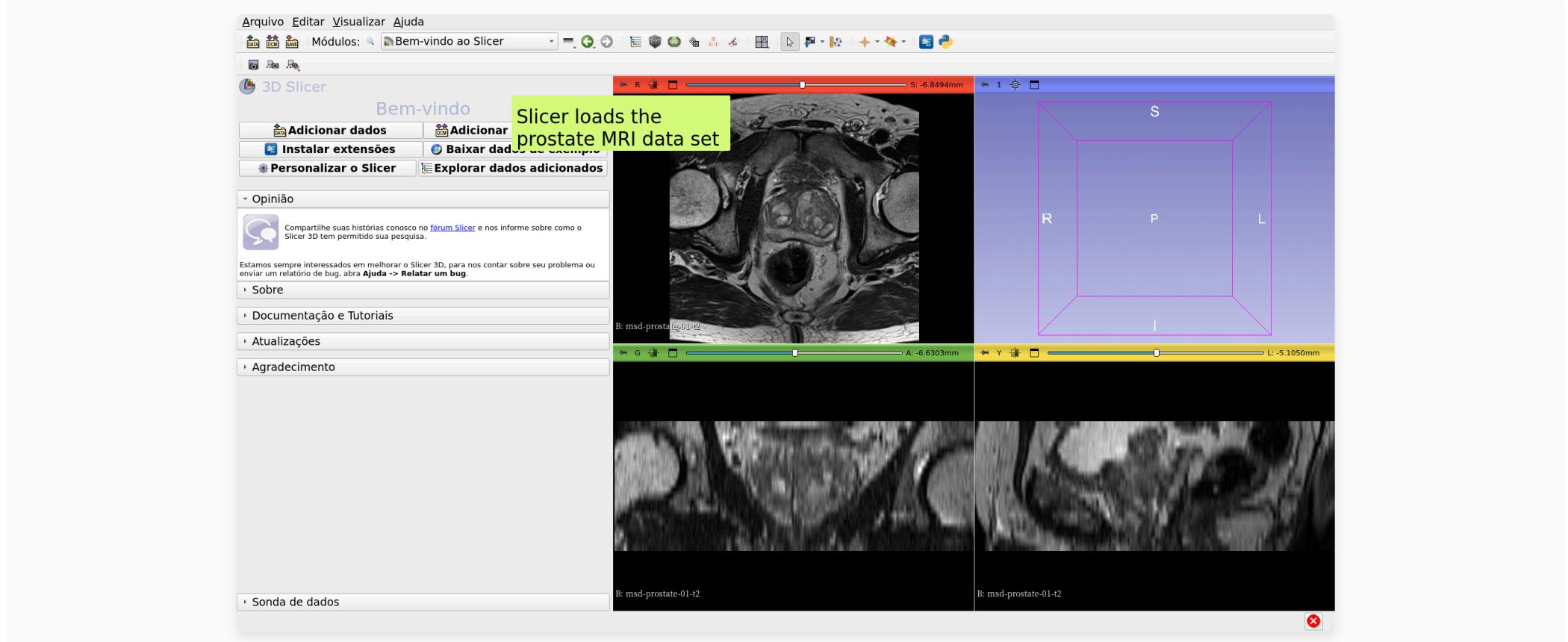
AI-based Segmentation of Peripheral Zone (PZ) and Transition Zone (TZ) of the prostate on T2-weighted MRI Images.

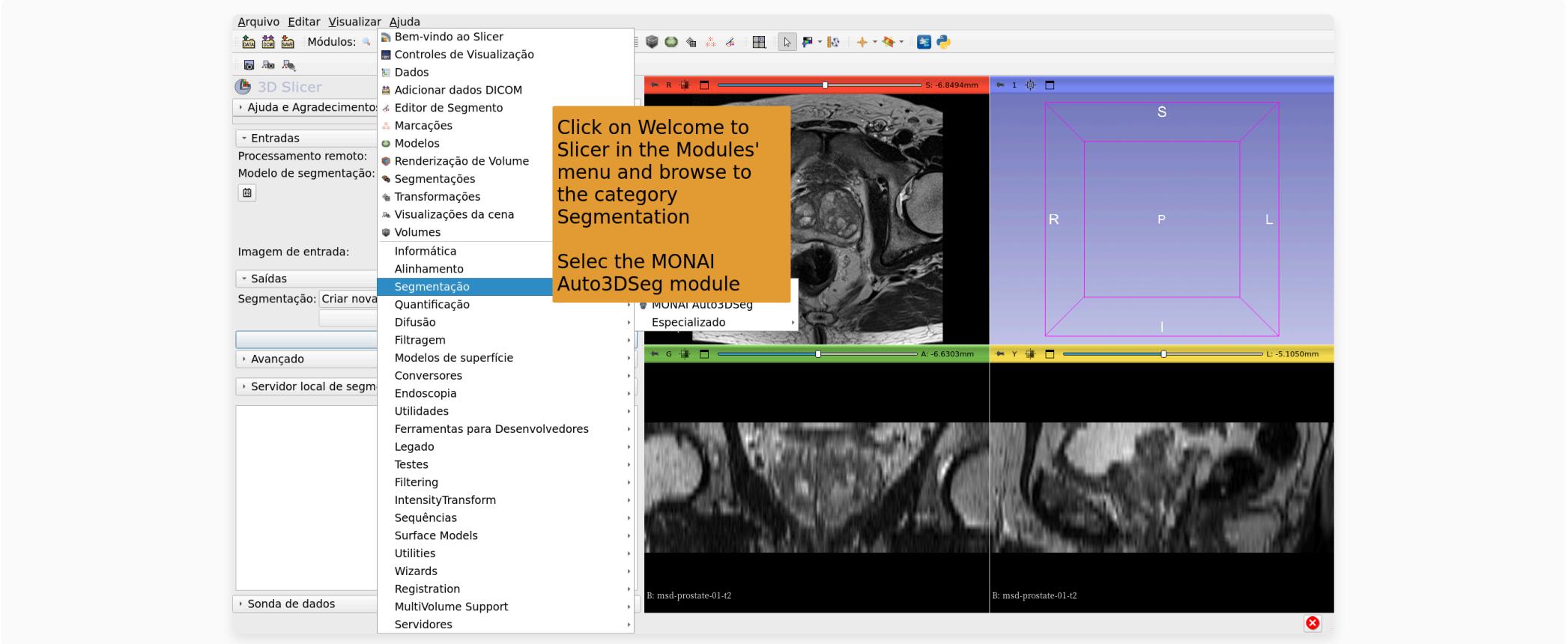
Dataset:

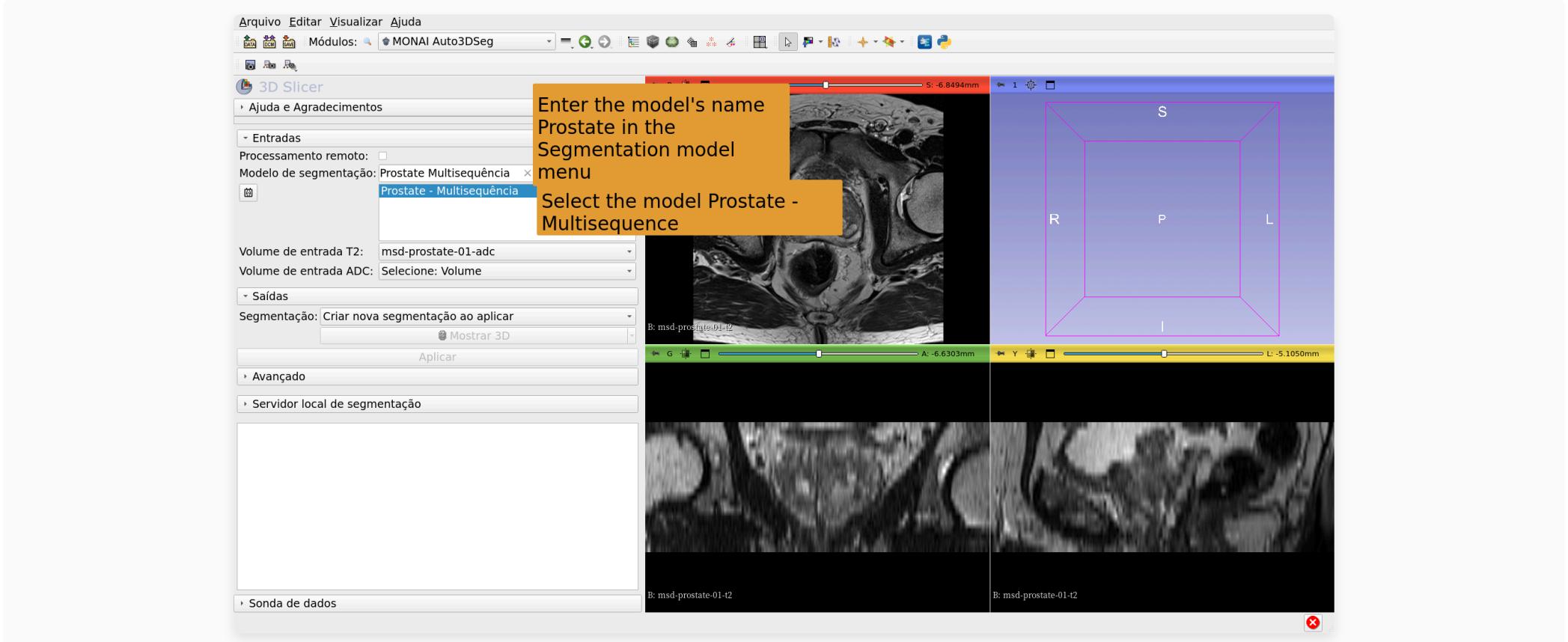
msd_prostate_01-t2

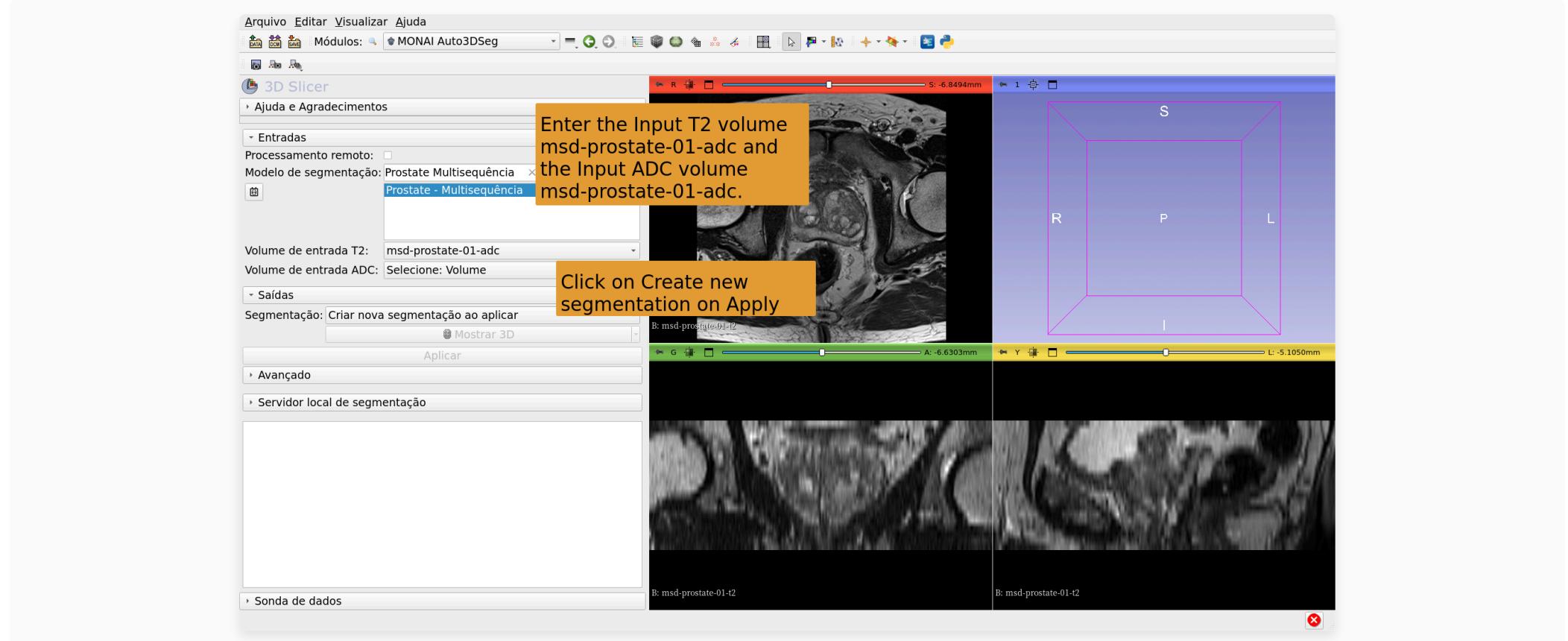
msd_prostate_01-adc

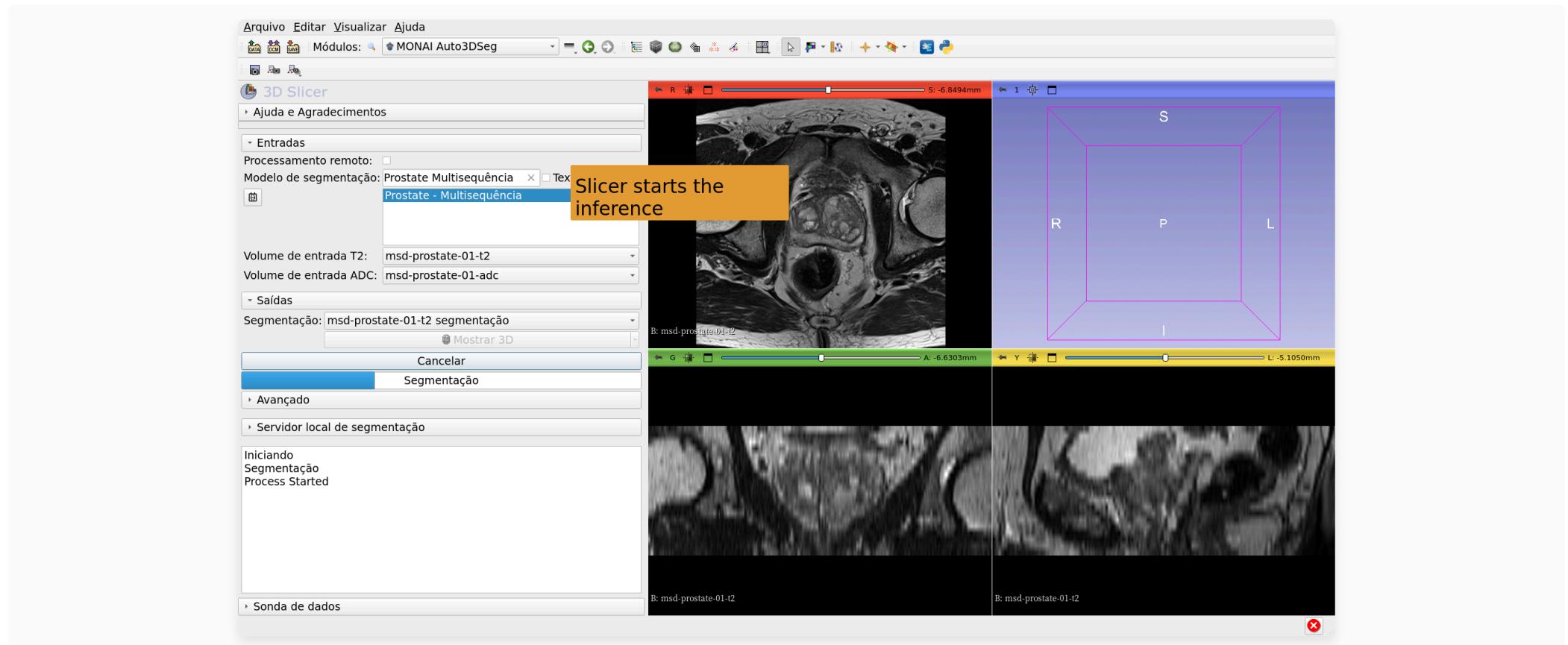


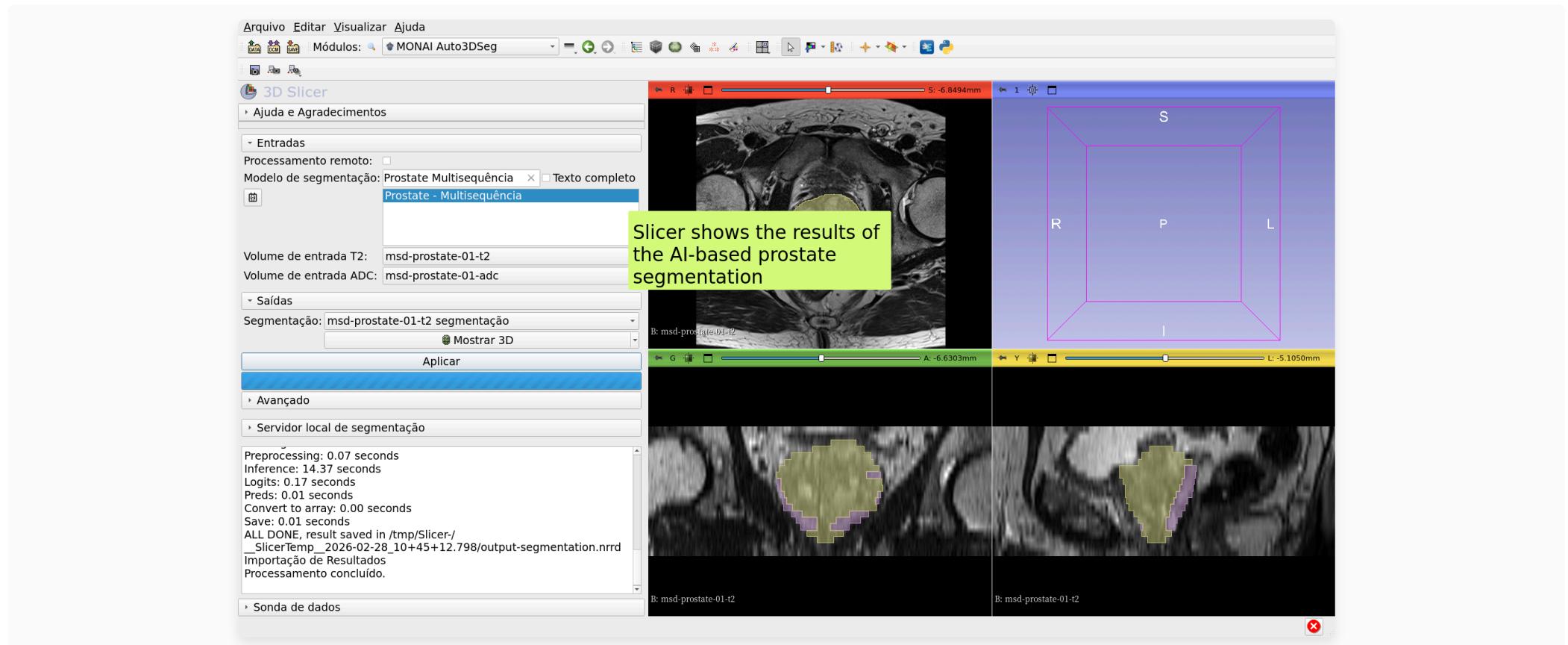










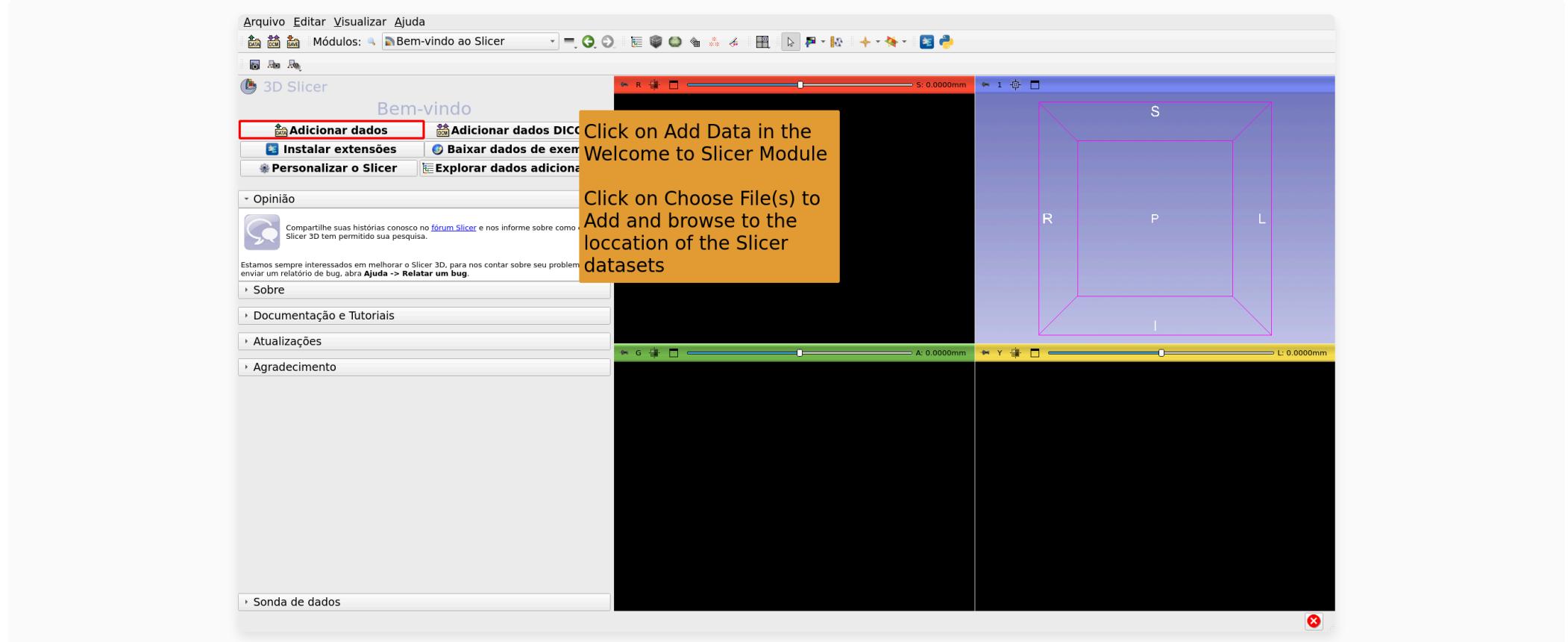


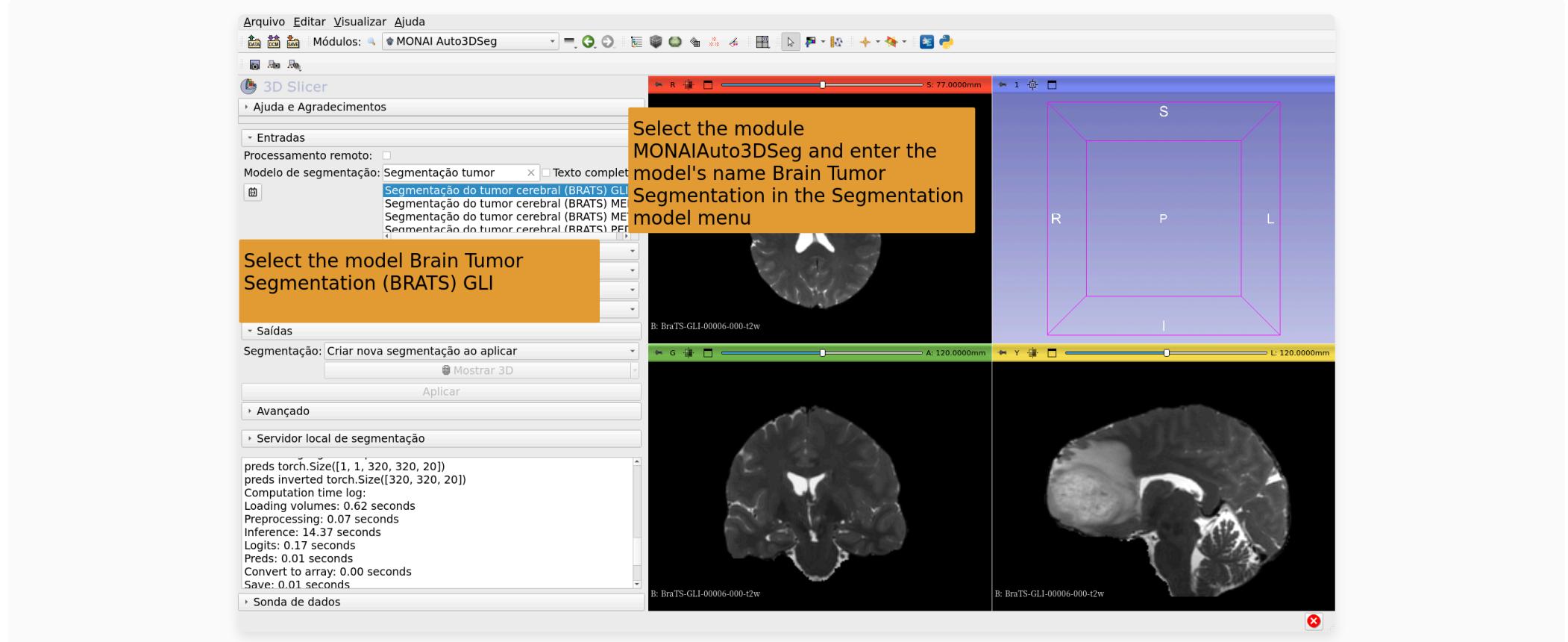
AI Segmentation Task #2: Brain Glioma

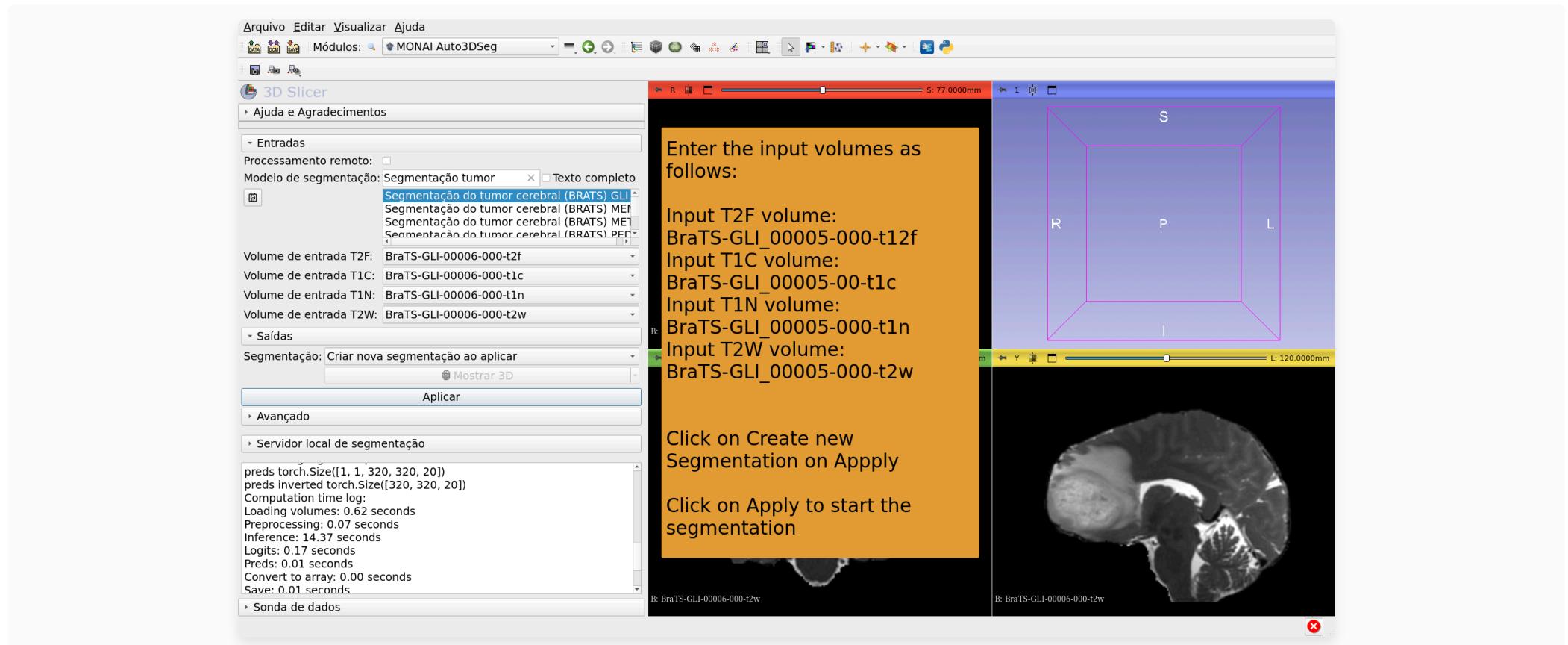
AI-based Segmentation of Neoplasm, Necrosis and Edema in Brain MRI images.

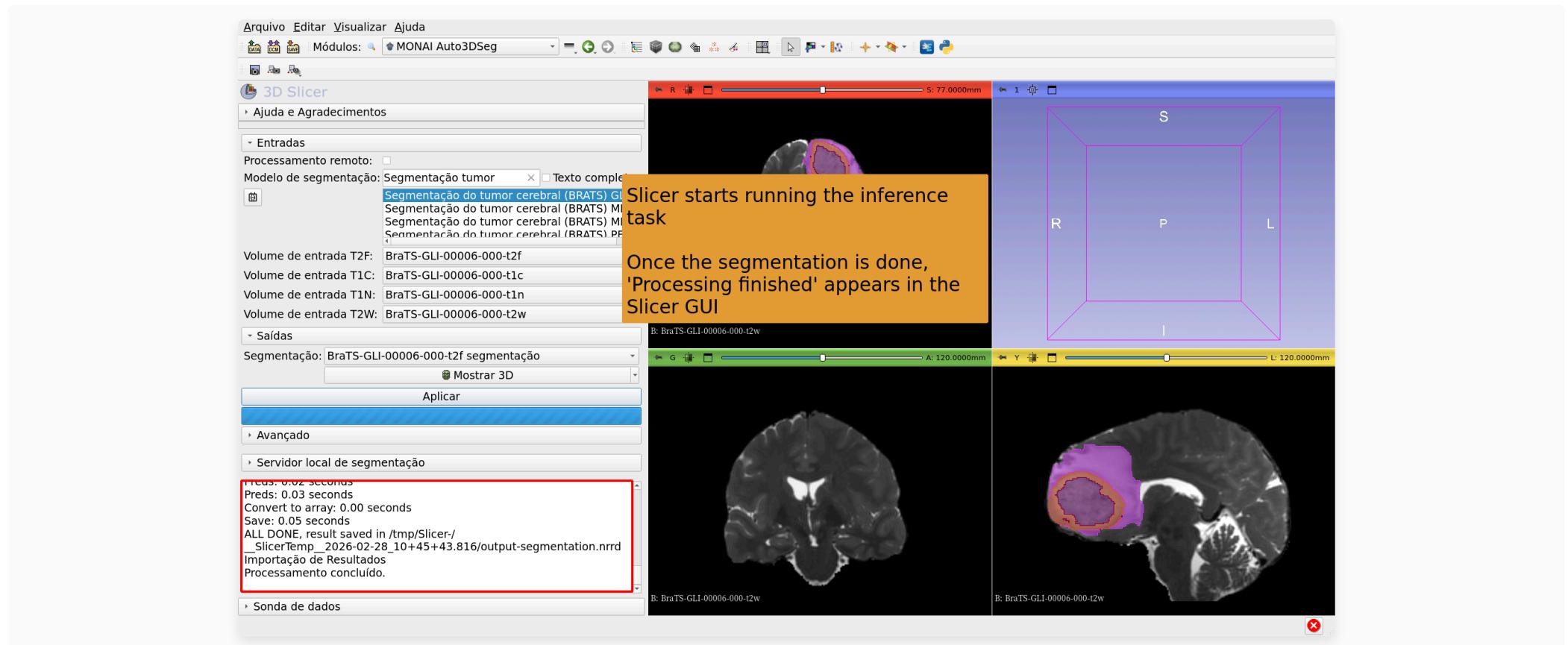
Datasets:

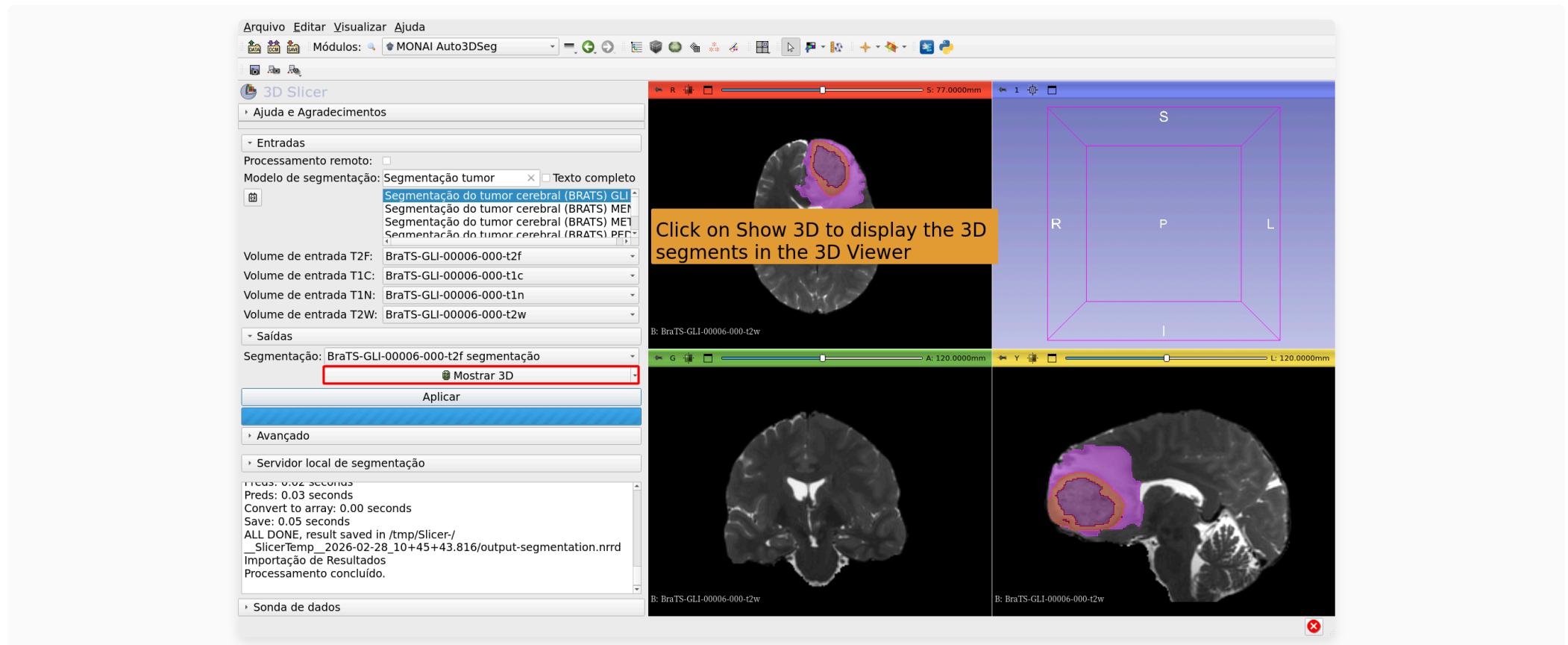
- 1) BraTS-GLI_00005-000-t1n (T1-weighted)
- 2) BraTS-GLI_00005-000-t1c (T1-weighted post-Gd)
- 3) BraTS-GLI_00005-000-t2w (T2-weighted)
- 4) BraTS-GLI_00005-000-t2f (T2-FLAIR)









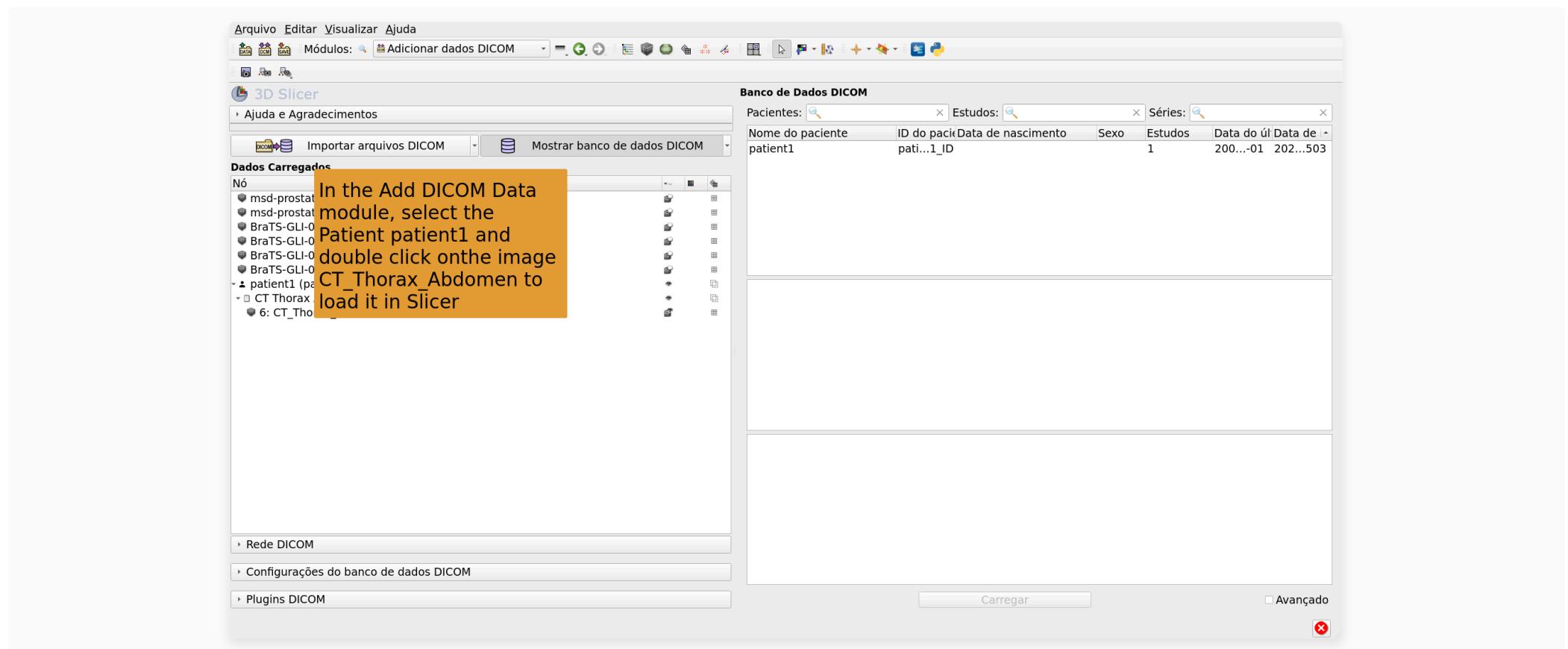


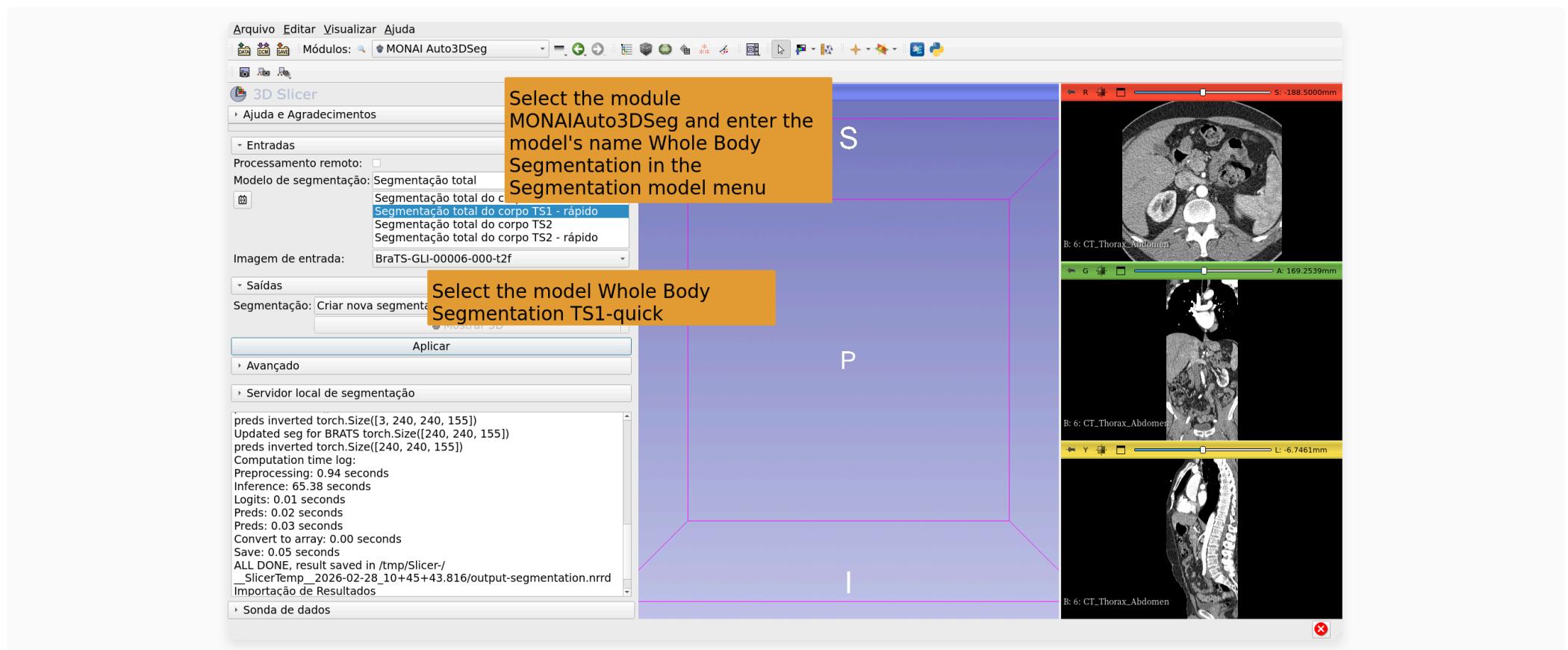
AI Segmentation Task #3: Whole Body Segmentation

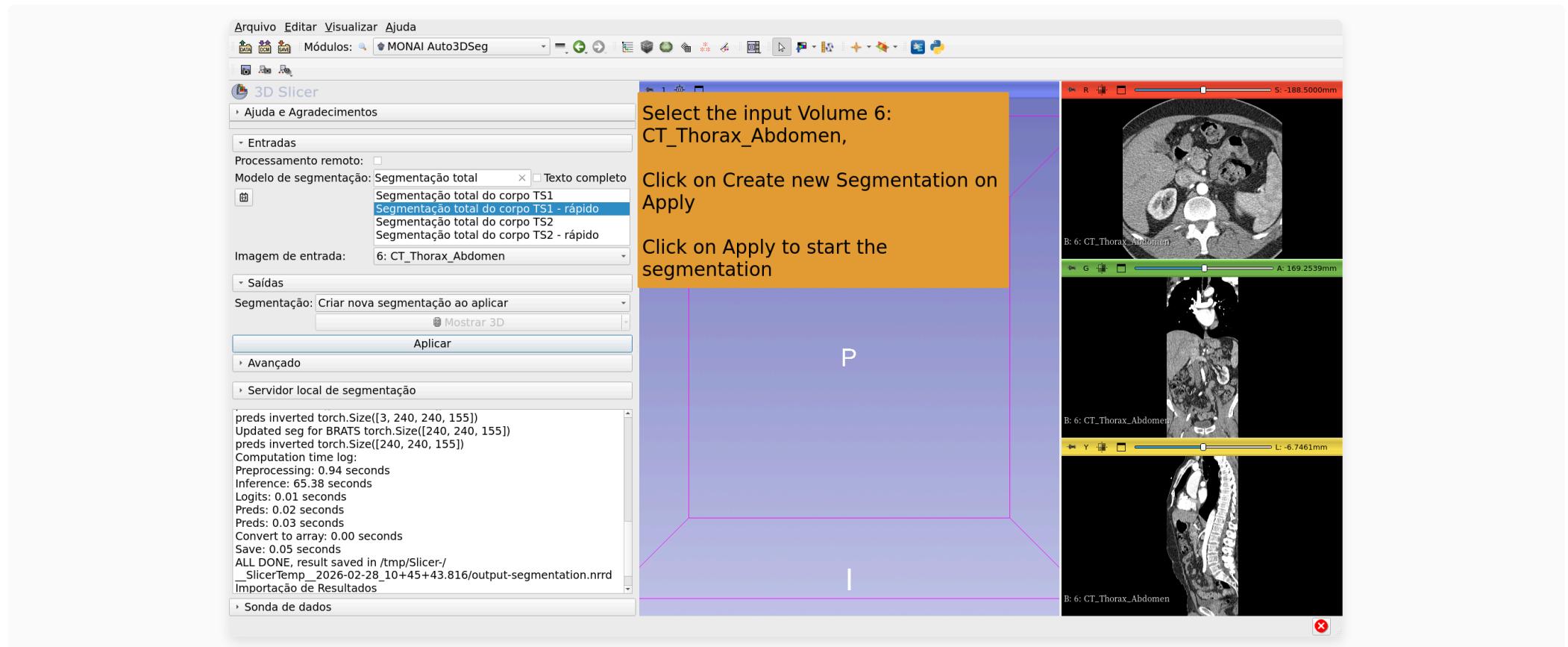
AI-based Segmentation of the whole body.

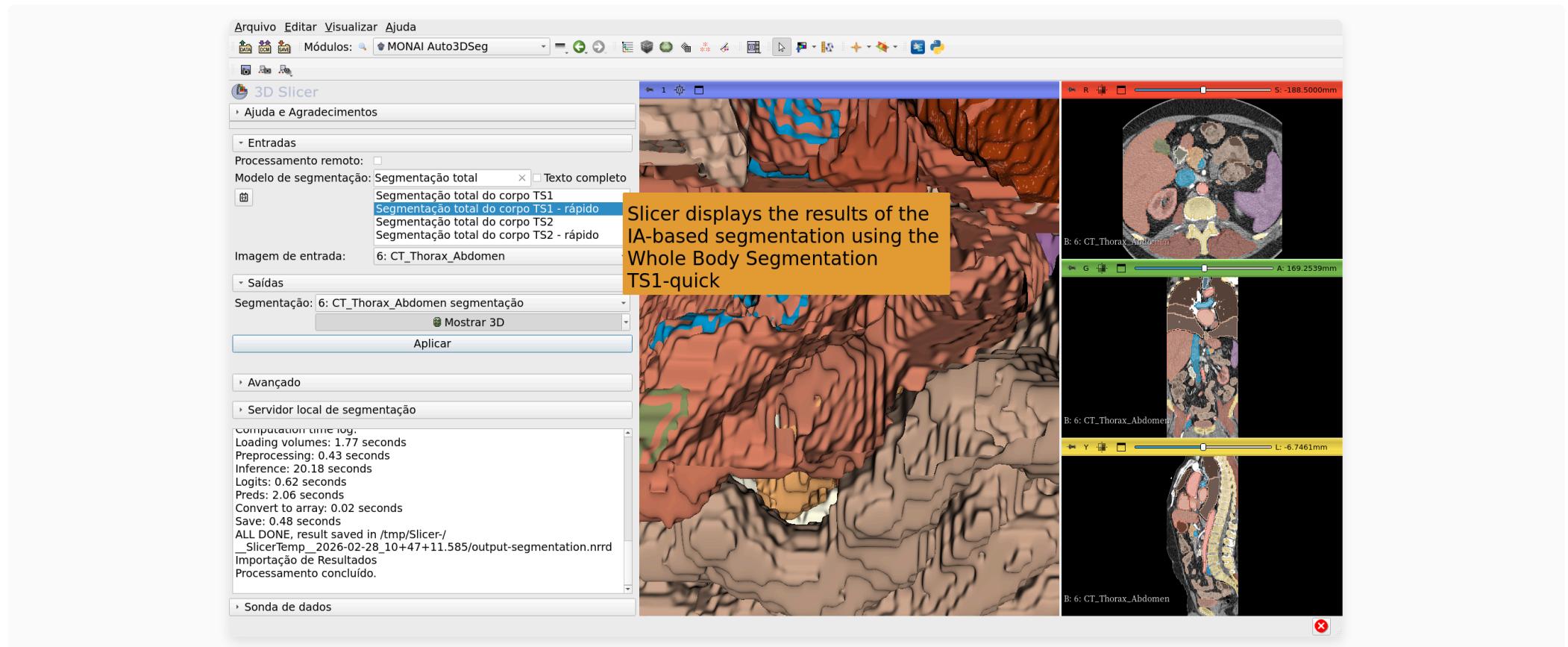
Dataset:

CT_ThoraxAbdomen









Conclusion

The 3D SlicerMONAIAuto3DSeg extension provides fast AI-based segmentation of anatomical and pathological structures.

The module can run on standard laptop and desktop computers with no GPU.

Agradecimientos

The 3D Slicer internationalization project and the 3D Slicer for Latin America project have been made possible by two CZI Essential Open Source Software for Science (EOSS cycle 4 & 5) grants.