Free yourself from hours of tedious contouring

Philips Pinnacle³ Auto-Segmentation with SPICE specifications

Pinnacle³

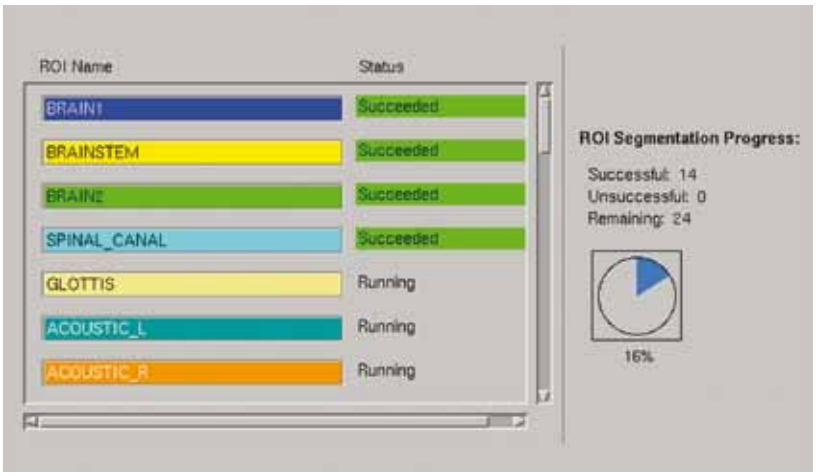
PHILIPS

sense and simplicity

Fast. Consistent. Confident.

Until now, contouring has been a time-consuming and inconsistent process, taking anywhere from 30 minutes to three hours, depending on the anatomy of the case and on the operator. Auto-Segmentation with SPICE, created by Philips, uses probabilistic segmentation to reduce hours of manual contouring down to a few clicks.

SPICE auto-generated contours designed to meet strict acceptance metrics.



The SPICE user interface is customizable by the user and provides real-time status updates.

New features

Quality contours with SPICE

SPICE (Smart Probabilistic Image Contouring Engine) provides deformable registration and probabilistic segmentation algorithms with 2D editing tools to modify auto-contoured structures.

Completely integrated into Pinnacle³

SPICE is accessible from any onsite or remote Pinnacle³ access point with no need to import/export contours between systems. SPICE also incorporates Auto-Segmentation into Pinnacle³ scripts for seamless integration into department process maps.

Starting Auto-Segmentation

Start Auto-Segmentation from Pinnacle³ LaunchPad and within Planning, ImageFusion, and AcQSim³ at any time during simulation and treatment planning.

Simple 3-step process for contouring

- Select image set
- Select appropriate atlas
- Start Auto-Segmentation

Contouring images

SPICE allows contouring on CT images.

Contouring times

In factory testing, contouring times were between three to eight minutes depending on system, number of slices, and structures involved. The majority of tasks run in the background, requiring no user intervention.

Simultaneous auto-contouring for multiple patients and multiple organs

Start contouring for multiple patients from LaunchPad, in each case using either the same or a different atlas (the number of sessions is limited by system configuration).

Customization

SPICE offers a secure library of clinically validated and factory-tested structures. The Preferences function offers the ability to customize structure names and colors, as well as atlas names and structures within each atlas.

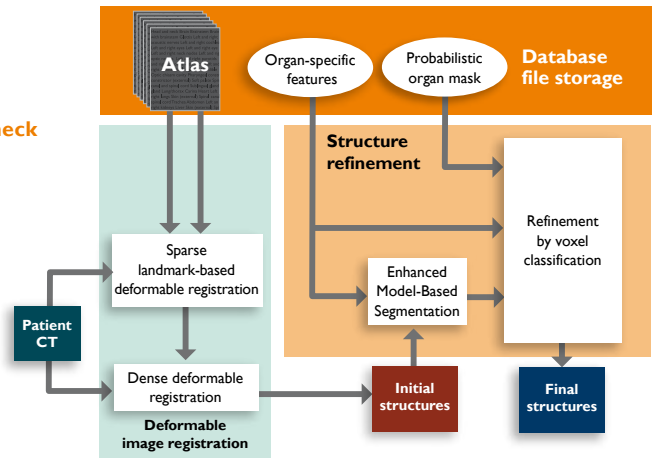
Added functionality when combined with Model-Based Segmentation (MBS)

Additional contouring functionalities with the MBS license include:

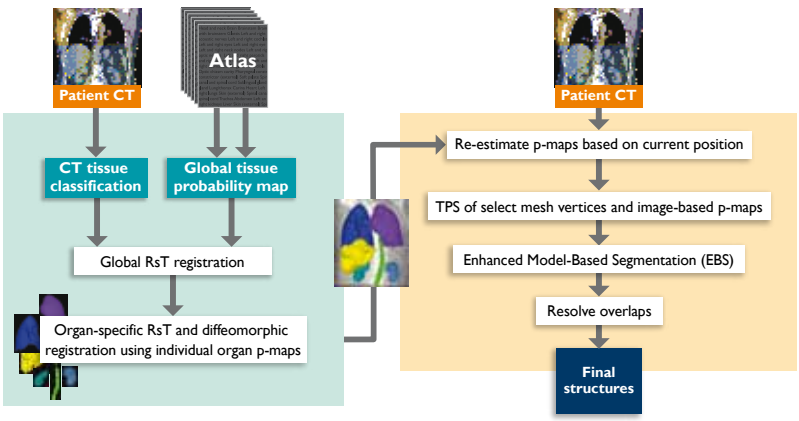
- Contouring on MR images
- Contouring non-anatomic structures (such as couch and masks)
- 3D editing tools
- Ability to add new structures to the MBS library

One feature, two processes, three steps

Thorax and head-and-neck algorithm pipeline



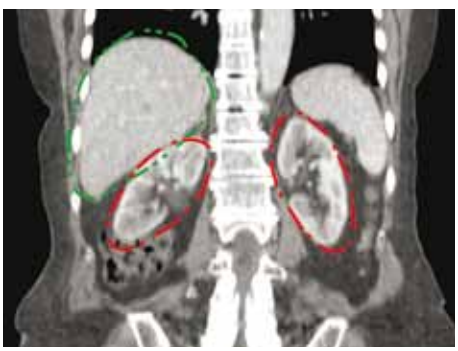
Liver pipeline



How Auto-Segmentation with SPICE works

Auto-Segmentation with SPICE is a simple tool to use, but is sophisticated and designed to perform its tasks with remarkable precision. There are several algorithms used depending on the type of structure being contoured. The two main types of algorithms are designed to optimize the contours of very different types of anatomical structures. Complex structures like the head and neck uses two types of deformable registration to position and deform the atlas to the image before it is sent to refinement. Smoother anatomical structures like the liver use a workflow and a process that is optimized for that anatomy, with more attention to slight differences in gray scale. The three processing steps in each workflow can be generalized as follows:

1. Initialization

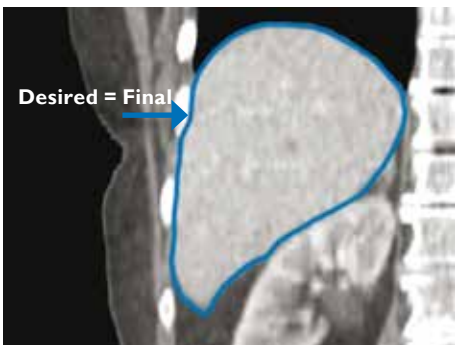


Initial positioning of all the organs on patient CT images using probabilistic approach that applies contours from the "best-fit expert atlas."

2. Coarse deformation

Implementing coarse deformation matches patient anatomy to organ-specific probabilistic atlases.

3. Refined deformation



Refined deformation obtains the final contours for each organ.

Why it works

Metrics-based precision and accuracy

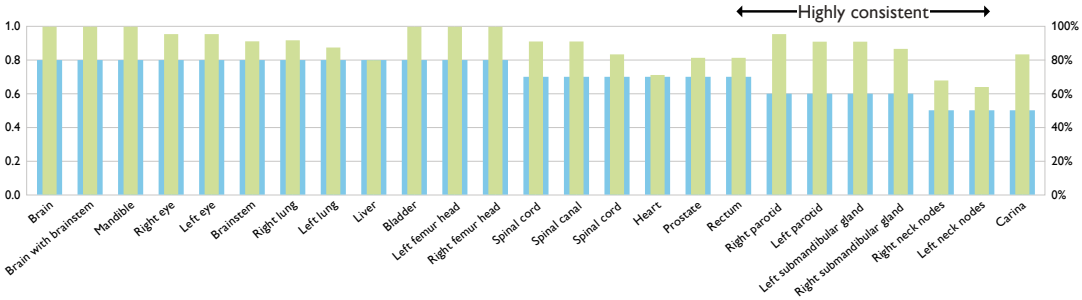
Dice Similarity Coefficient (DSC) scoring compares the similarity of surfaces between the auto-generated volumes and the appropriate atlas volume (standard). The higher the score, the better the match between the SPICE results and the ideal, perfectly contoured organ. DSC targets were selected to achieve results to be as close to the ideal or structure as possible so that the results would not require additional editing to achieve a close to perfect match (blue bars in graph). Clinical results show how SPICE performs clinically in a wide range of structures (green bars in graph). DSC scores do not determine clinical acceptance – this is left to the clinicians approval.

DSC=1
Complete similarity

0<DSC<1
Partial similarity

DSC = 0:
No similarity

In clinical validation even the "challenging" structures required little or no editing



Blue
Factory specification

Green
Clinical results

SPICE atlases and structures

Head and neck
- Brain
- Brainstem
- Brain with brainstem
- Glottis
- Left and right acoustic nerves
- Left and right cochleae
- Left and right eyes
- Left and right eye lens
- Left and right neck nodes
- Left and right optic nerves
- Left and right parotids
- Left and right parotids with ducts
- Left and right submandibular glands
- Mandible
- Optic chiasm
- Oral cavity
- Pharyngeal constrictor
- Skin (external)
- Soft palate
- Spinal canal and spinal cord
- Sublingual glands
- Thyroid gland

Lung/thorax
- Carina
- Heart
- Left and right lungs
- Skin (external)
- Spinal canal and spinal cord
- Trachea

Abdomen
- Left and right kidneys
- Liver
- Skin (external)
- Spinal canal and spinal cord

Male pelvis
- Bladder
- Prostate
- Rectum
- Left and right femoral heads
- Seminal vesicles
- Skin (external)

Atlases and structures that can be tailored to suit individual operators.

Please visit www.philips.com/SPICE

© 2012 Koninklijke Philips Electronics N.V.
All rights are reserved.

Philips Healthcare reserves the right to make changes in specifications and/or to discontinue any product at any time without notice or obligation and will not be liable for any consequences resulting from the use of this publication.

Philips Healthcare is part of Royal Philips Electronics

www.philips.com/healthcare
healthcare@philips.com

Printed in The Netherlands
4522 962 87061 * JUN 2012