



Segasist Technologies

# Segasist<sup>TM</sup> Contouring Tools

*For Precise Tracking and Tracing of Lesion Volumes:  
Raising the Bar on Unedited Accuracy*



## Segasist™

### The Importance of Medical Imaging

Diagnostic radiology, i.e. the use of advanced medical imaging, is a fundamental aspect of modern medicine. Magnetic Resonance Imaging (MRI), Computed Tomography (CT) and Ultrasound (U/S) are used in a multitude of ways for applications such as: the location and identification of tumors, the measurement of tumors, organs and other tissues, treatment monitoring and planning, and computer-guided surgery. There are millions of imaging procedures, producing roughly 664 billion digital images annually in North America; some common radiology procedures can generate up to 10,000 images per procedure (e.g., a 128-slice CT scan of the heart can produce between 5,000 and 10,000 images<sup>1</sup>).

Medical imaging is an essential component of Radiation Oncology – the use of radiation to control malignant cells in the treatment of cancer. It is used to detect and determine the exact location and volume assessment of tumors/organs to be treated. Currently, there are 37 million radiation oncology imaging cases in the US annually, with over 6,500 working radiation oncologists/radiation physicists (2004).

With a growing number of images per patient case, an aging population, and new imaging methods that require new analysis software, more efficient ways of extracting useful information from all of the medical imaging data generated is essential to maintaining – or increasing – the quality of patient care. Specifically, the ability to extract the volumetric data contained within a patient's images is becoming increasingly important; patient outcomes depend heavily upon accurate analysis of tumor volume.

### Improved Volumetric Analysis

The first step to extracting volumetric information is to mark the boundaries of region of interest within each slice, a task generally called segmentation or contouring. Accurate contouring of lesions/organs means greater precision in calculating its volume and, consequently, improved analysis of its current state or the efficiency of treatment.

In radiology, accurate volumetric measurement can allow an oncologist to determine: (1) the initial size of a tumor/organ, (2) whether a tumor is shrinking or growing, and (3) whether a treatment such as chemotherapy or radiation is working to shrink a tumor.

In radiation therapy, accurate volume delineation between healthy and unhealthy tissue helps to better target radiation towards diseased tissue while preserving as much healthy tissue as possible. Currently, a lack of tools means it may take as long as several days to calculate the volume of diseased tissue and then to create a radiation treatment plan based on those calculations.

*Segasist provides increased accuracy and consistency of volumetric analysis via precise contouring.*

<sup>1</sup> MedWatch Today, Clovis gets region's first 128-slice CT scanner (<http://www.medwatchtoday.com>), Mar-2010.



## The Segasist™ Solution

Segasist Technologies has developed Segasist, a software platform that provides more accurate contouring of organs, glands and tumors than any current competitive method. In particular, Segasist is especially effective for more challenging image types and body parts such as head and neck, brain, lung and liver.

Segasist is a widely automated system for volumetric analysis; it provides a new approach to volumetric calculations. Through use and “training”, Segasist can improve automated analysis and contouring decision-making capabilities. The use of Segasist in a clinical setting provides the opportunity for increased accuracy and, hence, time saving.

### The First Step: Improved Contouring

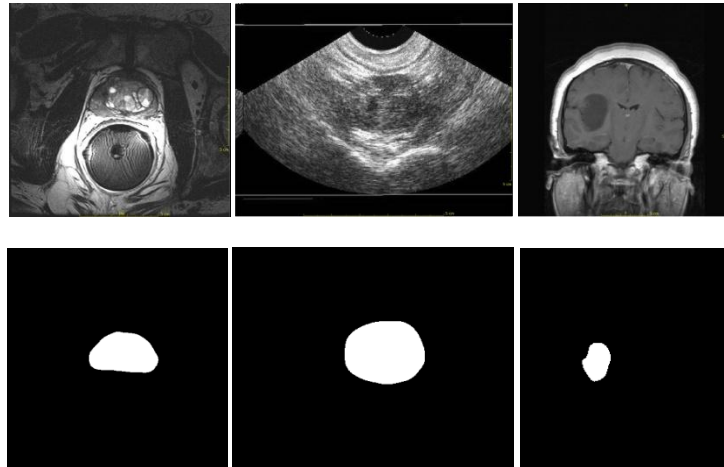
Contouring, or segmentation, of medical images from different modalities like CT or MRI, is a major activity in disease tracking and treatment planning (see Figure 1). In radiation therapy planning, for instance, segmentation is used to delineate the boundary between healthy and unhealthy tissue so therapy can be properly focused. In radiology, segmentation can help track tumor growth or recession and provide information about cancer staging and treatment.

Though segmentation is a major contributor to radiation treatment planning, clinicians (radiologists, oncologists, physicists etc.) must rely on laborious manual segmentation/delineation for results. The time that is required for this manual contouring delays patient treatment planning and slows the overall workflow in the clinic or hospital. Further, in some areas of diagnostic radiology, accurate segmentation is so time-consuming that some objective measures – changes in tumor or body part volume, for instance – go unexploited and further hinder the therapy and planning processes.

Current software tools for contouring are limited in their accuracy, cross-modality application and user-friendliness, but technology is increasingly providing superior solutions. The contouring process can be

*Segasist: a more efficient approach to contouring for radiation therapy. An assistive contouring software with learning ability.*

widely automated using productivity tools to increase throughput and, as a result, access to a greater number and variety of images and objective measures for treatment planning. One such segmentation assistant is Segasist, a tool that improves its automated ability through clinician training and use. As the clinician works with Segasist, the software learns to interpret with an accuracy ultimately approaching that of the expert user, increasing the unedited accuracy that is achievable with any state-of-the-art contouring software.

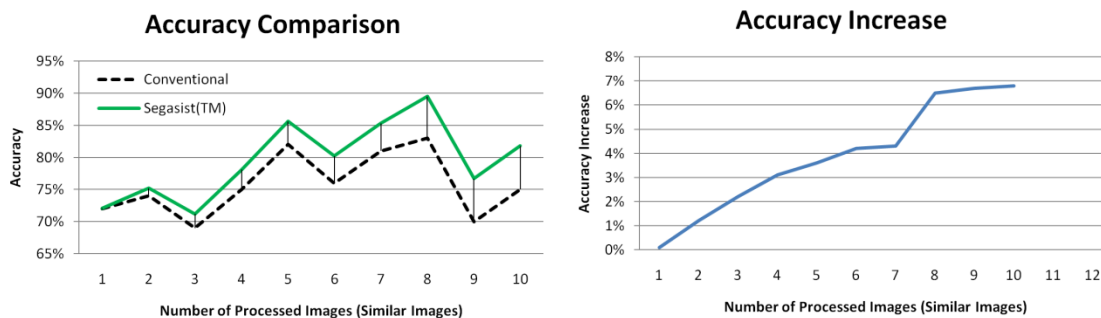


**Figure 1.** Segasist can be applied to different cases/modalities. From left to right: prostate MR, prostate ultrasound, brain MR.

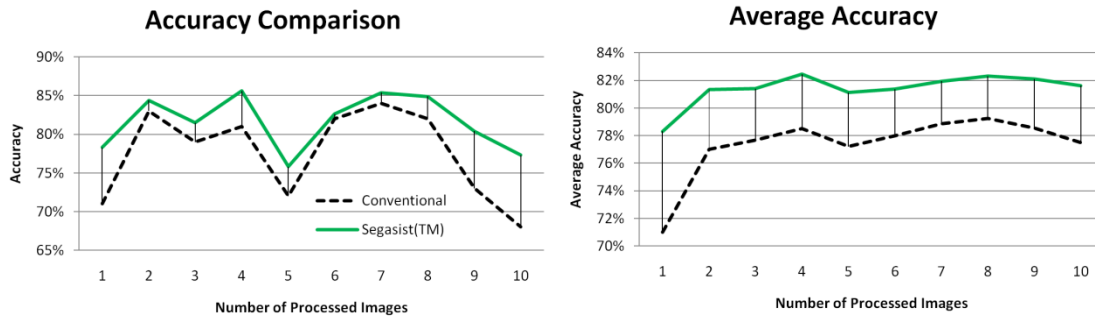
Segasist can be integrated into existing clinical workflow to provide a more efficient approach to auto-contouring for radiation therapy. As a “trained” Segasist installation reaches the upper thresholds of accuracy and throughput, a practical way of calculating objective measures from patient images becomes possible: shortening editing time, enabling adaptive re-planning, affecting patient outcomes, and helping to reduce the cost of healthcare delivery.

## Improving Accuracy through Learning

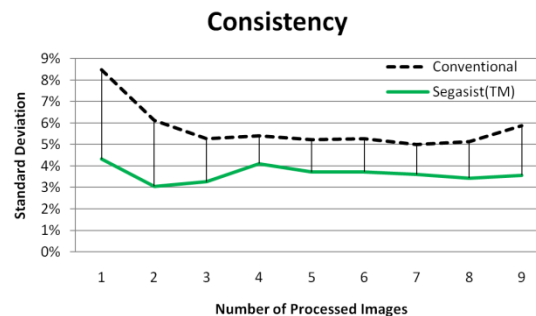
Segasist overcomes any current upper bound on accuracy, raising the bar for unedited volumetric analysis solutions (see Figures 2-4). It does this by learning how to guide the segmentation in order to reach higher agreement with the expert user’s manually segmented images (as “learned” during training phase and as well during real-time edits as the software being used).



**Figure 2.** Accuracy comparison between conventional segmentation (base technology) and Segasist (controlling the base technology). The diagram at left shows the accuracy difference when ten similar images are processed (similar images contain lesions with similar shapes and similar gray-level distribution, for instance adjacent slices in volume data of the same patient). The diagram at right demonstrates the steady accuracy increase toward a maximum achievable upper bound. The test images are prostate MR images.



**Figure 3.** Accuracy comparison between conventional segmentation (base technology) and Segasist (controlling the base technology): the diagram at left shows the accuracy difference when ten different images are processed (different images usually belong to different patients, or may have been acquired with different settings and protocols). The diagram at right demonstrates the average accuracy. The test images are prostate MR images.



**Figure 4.** Comparison of result variability for the data in previous diagram. The standard deviation is calculated for any given image taking into account all previous cases.

## Segasist Learning Sequence

Through use and “training”, Segasist can improve decision-making capabilities via accurate contouring . Segasist learning occurs during both Training and InterActive Contouring Modes, allowing an expert user to input important case material in situ or as time permits.

There are three steps to using Segasist.

### Step 1: INTERVIEW MODE

An initial configuration occurs when a project is initiated. The software asks the expert user a few questions to configure the tool.

### Step 2: TRAINING MODE

Pre-segmented sample images are provided and the Segasist software begins learning from these images, building a library of image and case-based decision-making parameters. The greater the number



and the more representative the samples provided, the better the baseline learning that occurs during this step. Training Mode must follow the Interview Mode.

At this point the software has a baseline of knowledge that can be used to contour the selected lesion/organ (e.g. brain tumor, prostate gland etc.) in corresponding modality (e.g. CT, MR etc.).

### **Step 3: INTERACTIVE CONTOURING MODE**

In Interactive Contouring Mode, Segasist can contour new images using the accumulated knowledge from the Training Mode. If the clinician then manipulates a contoured image, Segasist makes appropriate adjustments to its internal knowledge base, applying the revised (extended) knowledge to any subsequent images. The changes a clinician makes will affect contours for new images as the software adjusts itself toward higher compliance with clinician expectations.

## **Multiple Profiles, Reducing Variability**

During training and use, the Segasist software accumulates knowledge on an expert user's contouring preferences and stores the data for future use. A user's contouring preferences include "how to" information, assisting Segasist in contouring based on modality and body part/lesion. Segasist can manage multiple user profiles, each storing distinct contouring preferences.

The user's editing preferences are stored in a user profile and applied to future segmentations of images taken from the same modality or lesion/body part. Over time as the expert uses Segasist, less time is required to segment and correct results as the software learns how to contour more accurately.

### **Reduced Inter-Observer Variability**

Once many user preferences have been collected, they can be used to configure a "best-practice" rule set which Segasist can then apply to subsequent segmentation. That is, Segasist can be configured to display modality and anatomy-based preferences – warning the user about non-standard edits and assisting with best-practices observance. This capability could help reduce inter-observer variability, another major obstacle to establishing efficient and fast image analysis in treatment planning and diagnosis.

## **About Segasist**

### **Clinical Usage**

Segasist segmentation assistant software is initially thought to be feasible for use in radiation therapy planning and radiology. It can be integrated into existing planning software or used as a plug-in volumetric measurement tool.

The Segasist software was created by Segasist Technologies to be compatible with all existing Patient Archiving and Communications Systems (PACS), providing seamless workflow integration and



connectivity with digital imaging communications equipment. The software uses a combination of unique, proprietary algorithms referred to collectively as the Omni-Modality Intelligent Segmentation Agent (OMISA).

Segasist Technologies welcomes interest from clinical validation sites for its completed software and from vendors and clinical experts in other modalities and treatment areas to pursue feasibility studies. In addition, clinical advisory board openings need to be filled. If you are interested in any of these opportunities, we look forward to hearing from you.

For more information on Segasist or Segasist Technologies, please contact us.

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