MRI- TRANS RECTAL ULTRASOUND FUSION FOR IMPROVED PROSTATE CANCER THERAPY (Tel Hashomer)
code: THM 2013017

MRI- Trans Rectal Ultrasound fusion for improved prostate cancer therapy

Dr. Zvi Simon and Dr. Arlando Mayer, Sheba Medical Center

Categories	Image Processing , Medical Algorithm, Medical Navigation, Prostate Cancer
Development Stage	Clinical Stage
Patent Status	WO2015/008279 - "MRI Image Fusion Methods and uses Thereof"- Pending
THM Reference	2013017

Background of the Invention

We develop a complete framework for focal therapy of the prostate guided by TRUS-MRI image fusion.

In image guided prostate biopsy, we distinguish between the first biopsy and the recurring follow-up. In the first biopsy it is necessary to ensure that the lesion(s) will be sampled to provide informative tissue for the pathologist and accurate diagnosis. The accurate position of the area sampled inside the lesion is less important by itself.

In the recurring follow up it is required to sample the prostate at the locations that were sampled at previous biopsies in order to enable temporal evolution monitoring. Here again it is important to ensure that the needle re-samples an area sufficiently close the previous biopsy location to provide comparable pathology results over time. For example, if the area sampled at first biopsy was inside a lesion, it is important that the corresponding area sampled in the recurring biopsies be inside the same lesion.

On the other hand, prostate focal therapy has much more stringent requirements in terms of accuracy. Fusion accuracy must enable to mark the whole volume of the targeted lesion up to a predefined resection margin. The acceptable resection margin will usually be much smaller (1-2 mm) than the tolerable biopsy positioning error. According to Seifabadi, the maximum tolerable error in biopsy is 5 about mm, which is the radius of a clinically significant tumor assuming that it has a spherical shape .

The technologies that are developed these days for TRUS-MRI fusion in prostate imaging are dedicated to biopsy applications and are not designed to cope with the stringent accuracy requirements of focal therapy that we address in this project.

Our innovation revealed that software to register and merge data from magnetic resonance imaging (MRI) and ultrasound (US) images enables intraoperative visualization of tumors, not typically seen in a US image.It is possible that this technology may be essential for the efficient implementation of focal therapy techniques in which individual tumors are treated within an appropriate and safe surgical margin.

The Need

Prostate cancer is the most common cause of cancer in men in many countries. It is the second leading cause of death from cancer in American man.

Over the last decade, more accurate localization of cancers within the prostate

Growing interest in focal therapy

Less radical approach.

Image-guided radiation therapy (IGRT) is the process of frequent two and three-dimensional imaging, during a course of radiation treatment, used to direct radiation therapy utilizing the imaging coordinates of the actual radiation treatment plan**.**

IGRT and Precise radiation therapy offers several advantages:

1. Reduce severity and risk of therapy-induced complications.
2. Increase both quality and probability of success.
3. Broaden application of proven therapies.
4. Permit new therapies that are intolerant to geometric imprecision.

Potential Applications

Fusion between TRUS and multi-parametric MRI is a powerful tool for any guided prostate cancer intervention whether diagnostic or therapeutic and could be used to direct the sampling/treatment needle to suspicious lesions on MRI not clearly visible on TRUS alone.

These modalities include: -high intensity focused ultrasound, cryo-therapy, photodynamic therapy, gene therapy and guided biopsies.

This fusion technology can be easily adapted to CT-MRI fusion. Thereby, it has the potential of significantly improving the accuracy of CT-MRI fusion routinely performed in external beam radiotherapy (EBRT). Current fusion solutions for CT-MRI fusion in EBRT are not accurate enough and usually require much manual tweaking. The number of EBRT procedures is even larger than brachytherapy

In Addition, the automatic contouring technology we developed is also very useful in EBRT planning as manual contouring takes a significant amount of time and is difficult to realize on CT scans due to poor contrast in soft tissues. Actually, the contouring technology may be applied to other organs, leading to additional products.

The Market

The Global market for Radiation Therapy Equipment is projected to reach US$6.8 billion by 2018, driven by the increasing incidence of cancer around the world and by the development of **Image-guided radiation therapy tools**. Additionally, technological advancements are driving the market for Radiation Therapy Equipment, owing to the development of sophisticated screening methods that facilitate early cancer detection.

Brachytherapyis increasingly been accepted as standard treatment for prostate cancer and gynecological cancers including ovarian cancers, cervical cancer, and endometrial cancer among others. Brachytherapy offers several benefits to cancer sufferers who are increasingly adopting this non-invasive alternative, and this is predicted to continue to drive the future demand for brachytherapy. Extending applications of brachytherapy to other locations within the body to include gliomas and intraocular melanomas, which are a kind of brain tumor would assist in propelling the market for temporary brachytherapy devices in the future.

Approximately 70 percent of all the cancer patients globally undergo radiation therapy. But almost 20 percent of malignant tumors are radiation-resistant. The radiation can be delivered via external-beam radiation therapy, internal radiation therapy or systemic radiation therapy.

The market is also segmented by various technologies like intensity-modulated radiation therapy (IMRT), image-guided radiation therapy (IGRT), cyber knife, gamma knife, proton / neutron therapy and dynamic multi-leaf collimator (DMLC), among others, though External-beam radiation therapy (EBRT) continues to represent the largest segment.

Patent

WO2015/008279 - "MRI Image Fusion Methods and uses Thereof"- Pending

Tech Transfer Officer
Dr. Sylvie Luria

Tel Hashomer Medical Research, Infrastructure and Services

Tel: +972-3-5305998 Fax: +972-3-5305944 ; sylvie.luria@sheba.health.gov.il