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MR-Ultrasound Registrations for Image Guided Neurosurgery Using Raptor

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ABSTRACT:

In this work we proposed MR-Ultrasound image registrations using RaPTOR (Robust Patch Correlation Ratio) . The image registrations mean comparison of MR-ultrasound image. Registration pre-operative MR to post resections US for the first time. The 3D ultrasound used for registrations process more accurate and fast but exsiting method has more difficulties. RaPTOR computes local correlation ratio (CR) values on small patch. Here outlier suppression techniques based on the orientations of the RaPTOR and completely remove the leftover of the tumor. Proposing a CR-based measure that locally estimates the similarity metric from small patches, deriving the analytic derivative of the similarity metric and performing efficient optimization. Gradient refers the directions of the surgery.We present quantitative and qualitative result on images of brain or bone.

KEYWORD: US-MR Registration,Correlation ratio(CR),ANN(Artificial Neural Network),SVM(Support Vector Machine),Nonrigid Registration.

INTRODUCTION:

The success of the surgical resections of brain tumors depends to a large extent on the complete removal of the tumor. The proximity of the many tumors to critical brain structures coupled with of a poor visibility of brain tumors in operating room renders complete of the tumor challenging.In image guide neurosurgery the preoperative MR image can be connected to selected landmark on MR image. Ultrasound image and MR image should be in correct alignment. Hence the brain tumor have usually in preoperative MR image with high contrast in the preoperative MR image the registrations image to post resections US can reduced. However to measure evaluating the similarity of gradient orientations, a multiscale gradient orientations selection strategy to reduce uncertainty. The first is preprocessing stage images are computed at multiple scale and to measure of orientations alignment each scale transformations of previous scale .Kalman filter to improve the quality of strain estimations.Here to calculating the motion field between two ultrasound images.They can proposed the analytic minimizations take integer displacement field from dynamic programming(DP).The RF line from DP gives the subsample axial of entire image[3].we also perform nonparametric estimation,with the difference that we compute CR locally to achieve resistance to large spatial intensity inhomogeneity in us images.The derivative of the cost functions analytically and performing efficient gradient-based optimizations. To provide a good compromise between the running time and accuracy and robustness.

OBJECTIVE:

The main objective of the MR-Ultrasound registration for image guided neurosurgery using RaPTOR is used to reduce the outlier.

- To register (compare) MRI (preoperative) to US (post resection) image in IGNS using RaPTOR algorithm.
- To completely remove the leftovers of the tumor.

The contributions of this paper are as follows.

1) Proposing a CR-based measure that locally estimates the similarity metric from small patches, deriving the

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analytic derivative of the similarity metric and performing efficient optimization.

2) Introducing a novel metric for outlier rejection. And registering preoperative MR to postresection US for the first time. And locating corresponding anatomical landmarks between preoperative MR and postresection US for validation of the registration results, and providing these landmarks online. This is the first such database to the best of our knowledge.

METHODOLOGY

RAPTOR

RAPTOR is a Robust Patch based Correlation Ratio. It is a programming environment. RaPTOR programs are created visually and executed visually by tracing the execution. It can be correlated the preoperative image and post resection image and reduced the outlier .It can be used to completely remove the left over tumor.

SVM (SUPPORT VECTOR MACHINES)

It gives accuracy comparable to neural network. It can be used in object detection and recognitions based image retrieval, text recognition, biometrics, speech recognition.It is used for regression.

SVM becomes famous when using pixel maps as input; it gives accuracy comparable to sophisticated networks.

ARTIFICIAL NEURAL NETWORK

An artificial neuron network (ANN) is a computational model based on the structure and functions of biological neural networks.Information that flows through the network affects the structure of the ANN because a neural network changes-or learns, in a sense-based on that input and output

Correlation Ratio(CR)

X,Y pixel intensities in If and (choice of correspondence)

CR provides a value of what information in Y is explained by X.

Define EY|X as expected value of Y given X*

CR is calculated as,

$$\eta(Y|X) = \frac{\mathrm{Var}[\mathrm{E}\langle Y|X\rangle]}{\mathrm{Var}[Y]} = 1 - \frac{\mathrm{Var}[Y - \mathrm{E}\langle Y|X\rangle]}{\mathrm{Var}[Y]}$$

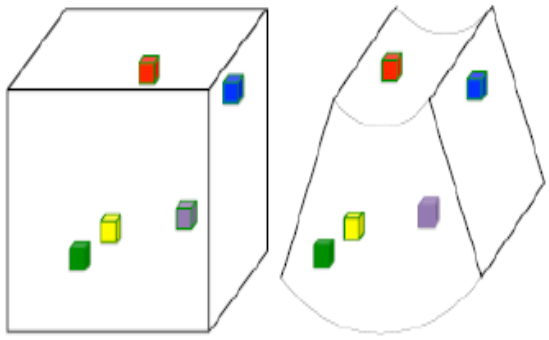
Patch-based Correlation Ratio

CR assumes pixel correlations consistent across the image

US intensities vary in a spatially dependent manner

Calculate CR independently for several small patches selected through out the volume

$$\mathrm{RaPTOR}(X,Y) = \frac{1}{N_p}\sum_{i=1}^{N_p}(1 - \eta(Y|X:\Omega_i)$$



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Robust Patch-based Correlation Ratio

Some patches provide a poor estimate of correspondence

Reject outlier patches to improve robustness of CR

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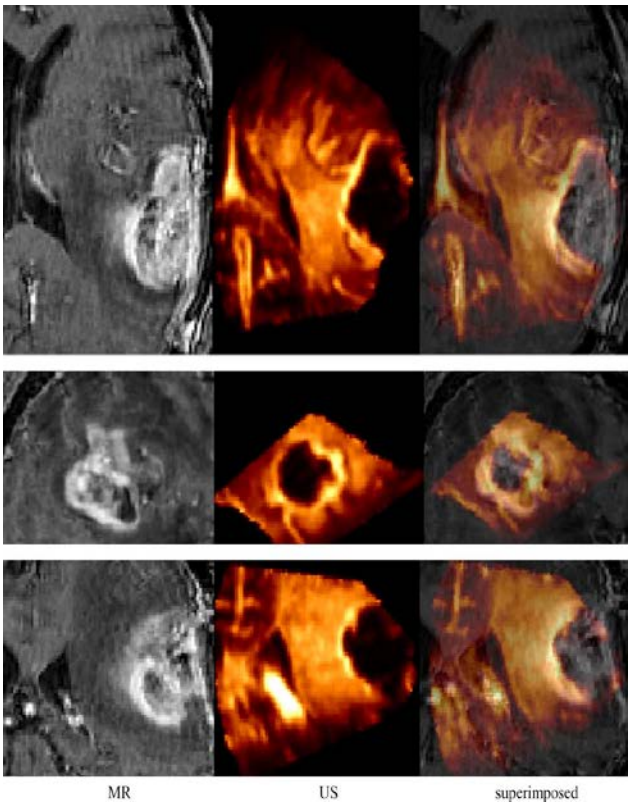
CR is a poor outlier detector

CR varies according to image alignment

Low CR could be misalignment (important to include) or mismatched patch (outlier to ignore)

Novel outlier detection according to CR gradient.



Tumor regions generally has texture in the MR image,while the cavity is generally uniform in the US.First, second and third rows are, respectively, axial,sagittal, and coronal slices.

CONCLUSION

We presented RaPTOR, an algorithm for nonrigid registration of challenging clinical images of preoperative MR and postoperative US. We analytically derived the derivatives of RaPTOR and optimized it using efficient stochastic gradient descent optimization. SWe also proposed a novel intuitive technique for minimizing the effect of outliers .We will provide our data available online, which we hope, speeds the translation of future registration techniques to the operating rooms.

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