Effectiveness of Radiation Therapy for the Treatment of Head and Neck Squamous Cell Carcinoma

Apurva Singh, Sharad Goyal and Murray Loew
Departments of Electrical and Computer Engineering
Radiation Oncology (GW Medical Center), and
Biomedical Engineering
The George Washington University, Washington, DC;
apurva_95@gwu.edu

GW Biomedical Engineering

School of Engineering & Applied Science
THE GEORGE WASHINGTON UNIVERSITY

INTRODUCTION

Head and Neck Squamous Cell Carcinoma is usually treated with Radiation Therapy (RT). Image registration is important to combine the information obtained by different image modalities and to correct the shift between the pre and post-treatment images. A comparison of the tumor size and texture in the pre- and post-treatment images gives a measure of the effectiveness of the treatment.

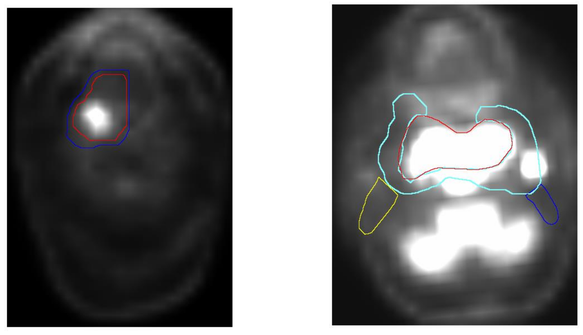


Fig: RT Structure indicating the position of the tumor in the baseline PET images

IMAGE DATABASE

1. The database is a new entry in the TCIA(The Cancer Imaging Archive).
2. Diagnostic scans in the form of DICOM images are included for 215 patients.
3. The modalities included are CT,PET,MR,RT.
4. Clinical data include 71 attributes including sex, age and site of the tumor.

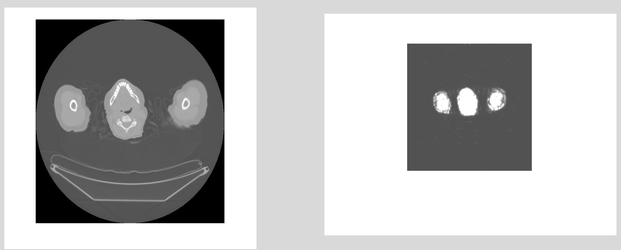


Fig: Corresponding baseline (pre-treatment) CT and PET images.

IMAGE REGISTRATION TECHNIQUES

Registration[1] between the pre- and post-treatment images is important because there are shifts between the images owing to factors including change in patient positions before and after treatment.
In this database, the baseline CT and PET images are intrinsically registered to each other.
However, there is a shift observed between the pre- and post-treatment CT and PET images respectively

Methods used for registration are as follows:
a) Feature extraction and matching (SURF and FAST).[2]

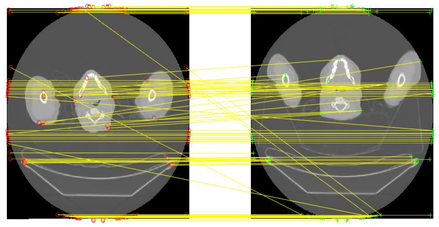


Fig: Matched points detected using SURF and FAST features between pre-and post-treatment CT images

b) Find appropriate geometric transform and warp the post-treatment image to align it with the pre-treatment image.

c) Translate the post-treatment to align it with the pre-treatment image

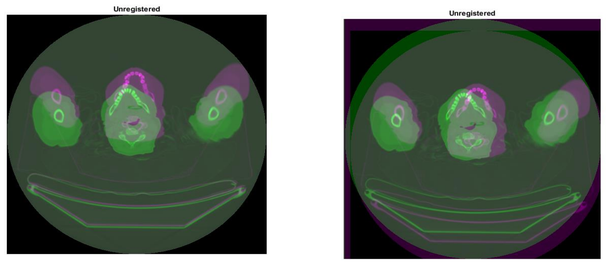


Fig: Pre-and post-treatment CT images before and after performing transition and warping

d) Apply template matching using normalized cross-correlation approach.

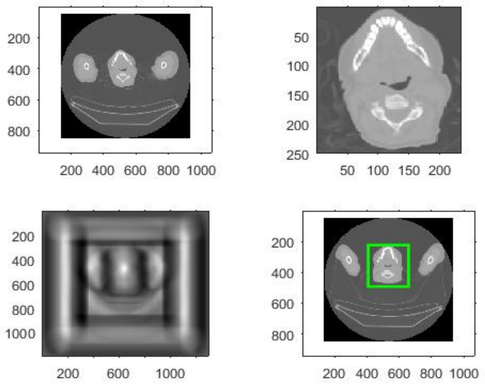
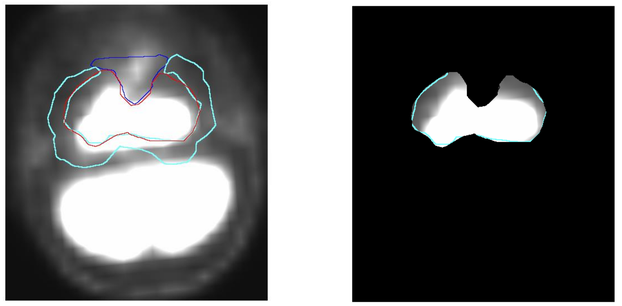


Fig: Template from the baseline CT image is correlated with the post-treatment CT image and the region of maximum correlation is located in the post-treatment image.

TUMOR DETECTION AND EXTRACTION

1. Patients who have had a local recurrence of the tumor are identified.
2. Control group for each patient includes patients who are in the same age group and
have the same tumor site.
3. RT Structure is overlain on the pre-treatment PET image to identify the tumor regions.
4. The bright region in the PET image indicates the tumor region as it has maximum FDG uptake.



(a) (b)

Figures (a) and (b) show the tumor region marked in the PET image and the region as extracted from the original image. The different colors in the tumor boundary signify the different RT dose.

CONCLUSION

Registration of images of different modalities is important to obtain structural and physiological information about the tumor regions. The RT data help to identify the tumor boundaries and indicate the radiation dose when overlain on the PT images. We believe that tumor texture characteristics[3][4] will help us in our comparative study of the patients with and without the local recurrence of the tumor.

ACKNOWLEDGEMENTS

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