

Imaging and AI/ML Opportunities

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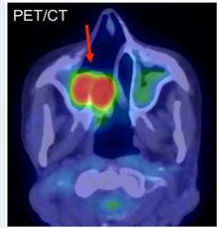
Background

Imaging in Radiotherapy

Diagnosis (and follow-up)



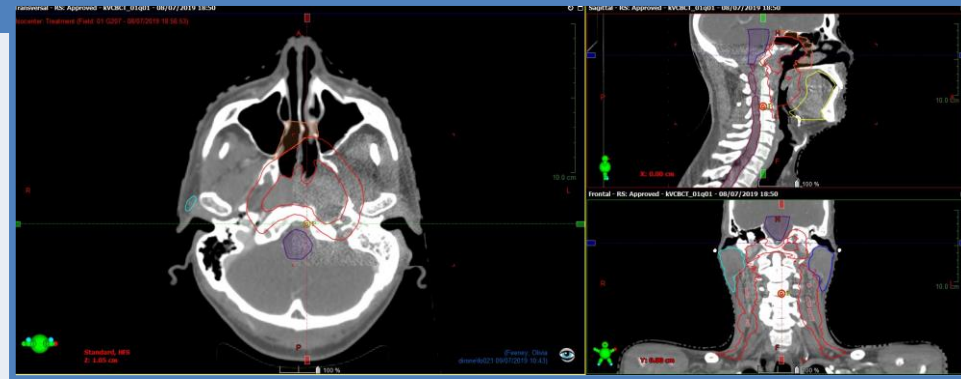
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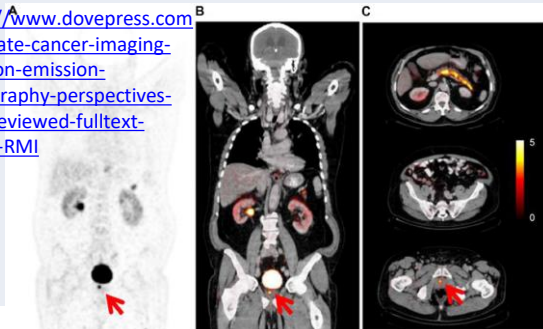
Planning



Verification (IGRT)

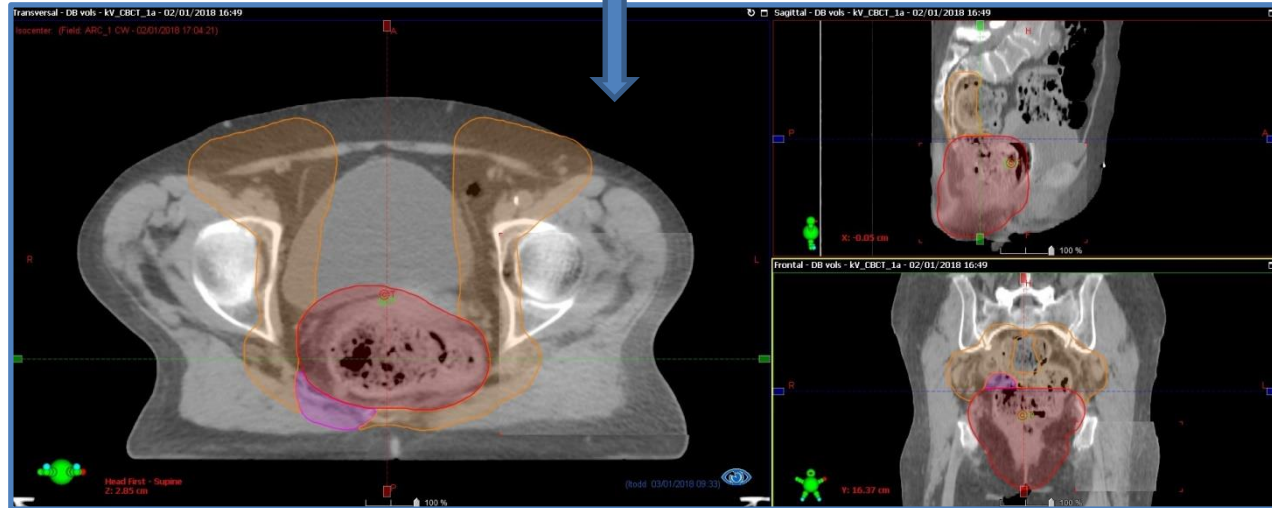
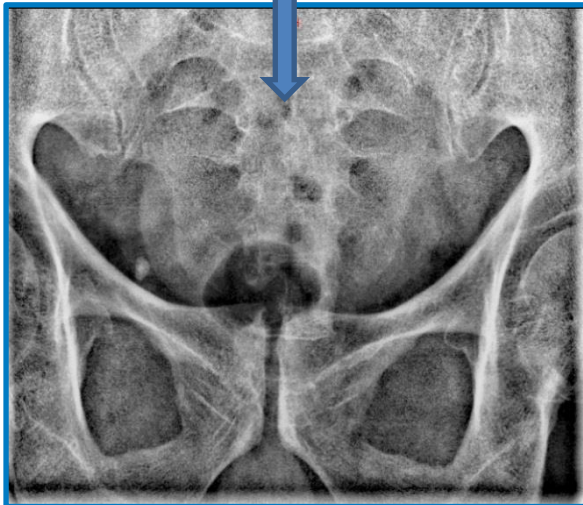
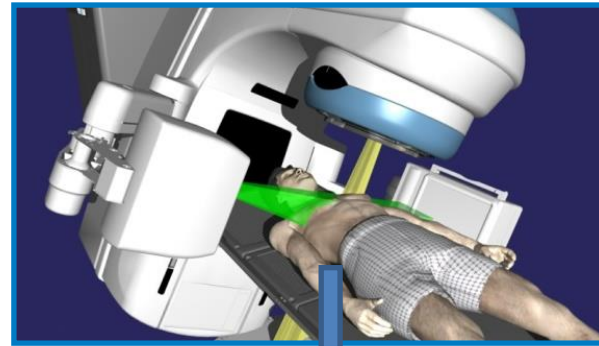


<https://www.dovepress.com/prostate-cancer-imaging-positron-emission-tomography-perspectives-peer-reviewed-fulltext-article-RMI>



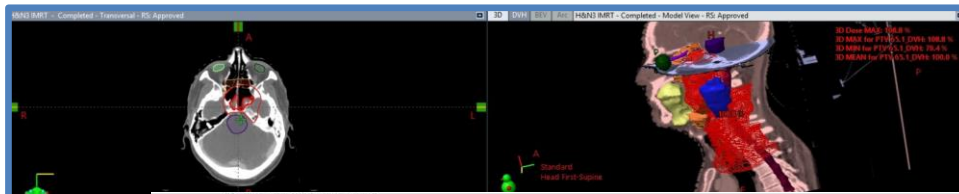
Background

Advances in volume definition and IGRT capability



Radiotherapy Planning

Auto-contouring: Atlas vs Machine Learning



Journal of Medical Radiation Sciences

Open Access

EDITORIAL

A future of automated image contouring with machine learning in radiation therapy

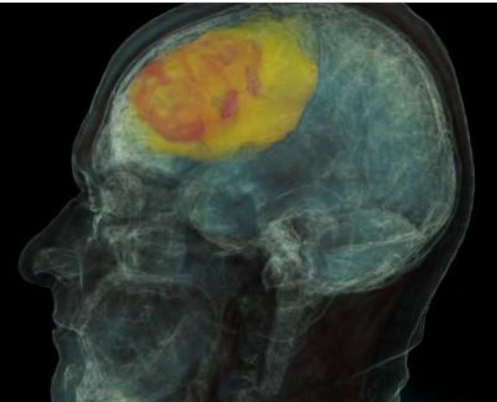
Project InnerEye – Medical Imaging AI to Empower Clinicians

VARIAN
medical systems

VARIAN
CONTOUR

Clinical Evaluation of an Automated Segmentation Module

Nicola Caria¹, Benedikt Engels², Samuel Brai³, Vincent Vinh Hung⁴,
Patricia Doornaert⁵, Alessandro Muraglia⁶, Paul Meskill, Anne Razavi⁷, Tomasz Morgas⁸



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MACHINE LEARNING
FASTER AND SMARTER
TREATMENT PLANNING



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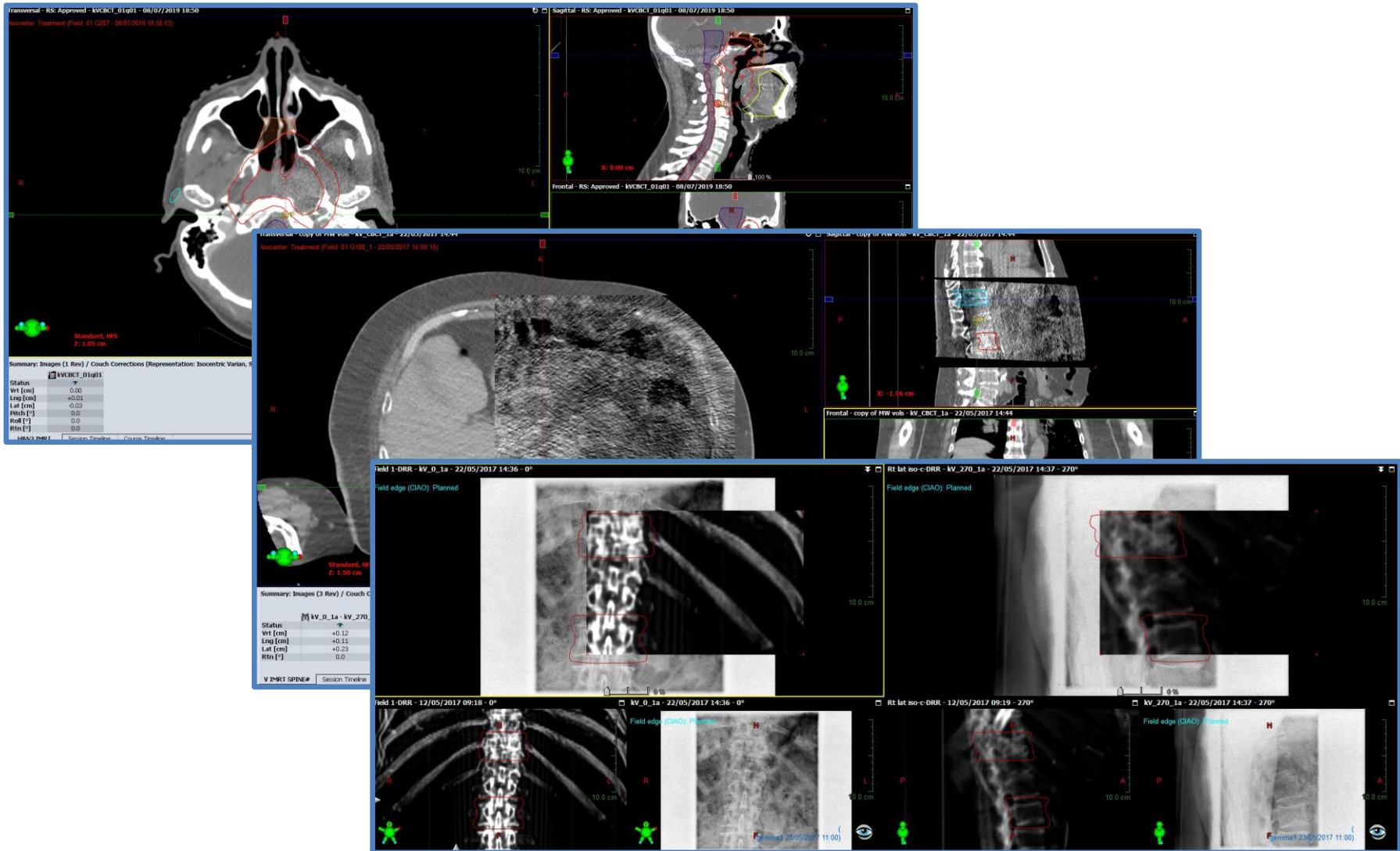
SERVICES

CAREER

Multi-atlas based segmentation in
RayStation

Radiotherapy Verification (IGRT)

Matching & Decision Making



Radiotherapy Verification (IGRT) Matching & Decision Making

Dan Ng
 Lei Xing
 Steve Jiang

LNCS 11850

Artificial Intelligence in Radiation Therapy

First International Conference on Artificial Intelligence in Radiation Therapy
 Shenzhen, China, 2016
 Proceedings



2 Materials and Methods

2.1 Deep Learning for Tumor Target Localization

The workflow of the proposed deep learning-based target localization process for prostate IGRT include three steps. The first step is to generate training datasets of kV projection X-ray images reflecting various situations of the anatomy, including different level of rotation, organ deformation, and translation of the patient. For this purpose, robust deformable models described by motion vector fields (MVs) are used to deform simulation CT to different clinical scenarios. The second step is to generate digitally reconstructed radiographs (DRR) for each deformed CT dataset in a predefined direction. Finally, the annotated samples are used to train a deep learning model for subsequent localization of the prostate target. Validation tests using both simulated DRR and clinical on-board imager (OBI) daily positioning images were performed. More details are described in the following subsections.

Image-Guided Radiotherapy using Deep Learning for Target Localization

Younouski, Steven L. Hancock,
 Lei Xing^(✉)

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Radiotherapy often relies on external beam (EB) or transducers for target localization. EB requires an invasive procedure and discomfort to the patient. Markerless prostate localization model to interpret routine prostate daily cone-beam computed tomography (CBCT) was first trained by using OBI images. The trained model is used to localize the prostate target for a given

input X-ray projection image. To assess the accuracy of the approach, six patients with prostate cancer received volumetric modulated arc therapy (VMAT) were retrospectively studied. The results obtained by using the deep learning model and the actual position of the prostate were compared quantitatively. Differences between the predicted target positions using DNN and their actual positions are (mean ± standard deviation) 1.66 ± 0.41 mm, 1.63 ± 0.48 mm, and 1.64 ± 0.28 mm in anterior-posterior, lateral, and oblique directions, respectively. Target position provided by the deep learning model for the kV images acquired using OBI is found to be consistent that derived from the implanted FM. This study demonstrates, for the first time, that highly accurate markerless prostate localization based on deep learning is achievable. The strategy provides a clinically valuable solution to daily patient positioning and real-time target tracking for image-guided radiotherapy (IGRT) and interventions.

Opportunities for CCAP?



Computing



Imaging



Machine Learning