ORBIT-RT: A Real-Time Platform for Knowledge-Based Quality Control of Radiotherapy Treatment Planning

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RETHINKING MEDICAL PHYSICS

INTRODUCTION

Radiotherapy (RT) treatment plan quality variations have been observed in instances where treatment planning guidelines were not patient-specific,[1,2] resulting in **avoidable patient toxicity**.

ORBIT-RT (Online Real-time Benchmarking Informatics Technology for RadioTherapy: www.orbit-rt.com) was thus launched to respond to the need for **(1) patient-specific quality control of RT plans**[1,3-11] and **(2) uninhibited access to this quality control**, completely independent of the treatment planning system. ORBIT-RT accurately predicts **dose-volume histograms (DVHs) of organs-at-risk (OARs)** while satisfying several criteria for suitable clinical use:

- A free, universally accessible web-based platform
- DICOM-based operation using MIM™
- Minimal user input: metadata + DICOM
- HIPAA-compliant anonymization with MIMCloud Assistant™
- Completely autonomous workflow
- Automatic contour identification for efficient operation

RESULTS
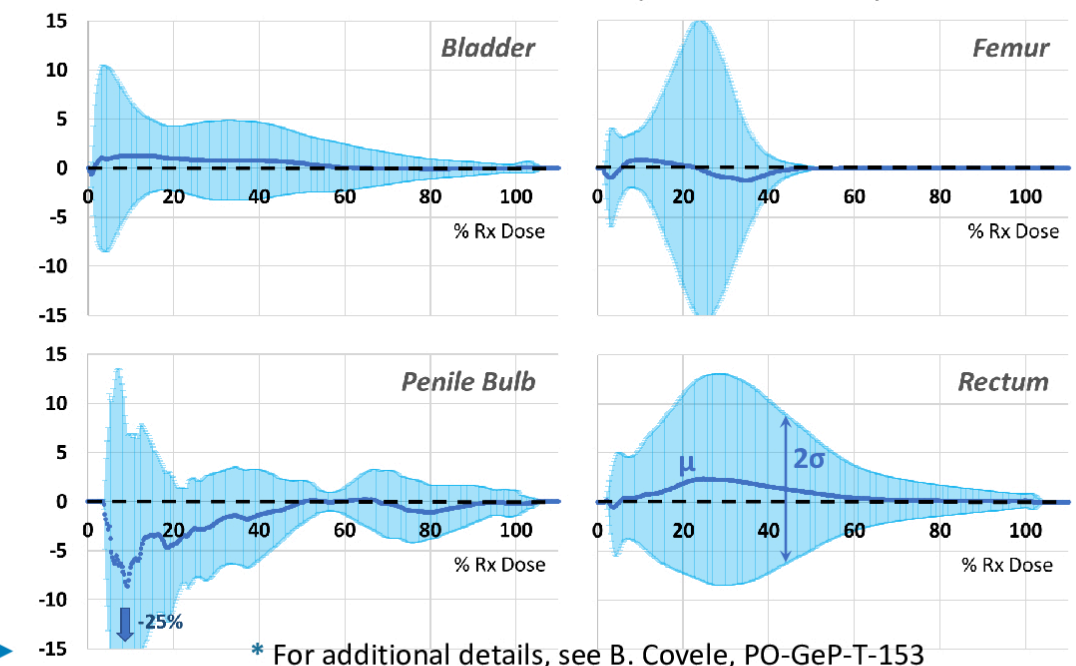
How *FAST* is ORBIT-RT?
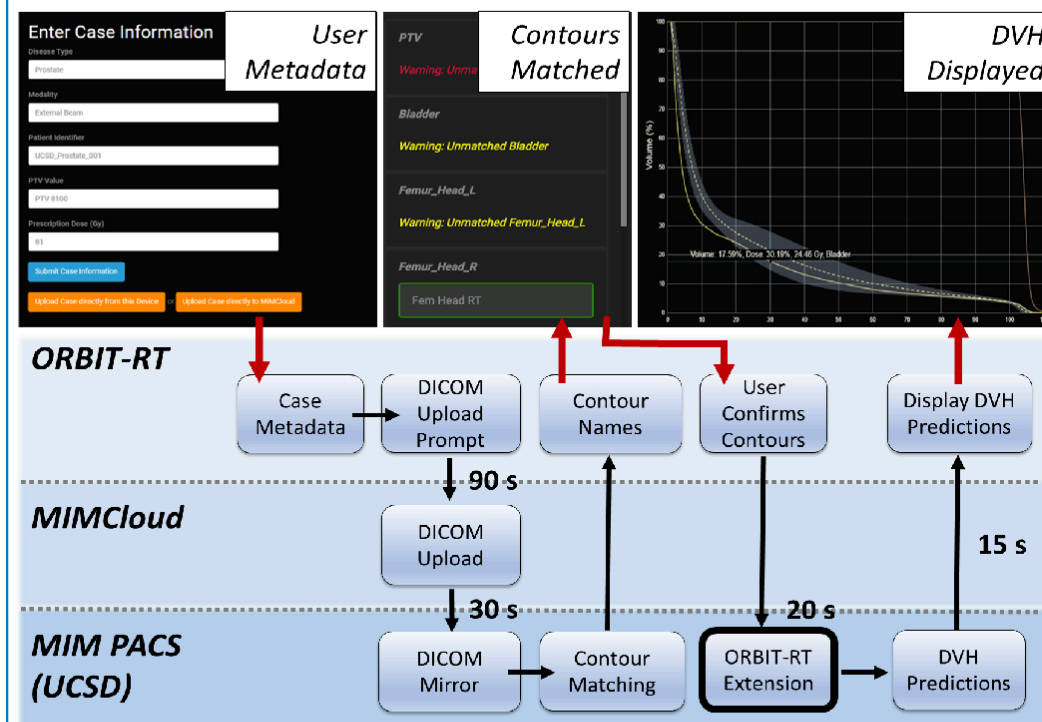
The ORBIT-RT workflow to produce OAR DVH predictions is fully autonomous upon receipt of the new patient DICOM. **Typical wait time for a set of prostate OAR DVHs is 2.5-3 minutes**, the majority of which is used for data transfer. Auto-matching of contour names to OAR models facilitates speed.
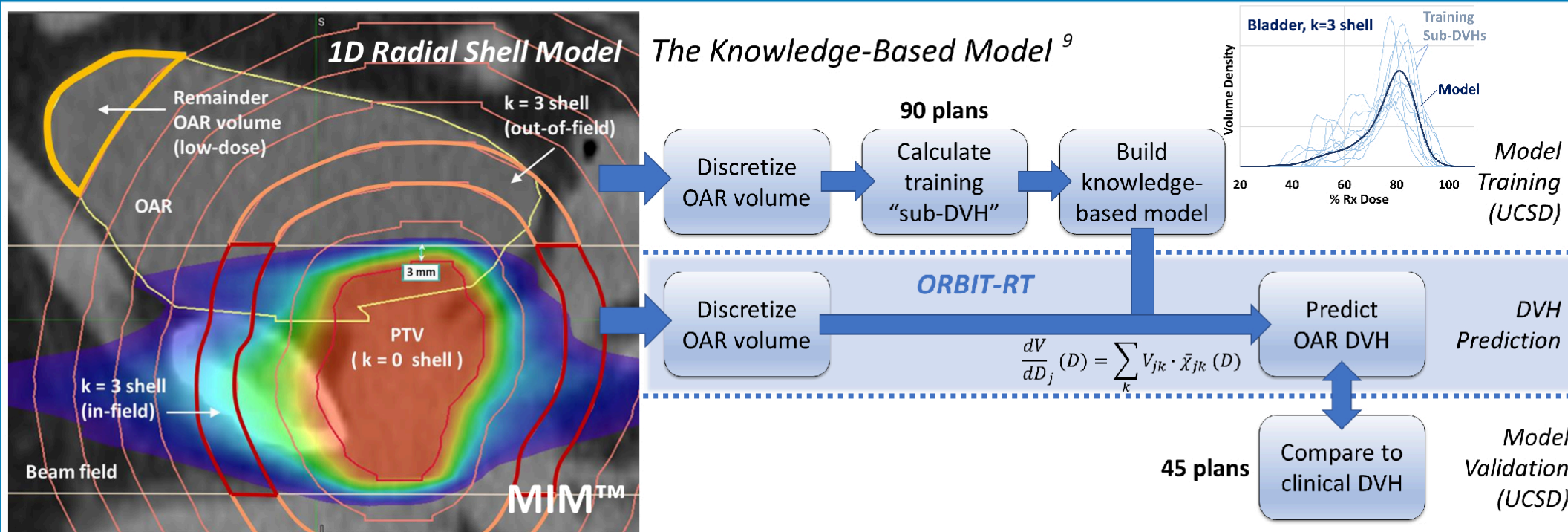
Mean (μ, curve) and standard deviation (σ, band) of ORBIT-RT prediction error from a validation cohort of 45 prostate clinical plans. Smaller μ and σ indicate less bias and uncertainty, respectively. At 40% Rx dose and higher, prediction bias is less than 2%, with uncertainty between 5-10%. **At 80% Rx dose and higher, prediction bias falls under 1%, with 2% uncertainty.**

How *ACCURATE** is ORBIT-RT?

Clinical DVH – ORBIT DVH (% OAR, Prostate)

* For additional details, see B. Covele, PO-GeP-T-153

METHODS

1D Radial Shell Model

The Knowledge-Based Model [9]

$$\frac{dV}{dD_j}(D) = \sum_k V_{jk} \cdot \tilde{\chi}_{jk}(D)$$

CONCLUSIONS

- ORBIT-RT demonstrated **fast, fully autonomous knowledge-based feedback of OAR DVHs on a web-based platform** that takes only anonymized DICOM-RT as input.

- ORBIT-RT can be used by clinicians anywhere, at any time, to improve the quality and consistency of their RT plans, free of charge. A MIMCloud Assistant™ account is free for registered ORBIT-RT users to upload DICOM.

- An ORBIT-RT prostate model has been trained on 90 training plans and validated on 45 additional plans, demonstrating suitable OAR DVH prediction accuracy.

- The ORBIT-RT workflow, powered by MIM™, is fast and efficient as to be suitable for real-time clinical use, taking **2.5-3 minutes to produce prostate OAR DVH predictions.**

AVAILABLE SITE MODELS

- **Current:** Prostate
- **Soon:** GBM, Lung, Mediastinum, Lung SBRT, Liver SBRT

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