Abstract Overview

Automated VMAT Planning for Ultra-Hypofractionated Prostate Radiotherapy

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Purpose

- To clinically validate a DL based automated planning (AP) pipeline solution for localized prostate (36.25 Gy / 5 fx).

Mat&Methods

- The AP pipeline was trained on 138 VMAT manual plans.
- Clinical validation was done on 20 patients from 2 centers in the following configuration:
  - 11 plans VersaHD with Agility MLC with Raystation TPS.
  - 9 plans TrueBeam with HDMLC with Eclipse TPS.
  - Quantiative evaluation was done between Manual and AP plans based on GETUC criteria.
  - Qualitative review was done by 3 senior Rad Oncs.
  - A subset of cases underwent patient specific plan QA measurements.

Results

- The full AP process required approximately 10 minutes.
- AP plans demonstrated superior target coverage compared to MPs.
- During physician review, the mean normalization adjustment was 2.9±1.9%, balancing CTV coverage and rectal sparing.
- All AP plans except one (minor sigmoid deviation) were considered clinically acceptable.
- Patient-specific QA confirmed excellent deliverability, with gamma pass rates above 99% (3%/2mm).

Conclusion

- The proposed AP pipeline enables fast, consistent, and clinically acceptable VMAT plan generation for ultra-hypofractionated prostate radiotherapy across different TPS and linac models.
- Integration of MRI-based urethral delineation is expected to further enhance OAR sparing.

- Fast generation of clinically acceptable VMAT plans.
  The automated pipeline produces plans in ~10 minutes (≈20 minutes including review) for Prostate cancer Radiotherapy, with nearly all plans deemed clinically acceptable.
- Improved target coverage with consistent plan quality.
  Demonstrates superior CTV coverage compared to manual plans, achieving target coverage in 20/20 cases under standardized criteria.
- Robust and clinically deliverable across systems.
  Validated across multiple TPS and linac models, with patient-specific QA confirming high deliverability (gamma pass rates >99%).

Structure	Dose Criteria	Manual Plans (mean + SD)	SmartPlan Plans (mean + SD)
PTV	D95% ≥ 34.4 Gy	35.48 ± 0.49	36.77 ± 0.18 *
	Dmax ≤ 120 %	37.93 ± 1.02	38.95 ± 0.71
CTV	D99% ≥ 36.25 Gy	35.98 ± 0.67	38.95 ± 0.71 *
Rectum	D50% < 8.1 Gy	9.49 ± 2.62	10.22 ± 1.69
	D20% < 29 Gy	19.19 ± 3.11	18.96 ± 2.7
	D1cc < 36.00 Gy	35.63 ± 0.67	37.41 ± 0.93 *
Bladder	D40% < 18.1 Gy	5.1 ± 4.2	6.59 ± 5.01 *
	D10% < 36.25 Gy	20.68 ± 6.68	22.32 ± 7.37
Left Femoral Head	D5% < 14.5 Gy	11.74 ± 1.52	11.96 ± 1.72
Right Femoral Head	D5% < 14.5 Gy	11.87 ± 1.49	11.71 ± 1.55

Table 1: Quantitative results Manual vs AutoPlan doses; with * are marked the statistically significant differences .

Internal