

Die Intraobserver Variabilität bei der Zielvolumensdefinition für die stereotaktische Strahlentherapie des Pankreaskarzinoms. Eine Studie der DEGRO AG Stereotaxie

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Hintergrund

Die stereotaktische Strahlentherapie des Pankreaskarzinoms ist erschwert durch die enge Lagebeziehung des Tumors mit den Risikoorganen.

Die Definition des Zielvolumens für die SBRT des Pankreaskarzinom erfordert eine besondere Expertise.

Das Ziel dieser Studie war es, die Variabilität bei der Konturierung durch ein Panel von Radioonkologen zu erfassen und zu quantifizieren.

Fall1: Rezidiv nach Whipple

Non-KM Planungs-CT: 3.0 mm,

4D CT: 2.0 mm, Abdominelle Kompression,

PET-CT: 3.0 mm, Abdominelle Kompression,

PET: 3.0 mm, Abdominelle Kompression,

KM CT: 3.0 mm, keine Abdominelle Kompression, Ende Inspiration

Fall2: Inoperables Pankreaskarzinom

PET: 3.0 mm, Abdominelle Kompression,

4D-CT: 3.0 mm, Abdominelle Kompression,

4D-PET-CT: 3.0 mm, Abdominelle Kompression,

Non-KM Planungs-CT: 3.0 mm, Abdominelle Kompression,

MR T1: 3.0 mm, keine Abdominelle Kompression, Ende Inspiration

MR T2: 3.0 mm, keine Abdominelle Kompression, Ende Inspiration

Fall3: Inoperables Pankreaskarzinom

KM Planungs-CT: 3.0 mm, Abdominelle Kompression, Freie Atmung

4D CT: 2.0 mm, Abdominelle Kompression, 10 Phasen

KM CT Arteriell: 1.0 mm, keine Abdominelle Kompression, Ende Inspiration

KM CT Venös: 1.0 mm, keine Abdominelle Kompression, Ende Inspiration

For the analytic comparison of the GTV, TV and PTV we used different qualitative and geometric metrics as described by Taha and Hanbury [3]:

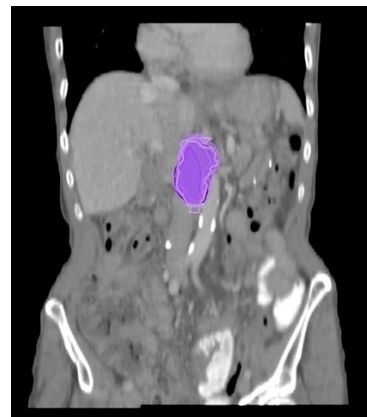
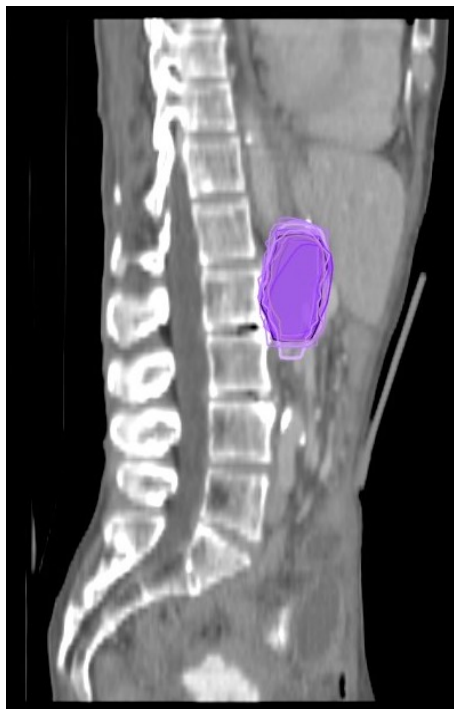
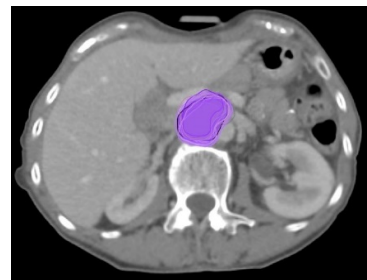
The Dice-Sorensen Coefficient (DSC), as an overlap based evaluation, which is the most used metric in validating medical image.

The symmetric Hausdorff Distance (HD), is a spatial distance based metric, as an outlier sensitive evaluation that ensures exact contours and alignment.

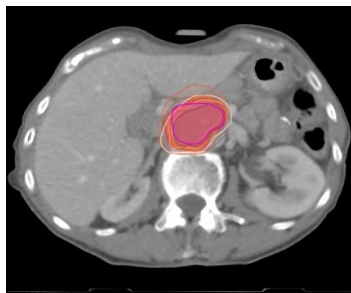
The Probabilistic Distance (PBD), is a probabilistic metric, that strongly personalizes alignment errors (when the segmented size of the volume is correct, but the overlap is low). It is relevant when the alignment is of more interest than volume or contour.

The **Volumetric Similarity (VS)**, which is a volume based metric, only compares the volume of two segmentations, assuming that the alignment is optimal. The overlap is not considered.

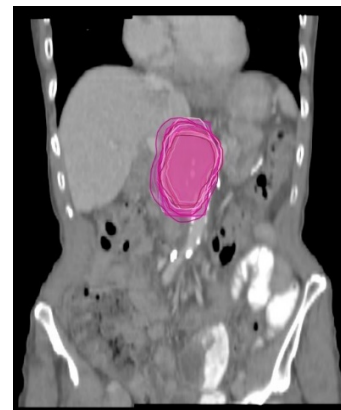
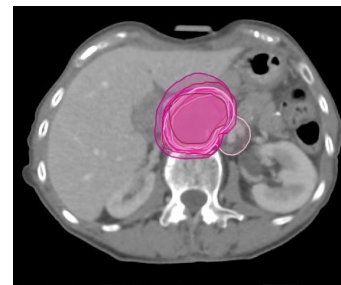
Fall 1
GTV



ITV

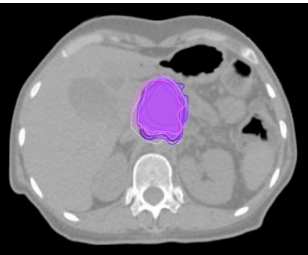


PTV

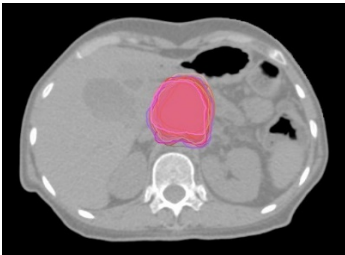


Fall 2

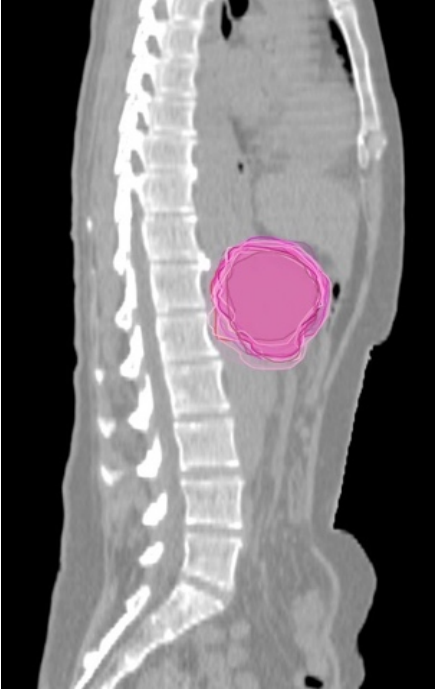
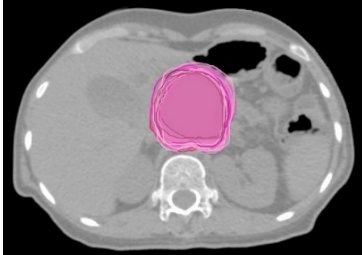
GTV



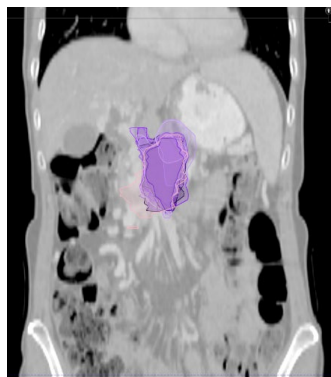
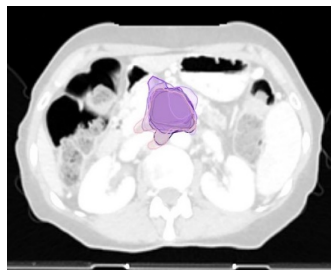
ITV



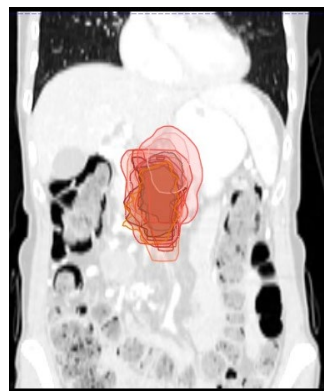
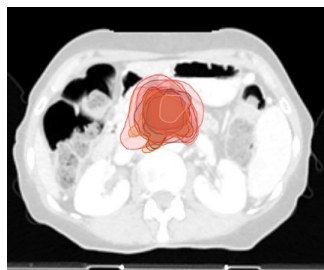
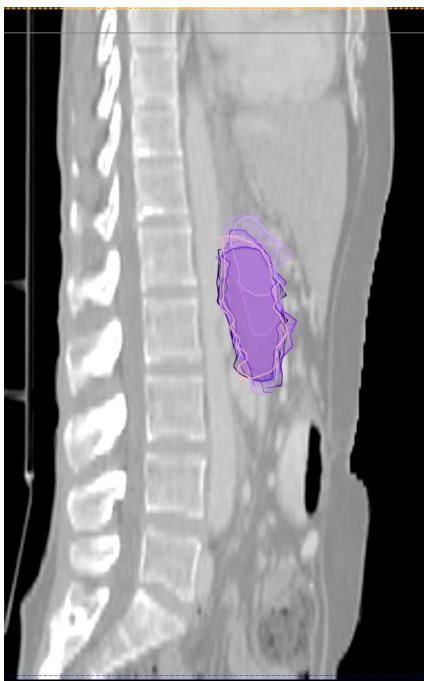
PTV



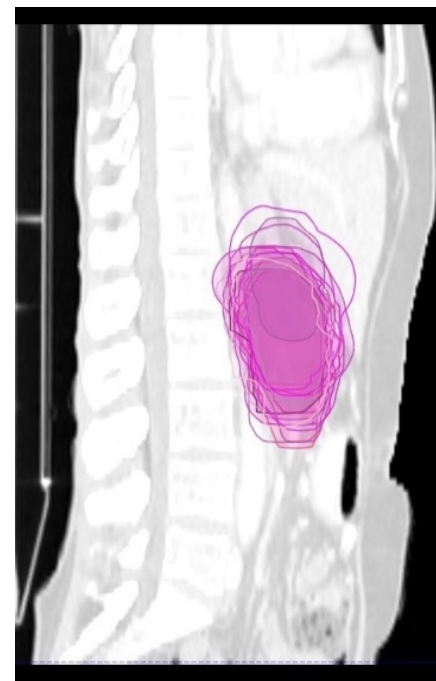
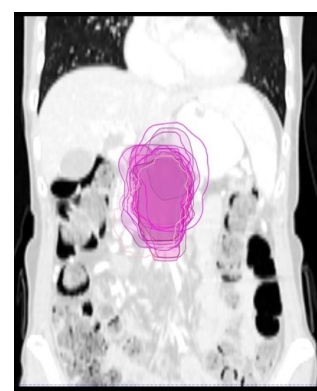
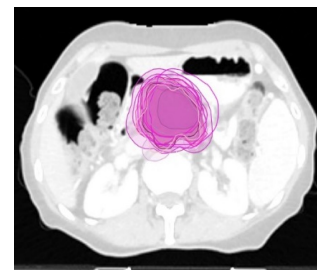
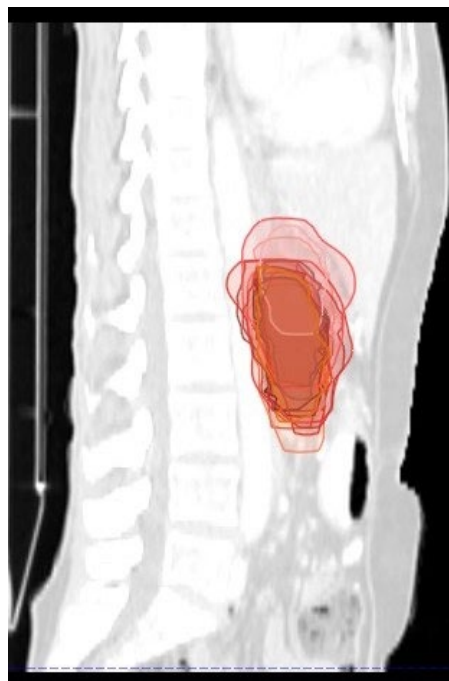
Fall 3
GTV



ITV



PTV



•Gross tumor volume

IOA	DSC Overlap-base	HD Distance-based	PBD Probabilistic- based	VS Volume-based
All Patients				
Minimum	0.17	3.22	0.06	0.34
Maximum	0.95	67.11	4.86	1.0
Mean	0.72	17.1	0.51	0.85
Median	0.75	15	0.33	0.88
Std	0.14	9	0.68	0.12
Patient 1(4D planning CT without IV contrast, planning PET CT, diagnostic CT with IV contrast)				
Minimum	0.56	3.22	0.06	0.58
Maximum	0.95	27.24	0.79	1.0
Mean	0.77	11.43	0.31	0.87
Median	0.78	10.35	0.28	0.88
Std	0.07	5.32	0.13	0.09
Patient 2 (4D planning PET/CT without IV contrast, diagnostic MRI)				
Minimum	0.45	6.6	0.08	0.48
Maximum	0.92	30.78	1.2	1.0
Mean	0.74	16.5	0.36	0.88
Median	0.7	15.4	0.31	0.91
Std	0.08	5.37	0.18	0.11
Patient 3 (4D planning CT with IV contrast, diagnostic CT)				
Minimum	0.17	8.73	0.17	0.34
Maximum	0.85	67.11	4.86	1.0
Mean	0.64	23.54	0.87	0.81
Median	0.73	21.61	0.38	0.84
Std	0.2	10.57	1.07	0.14

•Internal tumor volume

IOA	DSC Overlap-base	HD Distance-based	PBD Probabilistic- based	VS Volume-based
All Patients				
Minimum	0.2	3.87	0.06	0.28
Maximum	0.95	70.5	4.01	1.0
Mean	0.69	18.21	0.56	0.78
Median	0.72	15.87	0.39	0.82
Std	0.14	9.42	0.52	0.16
Patient 1(4D planning CT without IV contrast, diagnostic PET CT, diagnostic CT with IV contrast)				
Minimum	0.39	3.87	0.06	0.39
Maximum	0.95	722.56	1.59	1.0
Mean	0.71	12.55	0.45	0.77
Median	0.73	12.18	0.37	0.80
Std	0.11	4.03	0.28	0.15
Patient 2 (4D planning PET/CT without IV contrast, diagnostic MRI)				
Minimum	0.52	6.67	0.12	0.53
Maximum	0.89	34.07	0.94	1.0
Mean	0.76	15.73	0.33	0.84
Median	0.77	15.03	0.3	0.86
Std	0.08	5.42	0.16	0.12
Patient 3 (4D planning CT with IV contrast, diagnostic CT)				
Minimum	0.2	11.09	0.24	0.28
Maximum	0.8	70.56	4.01	1.0
Mean	0.58	26.67	0.92	0.72
Median	0.6	23.64	0.66	0.72
Std	0.16	10.94	0.73	0.18

•Planning tumor volume

IOA	DSC Overlap-base	HD Distance-based	PBD Probabilistic- based	VS Volume-based
All Patients				
Minimum	0.26	3.87	0.04	0.37
Maximum	0.96	70.56	2.88	1.0
Mean	0.74	18.53	0.41	0.82
Median	0.77	15.9	0.30	0.84
Std	0.13	9.15	0.537	0.13
Patient 1(4D planning CT without IV contrast, planning 3D PET CT, diagnostic CT with IV contrast)				
Minimum	0.44	3.87	0.04	0.44
Maximum	0.96	30.24	1.26	1.0
Mean	0.76	14.43	0.35	0.80
Median	0.77	13.16	0.29	0.82
Std	0.10	6.01	0.22	0.13
Patient 2 (4D planning PET/CT without IV contrast, diagnostic MRI)				
Minimum	0.61	6.9	0.09	0.62
Maximum	0.91	33.17	0.63	1.0
Mean	0.81	15.11	0.25	0.88
Median	0.81	14.2	0.24	0.89
Std	0.06	4.75	0.10	0.09
Patient 3 (4D planning CT with IV contrast, diagnostic MRI)				
Minimum	0.26	10.3	0.18	0.37
Maximum	0.85	70.56	2.88	1.0
Mean	0.65	26.05	0.65	0.77
Median	0.69	24.0	0.45	0.79
Std	0.14	10.35	0.51	0.15

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