DBP: Head and Neck Cancer

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As previously reported...

- Hot & cold spots in tumor

- 3 Gy
- 5 Gy
Patching

- 50%
- 90%
- 100%
Patching

Pre-treatment

Mid-treatment
Frontal
Maxillary
Ethmoid
Nasal cavity
RTOG 0617

- Locally advanced non-small-cell lung cancer
- Randomized trial: 60 Gy vs 72 Gy
- 423 participants enrolled 2007-2011
Radiobiology theory

*** TCP model by Niemerko, NSCLC parameters by Martel
RTOG 0617

- Locally advanced non-small-cell lung cancer
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- Lower medial survival for high dose (19.6 mo vs 28.7 mo)
- Lower QOL for high dose

Bradley et al., ASTRO 2011
Movsas et al., ASTRO 2013
PET in Lung Cancer
PET in Lung Cancer
Reason for displacement of the site of recurrence:
• direction of tumor growth

Shusharina, 2013
Dose accumulation in prostate cancer
Interactive registration

\[ C(I_0, I_1(D(\bar{x}))) = C_{sim}(I_0, I_1(D(\bar{x}))) + \lambda C_{sm}(D(\bar{x})) \]
\[ \nabla C = \frac{\partial C(\Phi^l)}{\partial \Phi^l} + h(F^l) \quad \text{where} \]
\[ D(\bar{x}) = \sum_{l=1}^{L} D^l(\bar{x}) \quad \text{and} \quad D^l \quad \text{are defined by} \quad \Phi^l \]

Input Accumulation \( F^l \)

B-Spline Registration

Visualization \( I_0(\bar{x}), I_1(D(\bar{x})), \Phi^l \)

Images \( I_0(\bar{x}), I_1(\bar{x}) \)

User Input
Apply forces \( f^l \) to anchor points

Expert Knowledge:
Ideal \( I_1(D(\bar{x})) \)

Kolesov 2014
KSlice Interactive Segmentation

- Editor module
- Inter-slice interpolation
- Control of user input function
- Choice for image cost functional
- Selection of tools for input
** MABS **

Multi Atlas Based Segmentation

- Atlas images
- Selected images
- Input image
- Atlas selection
- Registration
- Warped contours
- Label fusion
- Final segmentation
** MABS **
Multi Atlas Based Segmentation

- Atlas images
- Atlas selection
- Registration
- Warped contours
- Label fusion
- Final segmentation
- Atlas selection optimization
** MABS **

Multi Atlas Based Segmentation

Atlas images

Atlas selection

Selected images

Registration

Warped contours

Label fusion

Final segmentation

Fusion optimization
Registration optimization

Rigid
“Grid search optimization”

Deformable
“B-Spline, 10 cm grid”

Rigid
“Gradient Descent”

Deformable
“B-Spline, 10 cm grid”
Registration optimization

Rigid "Grid search optimization" → Rigid "Gradient Descent" → Deformable "B-Spline, 10 cm grid"

Average Dice: 0.689

Rigid "Grid search optimization" → Rigid "Grid search optimization" → Deformable "B-Spline, 10 cm grid"

Average Dice: 0.671
Atlas selection optimization

Parotid gland

Zaffino, ESTRO 2014
Segmentation using Learning and Regularization
** Thank you from the DBP team **

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