TU WIEN Informatics

Interactive Co-Registration for Multi-Modal Cancer Imaging Data based on Segmentation Masks

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MOTIVATION

Endometrial cancer is the most lethal gynecological malignancy worldwide

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Radiomic Tumor Profiling
Extract features from multi-modal images to find new tumor biomarkers

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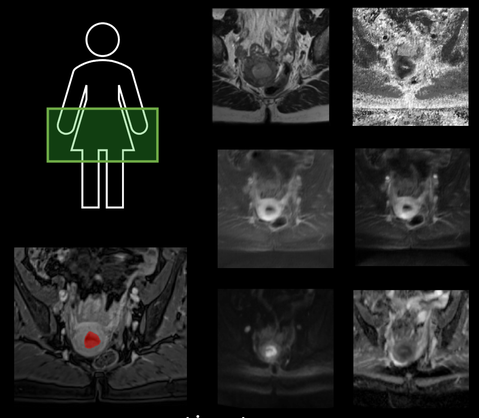
More personalized treatment

→ **Acquisition of multiple sequences per patient**



- 7 sequences per patient
- 1 tumor segmentation mask for feature extraction, generated for 1 sequence (= reference sequence)

PROBLEM

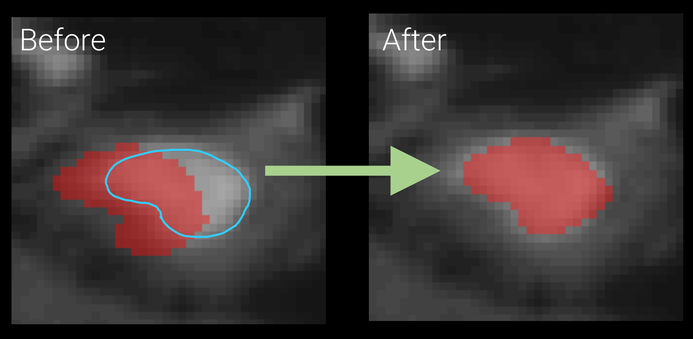
Poor Co-Registration Quality

- Reason: Internal organ movements
- Automatic approaches → unsatisfying results

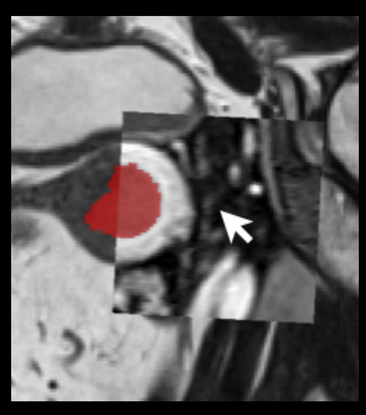
CONTRIBUTIONS: Web-based Application MuSIC (Multi-Sequence Interactive Co-Registration)

AUTOMATIC SHAPE MATCHING → **INTERACTIVE SHAPE MATCHING** → **CO-REGISTRATION**

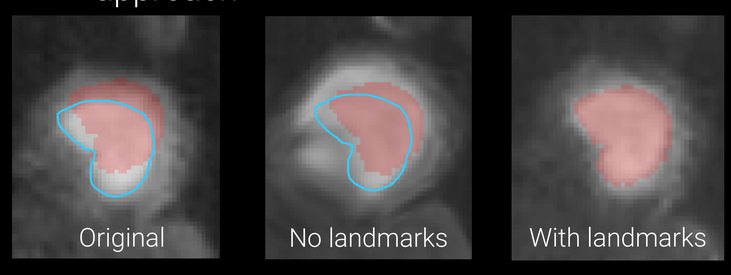
- We search for the shape of the tumor segmentation in the different sequences that can vary in **rotation** and **translation** parameters
  - Characterized by high gradient in the border area
- Based on **Simulated Annealing**



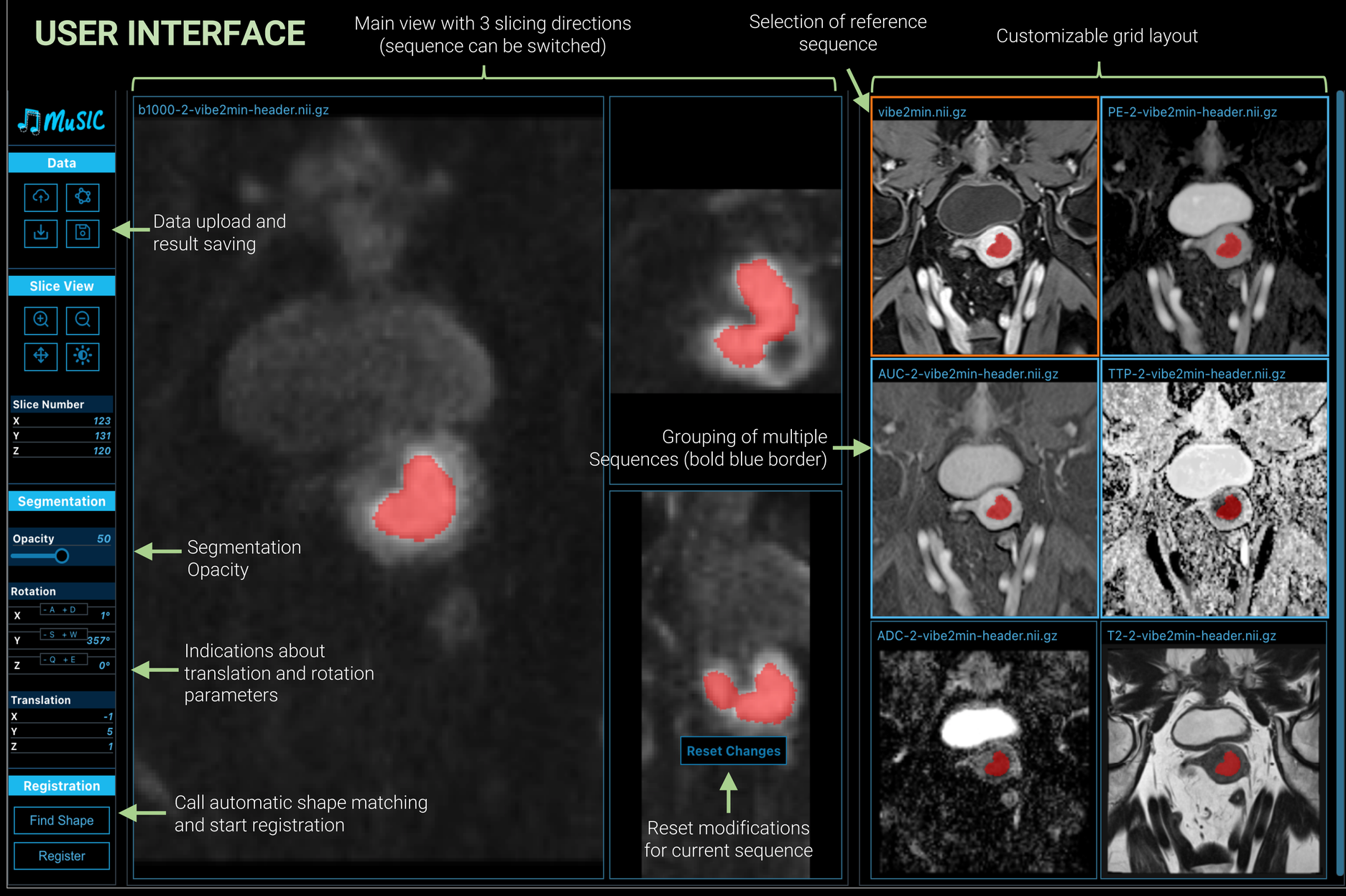
- If needed, the user can adapt the proposed positioning of the segmentation mask with the keyboard (rotation and translation)
- Support for visualization and simultaneous processing of **multiple sequences**
- Quality assessment of the future registration outcome via a **magic lens** showing the reference sequence
  - Updates on user interaction



- We use the indices of the original and transformed segmentation mask as landmarks for registration with **Elastix**
- **Rigid** or **deformable** registration
- In contrast to other approaches using deformable registration, we avoid tumor deformations due to our landmark-based approach



USER INTERFACE



USABILITY ANALYSIS

- Participants: 5 medical experts, 2 machine learning experts
- Average SUS Score: **95.4**
- Medical experts want to use MuSIC in the future
- Magic lens and multi-modal processing support were highly appreciated
  - Analysis revealed additional advantage: **Assessment of segmentation quality**

Sequence reveals different tissue characteristics

→Is yellow area part of the tumor?

→ **Future work**: make segmentation mask adaptable for combined multi-modal segmentation and registration