# Abstract: Multistage Registration of CT and Biopsy CT Images of Lung Tumors

Anika Strittmatter[1,2], Alexander Hertel[3], Steffen Diehl[3], Matthias F. Froelich[3], Stefan O. Schoenberg[3], Sonja Loges[4], Tobias Boch[4], Daniel Nowak[5], Alexander Streuer[5], Lothar R. Schad[1,2], Frank G. Zöllner[1,2]

[1]Computer Assisted Clinical Medicine, Medical Faculty Mannheim, Heidelberg University
[2]Mannheim Institute for Intelligent Systems in Medicine, Medical Faculty Mannheim, Heidelberg University
[3]Department of Radiology and Nuclear Medicine, Mannheim University Medical Centre, Medical Faculty Mannheim, Heidelberg University
[4]Department of Personalised Oncology, Mannheim University Medical Centre, Medical Faculty Mannheim, Heidelberg University
[5]Department of Hematology and Oncology, Mannheim University Medical Centre, Medical Faculty Mannheim, Heidelberg University
anika.strittmatter@medma.uni-heidelberg.de

The research project "Radiomics enhanced CT-guided targeted biopsy in lung cancer" utilises pre-calculated intratumoural heterogeneity areas to perform CT-guided biopsies of lung tumors. This involves the fusion of CT images acquired during preliminary examinations and their radiomics maps with biopsy CT images to detect potential intratumoral heterogeneity areas, requiring registration of the corresponding images. So, we developed a multistage registration approach with rigid preregistration. The dataset comprises 13 thorax CT volumes recorded during preliminary examinations (called CT images) and 13 narrow CT volumes (6 slices) acquired during biopsies (called biopsy CT images) of 13 patients with lung tumors. In some cases, due to the intervention, patients were lying on their side during the biopsy, whereas they were lying on their back during the preliminary examination. Rigid preregistration was initially performed to correct large rotations and translations. The rotation was determined using bounding boxes and ITK-Snap was used to estimate corresponding slices in the images. The preregistered CT images were then registered to the biopsy CT images using a SimpleElastix multistage algorithm, including rigid, affine, and deformable transformations. The transformations from the rigid preregistration and SimpleElastix were then applied to the radiomics maps. The results demonstrate that the multistage registration resulted in high structural similarity and overlap of lung tumors in the CT and biopsy CT images, enabling "virtual biopsies" and extraction of quantitative radiomics features of the exact puncture site [1].

## References

1. Strittmatter A, Hertel A, Diehl S, Froelich MF, Schoenberg SO, Loges S et al. A multistage registration of CT and biopsy CT images of lung tumors. Proc 6th Conf on Image-Guided Interventions. 2023:17–8.


A. Maier et al. (Hrsg.), *Bildverarbeitung für die Medizin 2024*,
Informatik aktuell, https://doi.org/10.1007/978-3-658-44037-4_56