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Deformable image registration

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Over the last few decades, deformable image registration (DIR) has gained popularity in image-guided adaptive radiotherapy for a number of applications, such as contour propagation, dose warping, and accumulation. The variety of proposed DIR algorithms is vast, ranging from well-known image-based iterative optimization processes to novel machine learning solutions.

However, proper validation of the available DIR algorithms from both a geometrical and dosimetric standpoint is mandatory to properly adopt this methodology into the clinical practice. This is even more evident in case of particle therapy where steep dose-gradients are present and where DIR inaccuracies need to be properly assessed.

In this talk, basic concepts of image registration will be presented along with different algorithms available in the literature. A specific focus will be also put on DIR validation to provide robust, reliable and accurate patient-specific strategies for DIR application in adaptive particle therapy.

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