2022 ESTRO Physics Workshop: Science in Development

Next generation MR-guided radiotherapy: AI applications for planning and image guidance

7 - 8 October 2022, Lisbon, Portugal

Chairs: Davide Cusumano, Marco Fusella, Lorenzo Placidi

Delegates of the workshop

We are thrilled to report the amazing experience we had in Lisbon at the European SocieTy for Radiotherapy and Oncology (ESTRO) physics workshop in October. We were honoured to chair the section that was focused on next-generation magnetic-resonance (MR)-guided radiotherapy: artificial intelligence (AI) applications for planning and image guidance. It was a great opportunity to meet and discuss such topics in person (finally).

Twenty participants from 10 countries, who worked in clinics, universities and industry, met first online in early September 2022. This online meeting opened with an overview of the state-of-the-art AI in three main topics of MR-guided radiotherapy.

The first talk summarised the problems and challenges in this field. It was focused on synthetic computed tomography (CT) generation and the lack of quality assurance (QA) programmes. Then the workshop turned to AI for image guidance and adaptive radiotherapy. Speakers considered real-time auto-contouring, auto-planning and advanced AI-based QA. The last talk was named “AI for patient outcome”: it focused on MR-based biomarkers that used radiomics analysis and implemented advanced imaging. The talks were followed by brief introductions of all the participants, in which each presented their background and expertise in the workshop field and pointed out what they considered to be the main challenges, according to their experience.

Based on participants' pitches, we identified a list of topics on which we wanted to focus the in-person meeting in Lisbon:

- AI tracking;
- Autoplanning;
- QA in AI;
- MR-based radiomics and advanced imaging; and
- MR-only workflow and synthetic CT.

During the two-day meeting in the beautiful city of Lisbon, we were delighted by the presentations by speakers Stefanie Corradini (Ludwig Maximilian University in Munich, Germany), Chiara De-Colle (University of Tübingen, Germany), Jennifer Dhont (Jules Bordet Institute, Belgium) and Tomas Jansen (The Netherlands Cancer Institute, Amsterdam). These offered clinical and physics perspectives and helped to stimulate a lively discussion. After the first day of thoughtful discussions, two sub-groups were defined to start working on workshop outcomes during the second day. Lively and deep discussions went on in the classroom and, of course, in front of beers during the networking event.

Outcomes for the workshop are being developed. They will include:

- a survey that is aimed to gather information on the actual experience of MRI-only workflow implementation, the status of QA, the variability of synthetic CT algorithms that are used in clinics, and dose calculation assessment in the absence of national and international guidelines;
- a position paper on MRI-only workflow and the suggestion of a QA protocol for synthetic CT generation and implementation; and
- a vision paper on AI-based tracking that will cover the current status and developments of AI and non-AI methods.

The workshop also enabled participants to contact each other and to start to develop collaborations with the aims of establishing a vendor-independent working group within ESTRO and setting up multi-centre studies. Further topics of discussion (such as the use of AI in quantitative MR imaging) will be discussed in a follow-up online meeting.

The chairs would like to thank ESTRO for this great opportunity, and the invited speakers and participants for their ideas and enthusiasm!

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