

AbstractID: 14512 Title: Real-time Re-planning for Online Adaptive Radiotherapy

By seamlessly integrating treatment simulation and planning into the treatment delivery process, online adaptive radiation therapy (ART) allows real-time treatment adaptations based on the current patient anatomy and therefore holds significant promise in maximally compensating for interfraction anatomical uncertainties. The clinical realization of online ART is extremely challenging, mainly due to the inability for real-time treatment re-planning. For real-time treatment re-planning, three key components need to be done in real time: anatomy segmentation, dose calculation, and treatment plan (re-)optimization. We have implemented all three components on GPU and gained real-time efficiency. Our preliminary results on an NVIDIA Tesla C1060 GPU card for various clinical scenarios are very promising. For a typical 9-field prostate IMRT case, the deformable registration can be done in 7 seconds, the dose calculation takes less than 2 seconds, and the plan re-optimization takes less than 3 seconds. Therefore, a new plan can be developed in about 12 seconds. These results laid a solid foundation for the development of a clinically functioning online ART re-planning system.

Learning Objectives:

1. Understand the basic concept and main challenge of online ART
2. Gain knowledge in the use of GPU for real-time re-planning

Conflict of Interest:

The research presented here is partially supported by NVIDIA.