

Acquisition and processing of multimodality image data are now fundamental parts of patient management in radiation therapy. Image data are acquired and analyzed to aid diagnosis and staging, to guide treatment planning and delivery and to help monitor the patient during and after therapy. Most radiotherapy departments have dedicated CT scanners, some with 4D capabilities. Many departments also have or are contemplating dedicated MR and PET/CT scanners. More imaging devices are also appearing in the treatment room, with in-room, on-board and integrated imaging devices becoming commonplace. The availability of hybrid MR scanner/treatment units is not far off.

Naturally, each imaging modality provides both benefits and challenges towards supporting and improving the radiotherapy process. In order to leverage the information in the various imaging studies, effective processing tools are needed to extract useful information and to combine and present it in a way that promotes a clear and efficient workflow. There are several classes of these tools including image enhancement, visualization, segmentation, registration and quantification. These tools may be used individually or in combination at many points in the radiotherapy process with the overall goal to create a more accurate and complete model of the patient so that an effective course of therapy can be devised and carried out.

This course will provide an overview of the different imaging modalities and procedures used in radiotherapy and highlight the benefits and challenges of each. The details of the various image processing tools used to extract, combine and analyze the information from the various imaging studies will also be presented. Finally, the effective use of these tools at each step of the radiotherapy process will be described and elucidated using several clinical examples.

Educational Objectives:

1. Understand the basic principles for the different imaging modalities used in radiation therapy.
2. Understand the mechanics of the different classes of image processing tools using in radiotherapy.
3. Understand how different image data and processing tools are used to support and improve the radiotherapy process.