AbstractID: 14509 Title: Image Registration on GPU

Medical image registration is a process of aligning two or more sets of images for combining complementary anatomical and functional information. It plays important roles for many radiation therapy applications including tumor delineation, target localization for daily treatment, adaptive radiation therapy, 4D treatment planning etc. However, one of the limiting factors for their ways to routine clinical use is their lengthy execution time. It is especially true for intensity-base deformable image registration (DIR) algorithms. To overcome such problem, many researchers have resorted to commodity PC graphics processing units (GPU), which are powerful parallel computation platforms, and yet cheap and readily available off the shelves. In the past, GPUs had fixed pipeline architectures, optimized for rendering graphics primitives such as lines and polygons, but modern GPUs are flexible enough for programmers to run general purpose algorithms through special shader or C/C++ like programming languages. Many commonly accepted rigid and non-rigid registration algorithms have successfully been adapted to GPU architectures. In this session, we will review GPU-based algorithms of 3D/2D registrations that exploit GPU for generating digitally reconstructed radiographs, diffusion-based ones, such as Demons and optical flow algorithms, mono-/multi-modal elastic registration algorithms, as well as implementations of mutual information based image registration techniques.

Learning objectives:

1. To understand basic components of image registration algorithms.
2. To learn the methods of mapping the algorithms to GPU; similarity metrics and transformations.