AbstractID: 6026 Title: Multi-Slice CT Image Reconstruction

Over the past decade, x-ray computed tomography has experienced tremendously technological advancements: the introduction of helical/spiral and multi-slice/volumetric acquisition. These advancements not only allow improved image quality and enable new clinical applications, but also significantly increase the technical challenges associated with image reconstruction.

The first part of this lecture will cover the fundamentals of image reconstruction. For the ease of understanding, we start with an explanation of the central slice theorem (Fourier slice theorem). Both theoretical and intuitive approaches are used to illustrate the concept. The reconstruction algorithm is then extended to fan beam geometry by mathematical derivation and graphic description.

Using the central slice theorem as the foundation, reconstruction algorithms for helical acquisition are discussed in the second part of the lecture. We analyze, for single slice, the major difference between helical and step-and-shoot acquisitions. Implications of different reconstruction approaches on image quality and computational complexity are also discussed.

Cone beam reconstruction discussion will start with one of the most popular algorithms: FDK algorithm. The derivation of the algorithm from the fan-beam case is first described and its extension to helical/spiral acquisition is then presented. The lecture ends with a discussion on some of the most recent advances in cone beam reconstruction, including both approximate and exact methods.

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Educational Objectives:

1. Learn the fundamentals of x-ray CT reconstruction.
2. Understand recent advancements in reconstruction algorithms.