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Computational Anatomy

Biomedical imaging modalities routinely provide a variety of information---ranging from highly detailed, three-dimensional pictures of structural anatomy to maps of functional activity within the body---that has become indispensable in investigating the health of an individual. In addition to its well-established clinical role in facilitating diagnosis and in monitoring response to treatment, imaging has gained an equally important function in advancing basic research in many areas of the biomedical sciences. A central factor in the success and increasingly wide-spread application of imaging-based approaches in medicine has been the emergence of sophisticated computational methods for extracting clinically significant and scientifically important information from image data. This talk aims to highlight some new research directions in methods for quantifying the ways in which anatomy can vary in nature, over time, or as a consequence of disease or intervention. The goal is to improve the detection of subtle changes on imaging studies and thus the specificity and reliability of diagnosis in patients with diseases who exhibit such changes and for whom there are often no known clinical diagnostic procedures. A precise understanding of normal and pathological variations in anatomy is also prerequisite for accurate localization of function that is critical to the success of imaging studies of organ structure-function relationships in health and disease.