

Learning and Discovery of Clinically Useful Information from Images

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Three-dimensional (3D) and four-dimensional (4D) imaging plays an increasingly important role in computer-assisted diagnosis, intervention and therapy. However, in many cases the interpretation of these images is heavily dependent on the subjective assessment of the imaging data by clinicians. Over the last decades image registration has transformed the clinical workflow in many areas of medical imaging. At the same time, advances in machine learning have transformed many of the classical problems in computer vision into machine learning problems. This talk will focus on the convergence of image registration and machine learning techniques for the discovery and quantification of clinically useful information from medical images. In the first part of part of this talk I will give an overview of recent advances in image registration. The second part will focus on the how the combination of machine learning and image registration can be used to address a wide range of challenges in medical image analysis such as segmentation and shape analysis. To illustrate this I will show several examples such as the segmentation of neuro-anatomical structures, the discovery of biomarkers for neurodegenerative diseases such as Alzheimer's and the quantification of temporal changes such as growth in the developing brain.