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Lecture 1: Learning imaging biomarkers: challenges and pitfalls

Quantitative imaging biomarkers play an increasingly important role both in large-scale clinical studies and in diagnosis, monitoring, and prognosis of disease in individual patients. Traditional imaging biomarkers measure factors that are already known to be related to disease, such as for instance the density of lung tissue or the size of certain brain structures. This talk covers a more data-driven approach in which image characteristics that are related to disease outcome are learned directly from a training set of imaging data with related patient data. I will discuss advantages and potential dangers of such approach and present techniques to address common issues in large medical imaging studies, including transfer learning to cope with differences between images acquired with varying scan protocols, and data synthesis or imputation to deal with missing data.

Lecture 2: Learning from weak labels

Supervised learning techniques applied in medical image segmentation or computer aided detection typically require a manually segmented training set. This can be difficult to obtain for various reasons. Much more training data would be readily available if also weaker labels, indicating for instance the presence, but not the location of an abnormality in the image, can be exploited. This talk covers multi-instance learning (MIL) approaches to learn from such weak, image-level labels and shows applications in chest CT analysis.