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Unsupervised Learning in Medical Imaging: Discovering Phenotypes and Detecting Anomalies

In this lecture I will present unsupervised learning approaches and their applications in medical imaging. We will discuss auto encoders (AE), generative adversarial networks (GAN), and their variants and adaptations used for learning representations based on large-scale medical imaging data. We will explore the underlying fundamental principles of unsupervised learning to understand its role in this context. In the application part, we will address two examples: (1) the lecture will cover the identification of new marker candidates for disease progression in medical imaging data based on models of variability observed in control populations; (2) the discovery of phenotypes in imaging data and the exploitation of their link to clinical information such as disease, diagnosis, treatment, and outcome.