UNIVERSITY OF COPENHAGEN
DEPARTMENT OF COMPUTER SCIENCE

Bachelor Project

Multiscale Brain MRI Segmentation with Deep Generative Models

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Introduction

Recent advances in medical image segmentation have been propelled by the synergy of UNet-based architectures [2,8] and diffusion models [3,5]. While traditional CNNs like UNet++ [8] addressed feature hierarchy limitations through nested skip connections, subsequent innovations such as UNet 3+ [2] expanded this framework with full-scale aggregation. These architectures laid critical foundations for handling anatomical complexity but faced persistent challenges in modeling ambiguity [4] and 3D consistency [1]. The advent of diffusion models has introduced paradigm-shifting approaches for uncertainty quantification. Concurrently, hybrid frameworks like MedSegDiff [6] and its transformer-enhanced variant [7] integrate diffusion steps directly into segmentation pipelines, achieving state-of-the-art performance on benchmark datasets. For volumetric data, [1] introduces diffusion-embedded 3D UNets, addressing memory constraints through adaptive spatiotemporal sampling. Test.

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