



Figure 1) Workflow for synthesizing edema maps from OS-CMR images

Step 1: Dataset Preparation and Annotation - Matching slices of T2-weighted and OS-CMR images are identified. Preprocessing steps, including normalization, scaling, augmentation, and applying window techniques.

Step 2: GAN Training - Various GAN models are trained to find the best match for generating synthetic T2-weighted images from input data. The proposed GAN model with residual blocks, referred to as RGAN, demonstrates the best results in capturing the nuances of edema.

Step 3: Validation Metrics - The synthesized images are evaluated against ground truth using various metrics like PSNR, SSIM and PCC to ensure their accuracy and fidelity.

Step 4: Signal Intensity Verification - The signal intensity of the synthesized images is compared with reference images using a Python script and certified CMR analysis software (cvi42) to test for the preservation of critical diagnostic information.

Step 5: T2 Curve and Map Generation - T2 curves are predicted using a model based on MRI parameters, and we assess the correlation between the real and synthetic curves, ensuring the accuracy of the synthesized data.

Step 6: Edema Case Testing and Analysis - The final synthesized images are tested on a case with known edema. T2 decay curves and maps are generated by replacing the synthesized image within a folder containing other T2-weighted image slices. These synthetic images are compared with the original images across various echo times (TEs) to validate their reliability. The resulting T2 decay curves for edema and non-edema regions are compared with original data to calculate RMSE, MAE, and correlation, confirming the synthetic images' ability to replicate the diagnostic features of edema in CMR.