Conclusions

- High speed scanning protocol promising technique for flat detector CT perfusion
- FDK-SR-JBF approach for computational fast denoising and streak artifact reduction

References


Introduction

- Flat Detector CT Perfusion (FD-CTP) with C-arm systems enables measuring brain perfusion during interventional procedures with full brain coverage
- Novel robotic C-arm systems (Artis zeeego, Siemens) with increased rotation speed (100°/s) enable a high speed scanning protocol for FD-CTP, which provides improved temporal sampling of time-contrast curves (TCCs)

High Speed Scanning Protocol

Multi-sweep protocol with ten alternating C-arm forward and backward rotations to acquire TCCs after contrast bolus injection

Noise & Streak Reduction

- Challenges:
  - Low contrast-to-noise ratio in brain tissue
  - Streak artifacts due to angular under sampling and patient motion
- Joint Bilateral Filtering [1,2]:
  - Bilateral filtering with a guidance volume for range similarity computation
  - Guidance volume: temporal maximum intensity projection (MIP) of the TCCs
- Streak reduction in guidance image:
  - Identify edges by total variation
  - Preserve edges at vessels by time curve analysis
  - Segmentation with streak detection & smoothing
  - Guidance volume after streak removal

FDK-SR-JBF Algorithm:

- FDK reconstruction
- Rigid motion compensation
- Create guidance volume
- Joint bilateral filtering
- Update guidance volume
- Segment brain
- Identify streaks
- Smooth out streaks in guidance image
- For i = 1, ..., N:
  - Joint bilateral filtering
  - Update guidance volume

Results

Digital Brain Perfusion Phantom [3] Study (CBF Maps)

Reference  FDK-SR-JBF  FDK-JBF  FDK  OS-TV

Patient Study 1 (CBF Maps)

Patient Study 2 (FDK-SR-JBF reconstruction)

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