1. Clinical background

Obstacles: aortic arch and carotid arteries
Complex tortuositities and angulations

Entry points:
Radial
Femoral

The type of aortic arch provides information on the complexity of navigation to the pathological area and helps to better plan procedures and choose the appropriate catheter.

2. Technical background

Task | Studies
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**SEGMENTATION** | • Studies are oriented towards the use of CTA volumes.
• U-Net variants are the most used architectures.
• Approaches like multi-view 2D CNNs [2] and multi-stage pipelines were used [3].
• Segmentation is often pathology oriented e.g. segmentation of type B aortic dissection [3].

**CHARACTERIZATION** | • Generic frameworks with sets of functions for geometric quantification of anatomical features and vessel characterization [4, 5]. These frameworks are suitable for engineers for research but not relevant for clinicians to use in a medical setting.

3. Data


Acquisition parameters: coronal plane covering: 250 slices; active TR/TE = 5.5/2.0 ms; flip angle = 27°; number of excitations = 1; acquisition bandwidth = 476.7 Hz; FOV = 380 x 321; voxel size = 0.5 x 0.5 x 1.0 mm; imaging time = 69 sec; Bolus track injection technique.

4. Segmentation and characterization pipeline

| Segmentation module | Post processing | Geometric characterization module |
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Localization CNN | Volume refocusing | Centerlines
Resampling & Normalization | Arch type (I, II or III) | Radii, take-off angles and reverse curves
Segmentation CNN | Lengths and tortuositities | Vertical distance to first major curvature
MRA Volumes | 3D reconstruction |

5. Results

- Dice score = 88.07%
- Precision = 84.10%
- Recall = 93.80%

6. Conclusion and perspectives

- Complete analysis pipeline, from MRA images to high-level features: arch type, tortuositities, reverse curves, take-off angles and access difficulty after engaging an artery.
- Quantitative and qualitative validation by comparison to the medical reference (manual measurements and segmentations).
- Clinical validation of our features on a diversified dataset in terms of demographic, pathological and imaging data of different modalities.

- 3D extension of our CNN pipeline to better capture vessels of different diameters.

References


