Using Automated Image Processing for Clot Detection during Cerebral Angiography

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Introduction

Why use AI in neuro angiography?

- Thromboembolic events during neuroangiographic procedures are critical complications. Prompt detection is essential for patient safety.
- Advances in artificial intelligence (AI) can improve real-time clot detection and procedural outcomes.

Study Objective:

- Develop and validate a proof-of-concept AI model for automatic thrombus recognition during angiographic procedures.

Methods and Materials

Data Collection:

- Retrospective analysis of 12 patients (16 vessels) treated for thromboembolic events.
- Anonymized DICOM data from a comprehensive stroke center were used.

Pipeline Development:

- **Step 1:** Deep learning classifier (GoogleNet) trained to filter usable angiographic images (98.17% accuracy).
- **Step 2:** Vessel maps constructed via adaptive thresholding and stacking of binary images.
- **Step 3:** Registration of pre- and post-treatment vessel maps using multimodal similarity transforms.

Technical Details:

- MATLAB-based pipeline with Gaussian blur preprocessing, Otsu's thresholding, and median filtering.

Results

Key Findings:

- 8 vessel maps were successfully created, demonstrating large and medium vessel occlusions.
- Average runtime: 15.97 (±0.51) seconds per case on a high-performance desktop.

Discussion

Impact of AI:

- Help neurointerventional workflow by reducing cognitive load.
- Complements intraoperative neurophysiological monitoring.

Limitations:

- Small sample size, retrospective design, simple processing techniques.
- Lack of validation for small vessel occlusions.

Future Directions:

- Expand dataset and improve classification and registration algorithms for more advanced image processing techniques.
- Validate against neuroradiologist interpretations with sensitivity/specificity analysis.
- Adapt the algorithm for real-time use.

Conclusions

Preliminary results demonstrate the potential of AI for thrombus detection in neuroangiography. Future refinements could integrate this pipeline into real-time clinical workflows, improving patient safety.

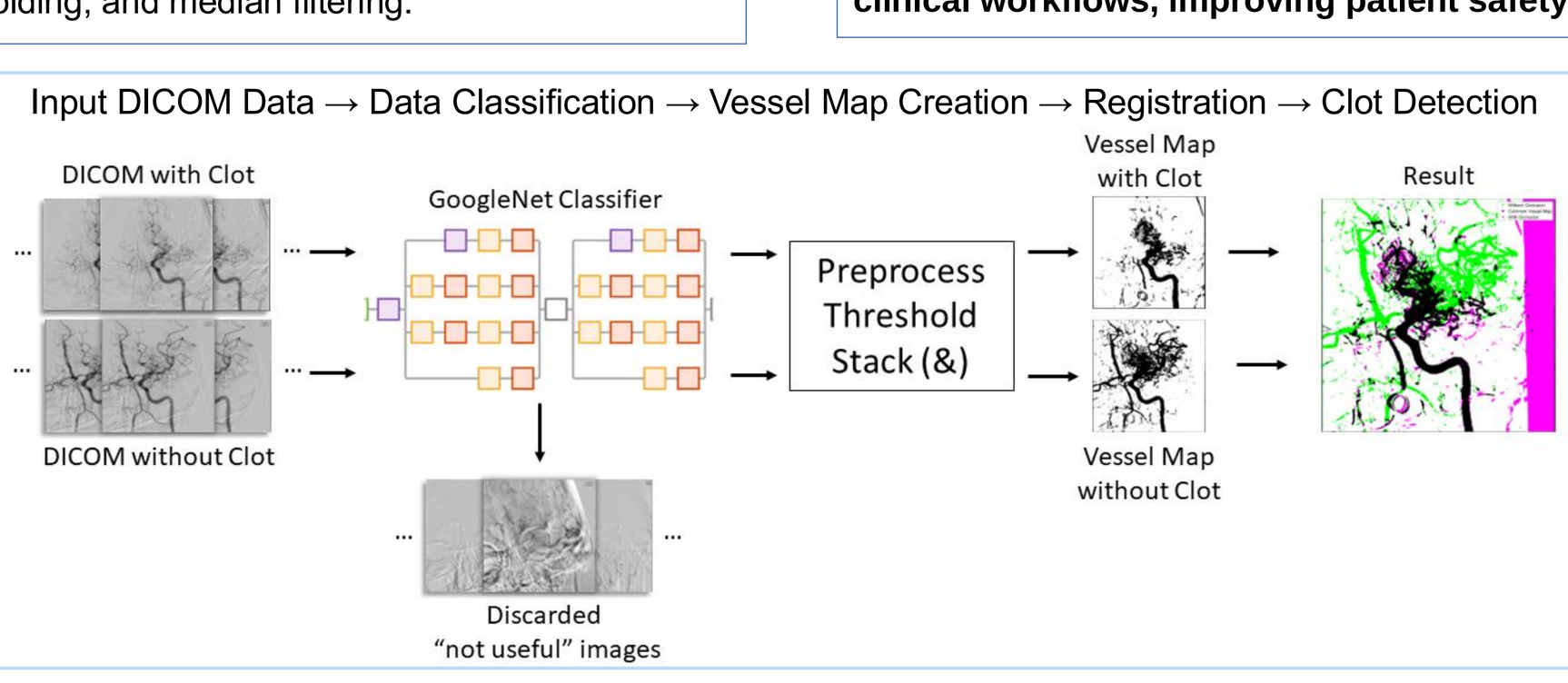

Figure 1.
Flowchart of the imaging processing method.

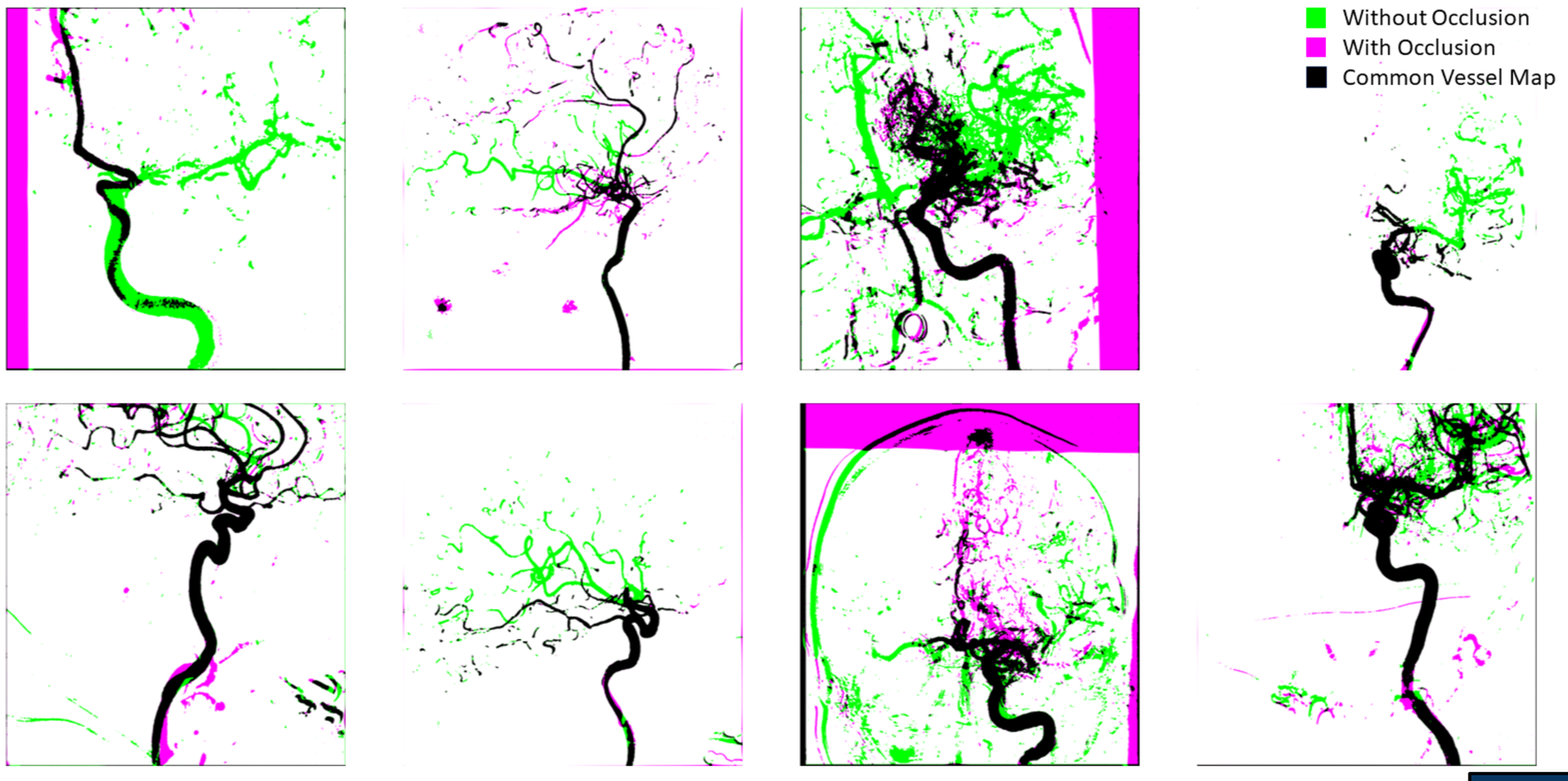

Figure 2.
Final product of the algorithm.

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