

Vessel Visualization using Curved Surface Reformation Evaluation

Name:

Date:

In this questionnaire several aspects of the proposed visualization technique Curved Surface Reformation (CSR) will be investigated and evaluated. The method will be compared to existing and well established visualization approaches such as Curved Planar Reformation (CPR), Multipath Curved Planar Reformation (mpCPR) and Centerline Reformation (CR).

Throughout this questionnaire please give a **single** or **no** answer for each question in the ☐ field, i.e. no question allows multiple answers. If you want to correct an answer, please indicate this explicitly and cross your new answer. For several questions it is highly beneficial for us if you could elaborate on the reasons for your answer; these questions are marked with the following text: (*please justify your decision in the comments*). Doing so, allows us to benefit from your expert opinion, enhances this evaluation and provides us essential information for future improvements of relevant software tools. In case of any other comments, please feel free to write them into the provided comment field as well. All comments are very appreciated and will help us to strengthen this evaluation.

1 General Assessment

In this section, general aspects of the three methods (CPR, CR and CSR) should be anonymously evaluated. Several images are shown on the next page, without knowing which particular technique has been used.

Vessel Lumen — images (a)-(c)

The **vessel lumen** is defined as the cut through the vessel along its centerline which covers the full width of the vessel. As this is the most important region to assess pathologies, e.g. calcifications, the visualization technique has to depict it as precise as possible.

- 1 Which image depicts the vessels best? a ☐ b ☐ c ☐
- 2 Which image shows the flow channels qualitatively better? a ☐ b ☐ c ☐
- none ☐

Surrounding Parts — images (a)-(c)

The **surrounding parts** of a vessel are the tissues and organs around the vessel lumen. They show additional information that might be useful for spotting pathologies not necessarily related to the vessels themselves. Some CPRs show artifacts in these regions. Open questions such as if they are desired or if they should smoothly extend to the borders of the image are investigated here.

- | | | | | |
|----------|------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------------|----------------------------|
| 3 | Which image shows the organs around the vessels with the lowest number of artifacts? | a <input type="checkbox"/> | b <input type="checkbox"/> | c <input type="checkbox"/> |
| 4 | Is the visualization of the organs around the vessels desired?
(please justify your decision in the comments) | YES <input type="checkbox"/> | NO <input type="checkbox"/> | |
| 5 | Is the visualization of the organs around the vessels helpful?
(please justify your decision in the comments) | YES <input type="checkbox"/> | NO <input type="checkbox"/> | |

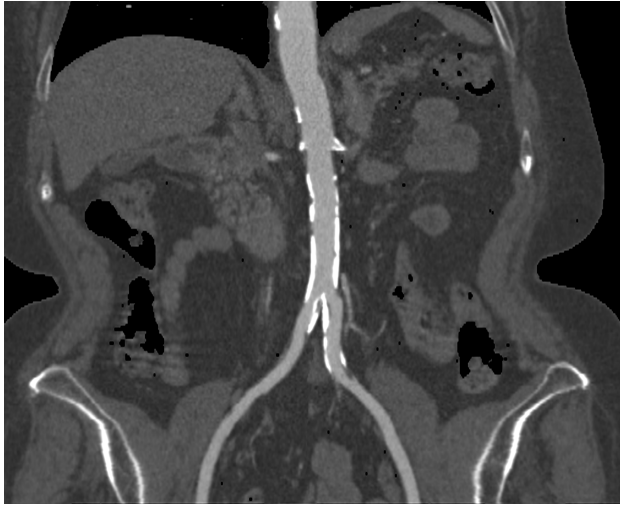
Visibility — images (d)-(f)

Finally, the correct **visibility** of the cuts through multiple vessels within one image will be assessed on the example of cervical vessels. Visibility refers to the depiction of correct obstruction of multiple vessel, i.e. which vessel is in front of another one.

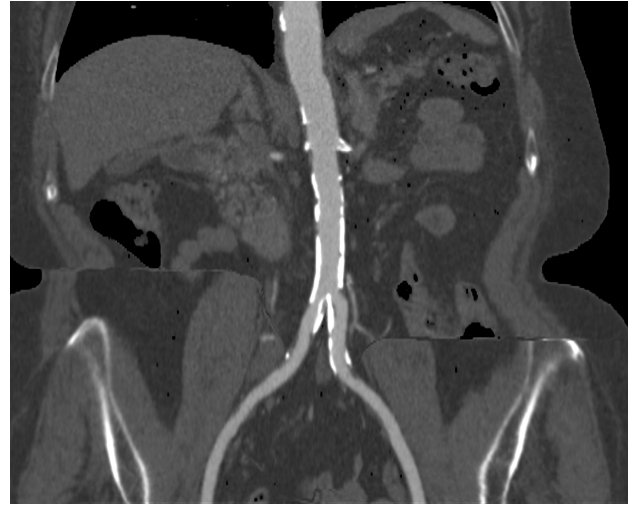
- | | | | | |
|-----------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------|-----------------------------|
| 6 | Which image has the best visibility of all vessel lumen? | d <input type="checkbox"/> | e <input type="checkbox"/> | f <input type="checkbox"/> |
| 7 | Which image preserves the relative location of the vessels to each other best? | d <input type="checkbox"/> | e <input type="checkbox"/> | f <input type="checkbox"/> |
| 8 | Is the three dimensional visibility of several vessels in one image desired? <i>(please justify your decision in the comments)</i> | YES <input type="checkbox"/> | | NO <input type="checkbox"/> |
| 9 | Which vessel is closer to the viewer in image (d)? | 1 <input type="checkbox"/> | | 2 <input type="checkbox"/> |
| 10 | Which vessel is closer to the viewer in image (e)? | 1 <input type="checkbox"/> | | 2 <input type="checkbox"/> |
| 11 | Which vessel is closer to the viewer in image (f)? | 1 <input type="checkbox"/> | | 2 <input type="checkbox"/> |

Comments:

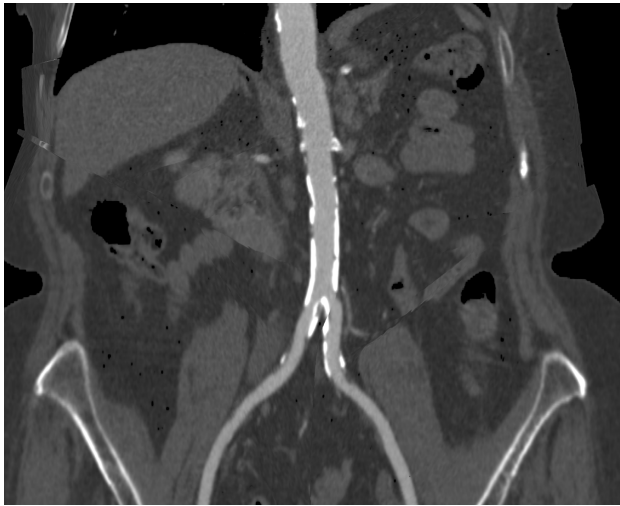
[illegible]



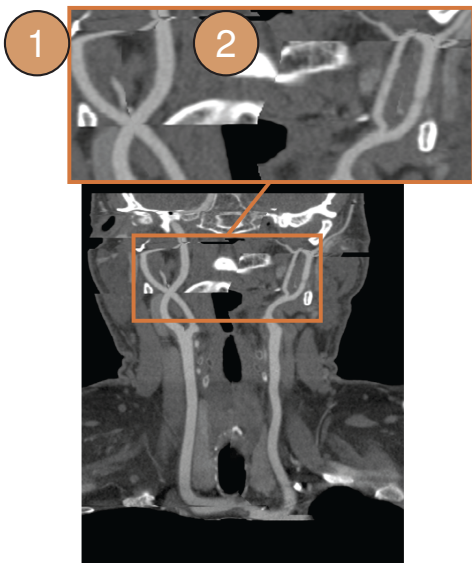
(a)



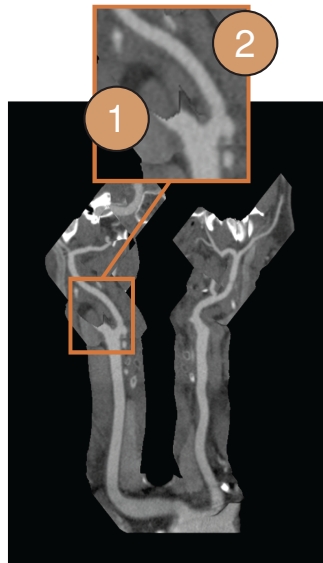
(b)



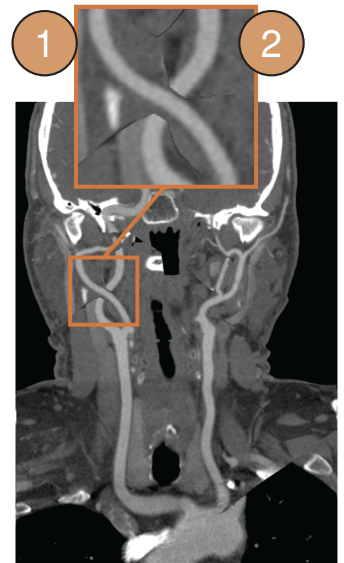
(c)



(d)



(e)



(f)

2 Perception

In this section we investigate perceptual issues of various vessel visualization methods. Several images on the next page show the abdominal aorta with its first branches. Your task is to decide, which vessel branch is closer to the viewer (i.e. in front of the other vessel branch).

Questions — images (a)-(f)

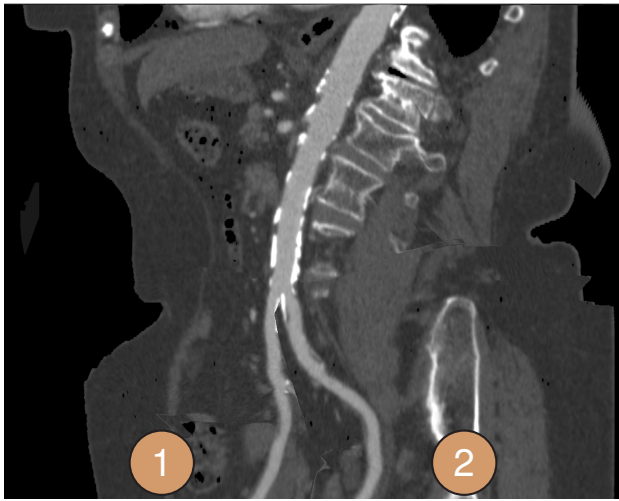
- | | | | |
|----|----------------------------------------------------|----------------------------|----------------------------|
| 12 | Which vessel is closer to the viewer in image (a)? | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 13 | Which vessel is closer to the viewer in image (b)? | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 14 | Which vessel is closer to the viewer in image (c)? | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 15 | Which vessel is closer to the viewer in image (d)? | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 16 | Which vessel is closer to the viewer in image (e)? | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 17 | Which vessel is closer to the viewer in image (f)? | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |

Silhouettes — images (g) and (h)

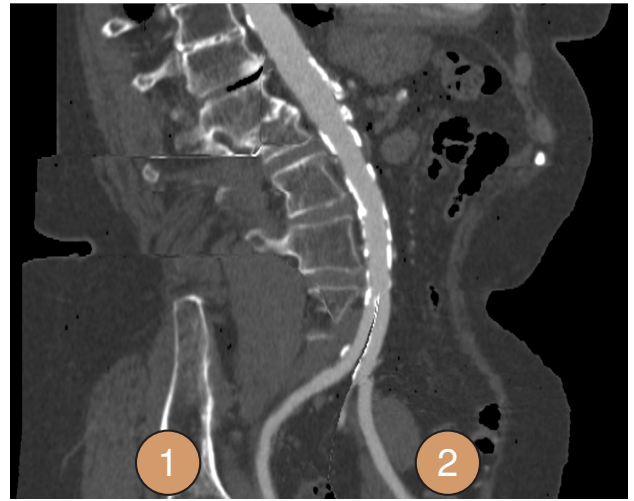
*The **yellow silhouettes** in the images (g) and (h) mark the boundaries between region with different distances from the viewer.*

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|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------------|
| 18 | Which vessel is closer to the viewer in image (g)? | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 19 | Which vessel is closer to the viewer in image (h)? | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 20 | Are silhouettes helpful for perceiving the vessel orientation in 3D space?
<i>(please justify your decision in the comments)</i> | YES <input type="checkbox"/> | NO <input type="checkbox"/> |
| 21 | Are silhouettes helpful for perceiving the boundaries of regions with different distances from the viewer?
<i>(please justify your decision in the comments)</i> | YES <input type="checkbox"/> | NO <input type="checkbox"/> |

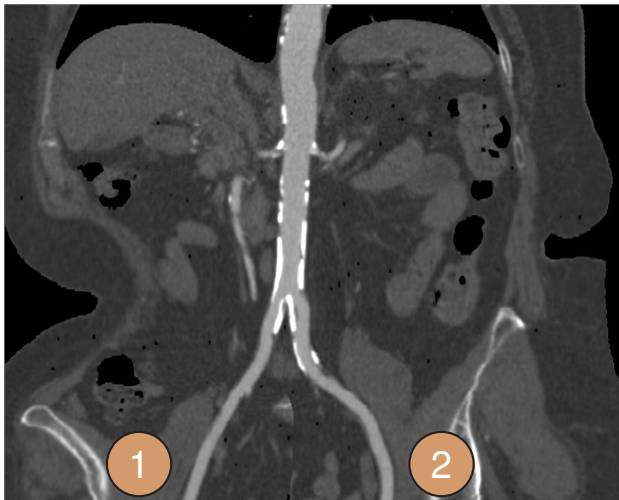
Comments:



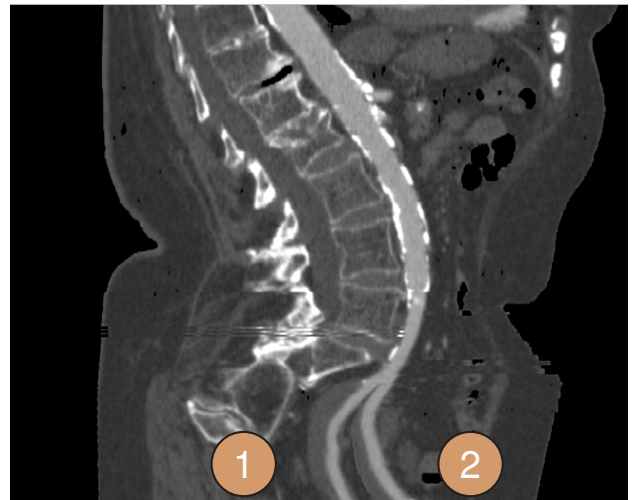
(a)



(b)



(c)



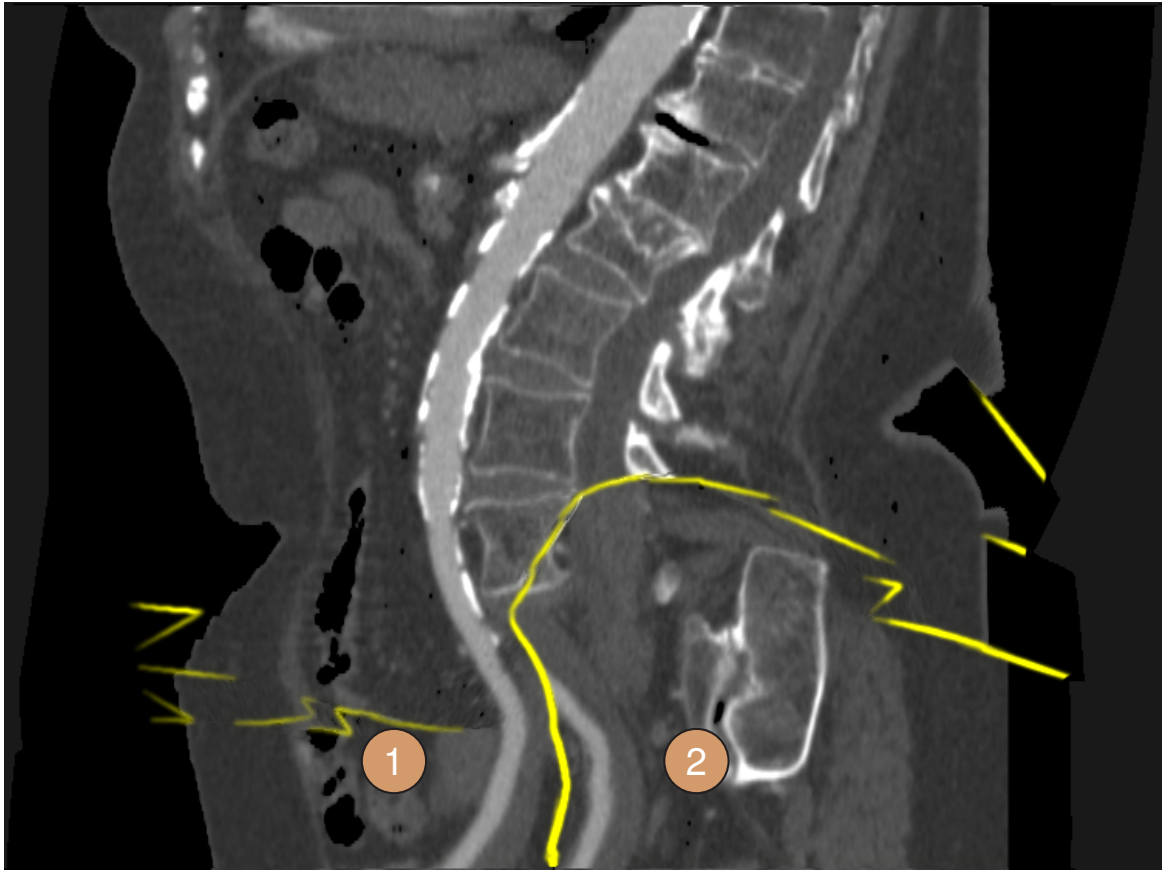
(d)



(e)



(f)



(g)



(h)