

Dear Reviewers,

we would like to thank you for taking the time reviewing our paper and for providing many helpful comments. In this cover letter, we'd like to describe how we have addressed your suggestions for improving the paper. It is divided into two parts: in the first part, we comment our changes resulting from the summary review, and in the second part, we comment the individual reviews.

Part 1: Summary Review

The primary reviewer asked us to include more details on the evaluation within a medical context:

All reviews suggest to add more details on the evaluation in a biomedical context to clarify the impact of the system. What new insights have been gained with respect to the application domain? It was not easy for me to judge, whether the authors will be able to add a more detailed evaluation within the short period of time available for a minor revision. However, most of the reviewers have the impression, that the authors must have done some evaluation already (which was probably dropped because there was not enough room in the paper)

We have extended Section 5 accordingly and have added a deeper discussion of three exemplarily cases, which have been analyzed using our system. Since Reviewer #3 has stated that we didn't confirm that the used registration technique works reliable by data shown in the paper, we describe the first case, which has been used in order to affirm the behavior of already known markers. The second case presents the findings of a detailed inspection of the behavior of the CGS marker. Although it was known before that CGS binds to atherosclerotic plaques, the locality as well as the state of the plaque it binds on was unknown. Finally, we present the results of an intervention study which shows the effect of feeding ApoE mice a high cholesterol diet. Thus, by using the proposed system, a better understanding of the CGS marker as well as a better understanding of the influence of different diets derived from the presented intervention studies became possible.

Furthermore, we have addressed the requirement of shortening the paper in order to get some more space for the evaluation:

The paper requires some editing in order to get accept: Some reviewers have made suggestions about shortening the paper, especially to make room for a more thorough evaluation.

Motivated by this and the comments of Reviewer #4 regarding the evaluation, the evaluation presented in Section 5 occupies now more than one page of the paper. We have managed this by incorporating the suggested shortenings. As proposed by the reviewers, we have mainly shortened and restructured those parts of Section 4, where we have described the CPR and the flattening approach. A detailed description of these and other conducted shortenings is provided in the second part of this cover letter, where we address the individual reviewer comments.

The third requirement for the minor revision was to add the missing references:

Include and discuss the missing references mentioned by Reviewer 2 and 3!

We have included all of them in Section 2, but couldn't add any other references regarding these topics due to space restrictions.

Part 2: Individual Reviews

In the following, we would like to address the individual comments of the reviewers. We first describe our efforts in shortening the paper.

Reviewer #2 has stated:

The text in Section 4 (before 4.1), after describing the five affordances, could be trimmed quite a bit. There's no good reason to reference "Gauss's Theorema Egregium", unless its important to show off how much you know. The motivation and description of the "intermediate visualization", which was an interesting contribution, was somewhat lost in the rest of the text.

We have addressed this by shortening the mentioned paragraphs, respectively. Among other applied text trimming, we have removed the surface parametrization analogy, shortened the description of the mental registration process and have drastically shortened the last paragraph.

Reviewers #2 and #6 have recommended to edit Section 4.2:

Most of Section 4.2 was much too long. What are the main points that the reader should appreciate about the work that was done? Successfully doing the centerline extraction, registration, deformation, and visualization of the of different aorta (e.g. fig 6) is an accomplishment, and the text should be edited to highlight the results and strategy applied. (Reviewer #2)

I think section 4.2 is a little too long and quite confusing to read. I would strongly recommend splitting it into subsections and rewriting parts of it to make it a little easier to understand. [...] I would also recommend that the discussion for Figure 6(b) be improved. Especially the sentences "Figure 6b shows a mesh, which has been generated by interpolating resp. extrapolating the determined $l(\pi)$ ". (Reviewer #6)

As suggested by Reviewer #6, we did split up the description, which should now also point better out the main points as mentioned by Reviewer #2. In order to shorten Section 4.2, we have trimmed several paragraphs and have removed the comparison with the CPR approaches by Kanitsar et al., since these are already described in the related work section. Furthermore, we have removed naming of the unsuccessful center line computation algorithms which we have tried on the data. Additionally, we have clarified the discussion of Figure 6 (b) as suggested by Reviewer #6 and eliminated the last paragraph by extracting its essence into a single sentence, which we have integrated into the beginning of Section 4.2.

Reviewer #2 comments:

Section 4.4 was much too long: just focus on the implementation decisions.

To meet these requirements, we trimmed several sentences and have shortened the first paragraph and shortened the parts describing the actual ray-casting approach. Additionally, we have omitted the standardized non-uniform width approach. Furthermore, we have clarified the structure by merging the paragraph about the wall thickness and the lumen diameter computation into the ray-casting paragraph.

Besides suggestions for shortening the paper, the reviews contained several other helpful comments. Reviewer #3 has stated:

The paper is technically sound. However, the audience might not be familiar with the medical terms used in the paper, e.g. on page 4 the branches of the aortic arch are named without reference to an image.

We have fixed this by including a reference to Figure 1.

Reviewer #6 stated:

Figure 7(d) too was not clearly explained in the paper and re-reading parts that was referencing it did not help either.

To make this figure more clear, we have added one explanatory sentence at the beginning of Section 4.4 and we have added a reference to Figure 8 in the caption of Figure 7.

Reviewer #3 and Reviewer #6 have noted some issues in Section 3:

Also, the description of the detailed medical procedures used to acquire the data could be better explained or omitted. (Reviewer #3)

The registration technique could be explained a bit better. (Reviewer #6)

We decided not to omit the medical procedures, since we believe that this background knowledge is essential for the concepts described in this paper. Instead, we have added here and there some clauses, especially to make the registration more comprehensible.

Furthermore, Reviewer #6 has stated that the results of the synthetic data set are not clearly explained. We have addressed this issue by adding arrows to Figure 9 (e) and adapting the explaining paragraph accordingly.

Furthermore, we proof read the whole paper, have removed the dangling participles and have added some more text corrections, especially in the abstract and Section 1.

Besides the comments, that we have integrated into the paper, we didn't integrate the following comment. Reviewer #6 has proposed to describe the benefits and drawbacks of certain views, which we have integrated into the presented system. We have decided to omit this, partially due to space restrictions and partially, since as also reflected by the design guidelines presented in the beginning of Section 4, all views are considered as essential for this specific task. Furthermore, at the moment the number of medical experts working with the system is rather low, and all of them have also contributed to the design of the system. Thus, we wouldn't expect to get any results, which are generally applicable, when discussing the pros and cons of the different views.

Sincerely,

Timo Ropinski.