**Image Analysis**

**Critical Analysis – Denoising of PET Images by Context Modelling Using Local Neighbourhood Correlation**

Submitted for the MSc in

Advanced Computer Science

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By

**Alexander C Whitehead**

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[Figure 2: This image shows the first figure used in the paper Denoising of PET Images by Context Modelling Using Local Neighbourhood Correlation with the caption of “The autocorrelation function normalised to the maximum pixel value: (a) 2D image, (b) display of matrices of weight for the first level. Diagonal orientation (top) and horizontal (bottom).” (Huerga, et al., 2017). 6](file:///C:\Temp\!!!Work!!!\Semester%202\Image-Analysis\Report\Report%20Template.docx#_Toc512370092)

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[Figure 7: This image shows the third figure used in the paper Denoising of PET Images by Context Modelling Using Local Neighbourhood Correlation with the caption of “A visual evaluation in the LOW-CONTRAST case. Top: image without post reconstruction filter (left), standard Gaussian filter processing (middle), wavelet filter processing described (right). Bottom: profiles through smaller spheres (peaks corresponding to the spheres of diameters 13 mm, 17 mm, 10 mm and 22 mm, left to right).” (Huerga, et al., 2017). 11](file:///C:\Temp\!!!Work!!!\Semester%202\Image-Analysis\Report\Report%20Template.docx#_Toc512370097)

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[Figure 10: This image shows the fourth figure used in the paper Denoising of PET Images by Context Modelling Using Local Neighbourhood Correlation with the caption of “A comparison of the SUVmean (top) and SUVmax (bottom) reduction rates (%) in more than 40 lesions from different patients.” (Huerga, et al., 2017). 13](file:///C:\Temp\!!!Work!!!\Semester%202\Image-Analysis\Report\Report%20Template.docx#_Toc512370100)

[Figure 11: This image shows the fifth figure used in the paper Denoising of PET Images by Context Modelling Using Local Neighbourhood Correlation with the caption of “Example patient 1; coronal slice with liver lesions. Top: image without post- reconstruction filter (left), standard Gaussian filter processing (middle), wavelet filter processing described (right). Bottom: the profiles for each image through the lesion are shown.” (Huerga, et al., 2017). 14](file:///C:\Temp\!!!Work!!!\Semester%202\Image-Analysis\Report\Report%20Template.docx#_Toc512370101)

[Figure 12: This image shows the sixth figure used in the paper Denoising of PET Images by Context Modelling Using Local Neighbourhood Correlation with the caption of “Example patient 2; coronal slice with mediastinum lesion. Top: image without post-reconstruction filter (left), standard Gaussian filter processing (middle), wavelet filter processing described (right). Bottom: profiles are shown for each image throughout the lesion.” (Huerga, et al., 2017). 15](file:///C:\Temp\!!!Work!!!\Semester%202\Image-Analysis\Report\Report%20Template.docx#_Toc512370102)

[Figure 13: This image shows the seventh figure used in the paper Denoising of PET Images by Context Modelling Using Local Neighbourhood Correlation with the caption of “Example patient 3; head and neck segmentation (top). Example patient 4; liver segmentation. The images on the left were processed with a 3D extension, the ones on the right were processed without.” (Huerga, et al., 2017). 16](file:///C:\Temp\!!!Work!!!\Semester%202\Image-Analysis\Report\Report%20Template.docx#_Toc512370103)

# Introduction

This is a report critically analysing the paper; Denoising of PET Images by Context Modelling Using Local Neighbourhood Correlation.

This report will first generally state the overall effect of the paper before moving on to critically analyse the title and authors of the paper, then in turn each section of the paper, in an orthodox order, will be critically analysed stating any major strengths and weakness of the section found.

This order is:

1. Acknowledgements
2. Abstract
3. Introduction
4. Materials and Methods (containing analysis of select tables and figures)
5. Results (containing analysis of select tables and figures)
6. Discussion
7. References

# Critical Analysis

## Title

The main strength of the title is, that it is short and to the point, this means that anyone browsing through a list of papers may choose to read this paper in particular because its title is easy to parse and inoffensive.

However, a major weakness of the title is, the fact that it doesn’t adequate describe the content of the paper. The vast majority of the paper references wavelet decomposition and this is not mentioned in the title at all, whereas the phrase “neighbourhood correlation” from the title is not repeated once in the body of the paper.

## Authors

A main strength of the authors of this paper is, that between them they have written numerous papers in the past, some authors having written more than others and some having written none, however as a collective they are quite well experienced. In addition, the authors are from a good spread of institutions and roughly equally represent both genders.

However, the main weakness of the authors is, that they are not geographically diverse, all of the institutions that are represented among the authors are situated within a few miles of each other in Madrid, Spain.

## Acknowledgements

The main strength of the acknowledgements/funding section of this paper is, that because the research was not funded by an external body it can be assumed that there may be less bias in the research and thus by stating that the research was not funded anyone reading the paper can come to the same conclusion, this conclusion may make people more willing to read the rest of the paper.

However, the main weakness of the acknowledgements/funding section is, that it is located at the end of the paper, in order for the strength above to be applicable this section has to be read before the rest of the paper.

## Abstract

The main strength of the abstract is, that it makes a good case as to why this research is worthwhile conducting. It states that in PET imaging there is a low signal-to-noise ratio (SNR) and to get the best images out of this device the SNR needs to be reduced, this is exactly what the rest of the paper then goes on to detail.

However, a weakness of the abstract is, that it doesn’t discuss the rationale behind why the method explored in the rest of the paper is different or better from the methods already used for this function.

## Introduction

The main strength of the introduction is, that a large amount of background research into and references to other solutions to the same problem have been included, this can be seen from the line starting “There are different approaches for removing noise in PET images”. Another strength would be, that the case as for why this research is relevant has been expanded upon from the abstract.

Some of the weaknesses of the introduction include, the fact that wavelets are discussed at length throughout the entire introduction but no effort is made to explain what wavelets are or how they function. In addition, the authors go on to use first person language towards the end of the introduction in the sentence “Our method is proposed” and in the same place also make a forgone conclusion in the sentence “The proposed noise-reduction technique is able to maintain uptake values”.

## Materials and Methods

## Table 1

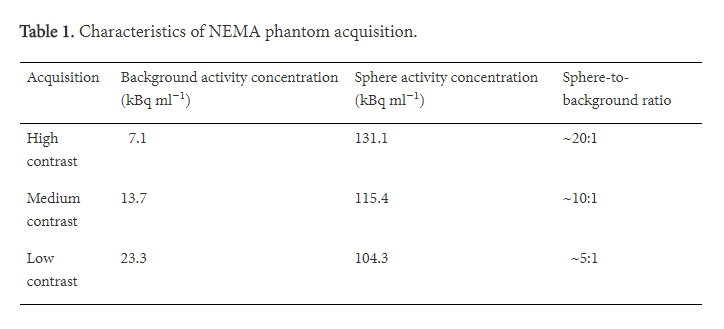


Figure 1: This image shows the first table used in the paper Denoising of PET Images by Context Modelling Using Local Neighbourhood Correlation (Huerga, et al., 2017).

The main strength of table 1 is, that the acquisition lables are quite detailed, meaning that the rest of the data in the table is more relevant.

However, the main weakness of table 1 is, that the ratio of the spheres size to background size is an approximation, by obscuring the actual ratio the data in the rest of the table becomes less relevant.

## Results

## Figure 1

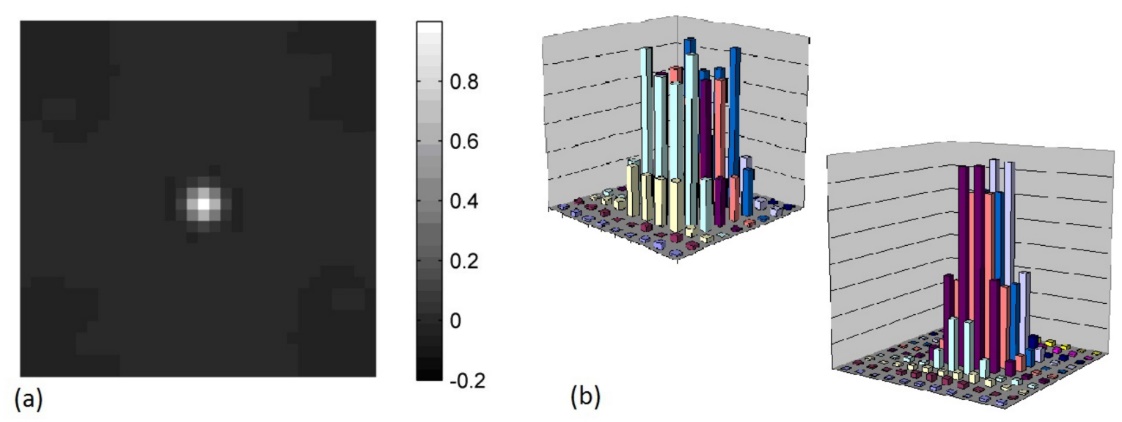


Figure 2: This image shows the first figure used in the paper Denoising of PET Images by Context Modelling Using Local Neighbourhood Correlation with the caption of “The autocorrelation function normalised to the maximum pixel value: (a) 2D image, (b) display of matrices of weight for the first level. Diagonal orientation (top) and horizontal (bottom).” (Huerga, et al., 2017).

## Table 2

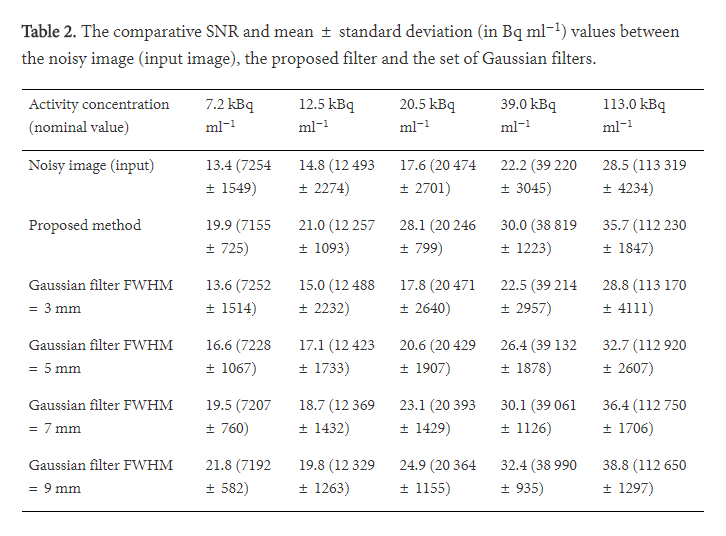


Figure 3: This image shows the second table used in the paper Denoising of PET Images by Context Modelling Using Local Neighbourhood Correlation (Huerga, et al., 2017).

## Figure 2

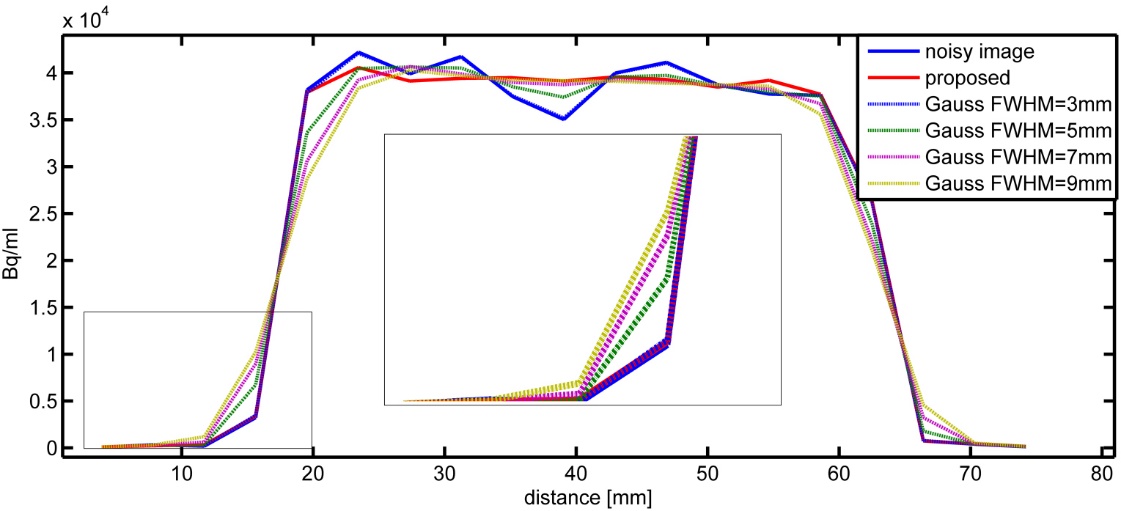


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## Table 3

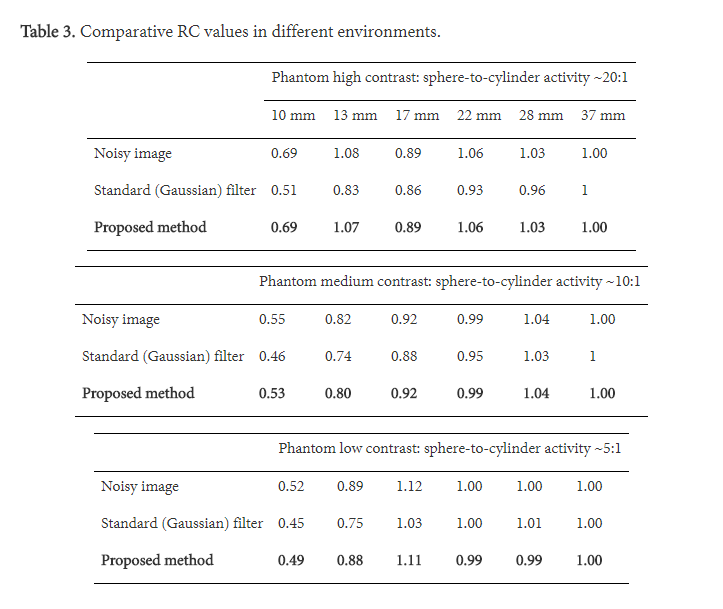


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## Table 4

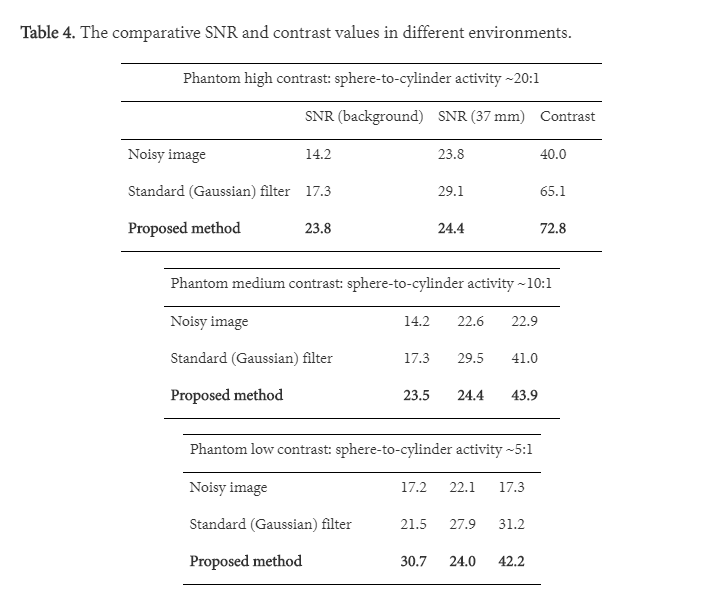


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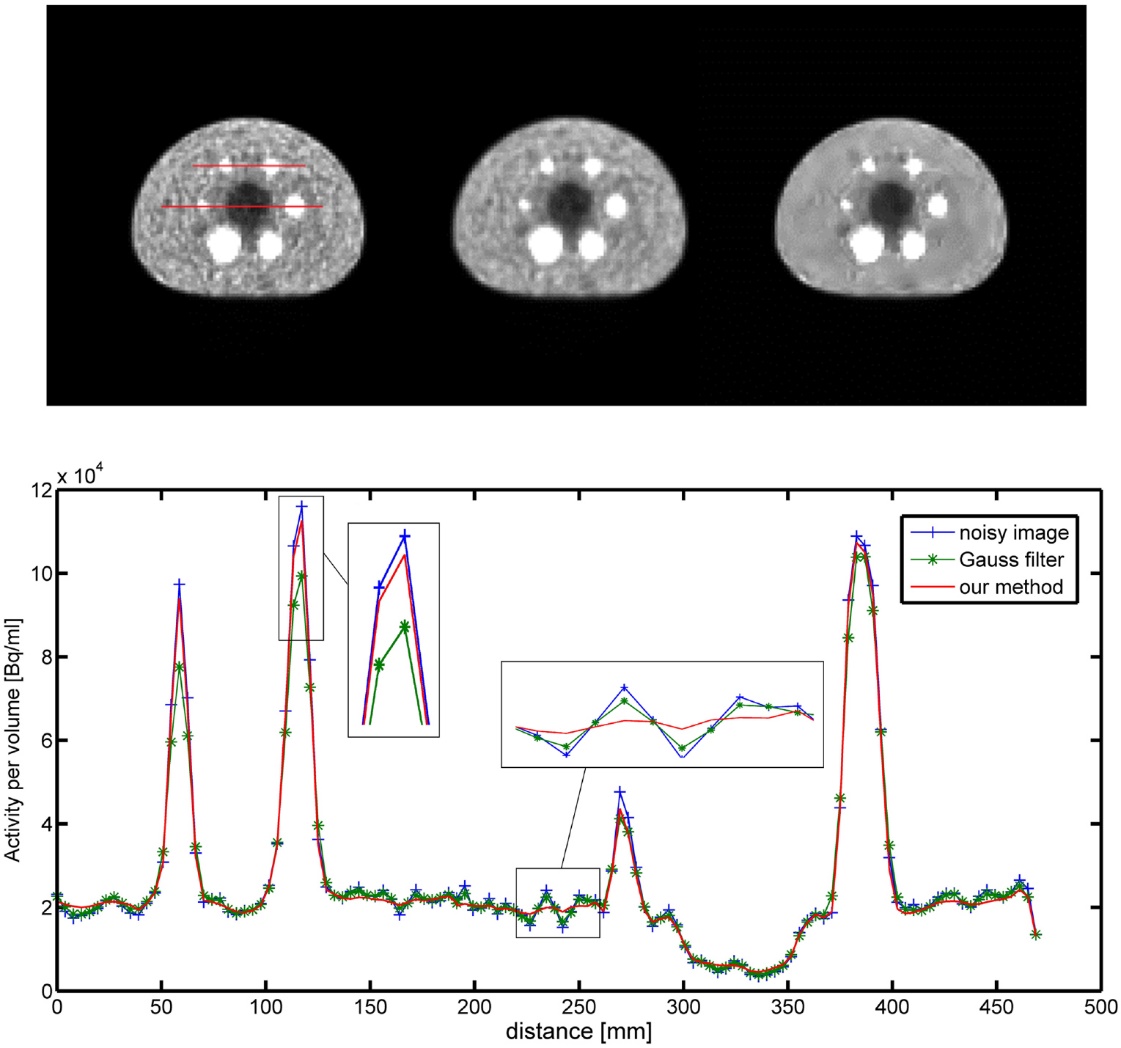


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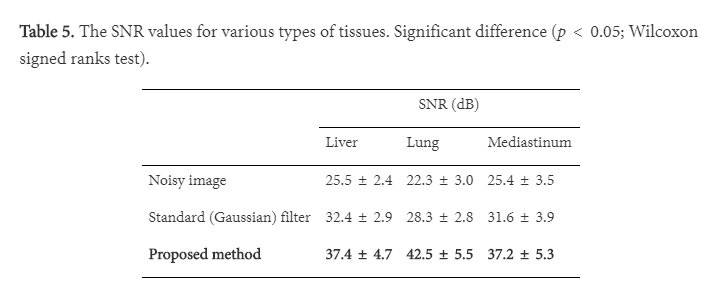


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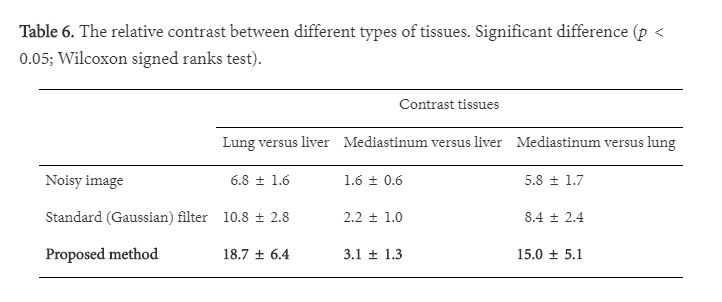


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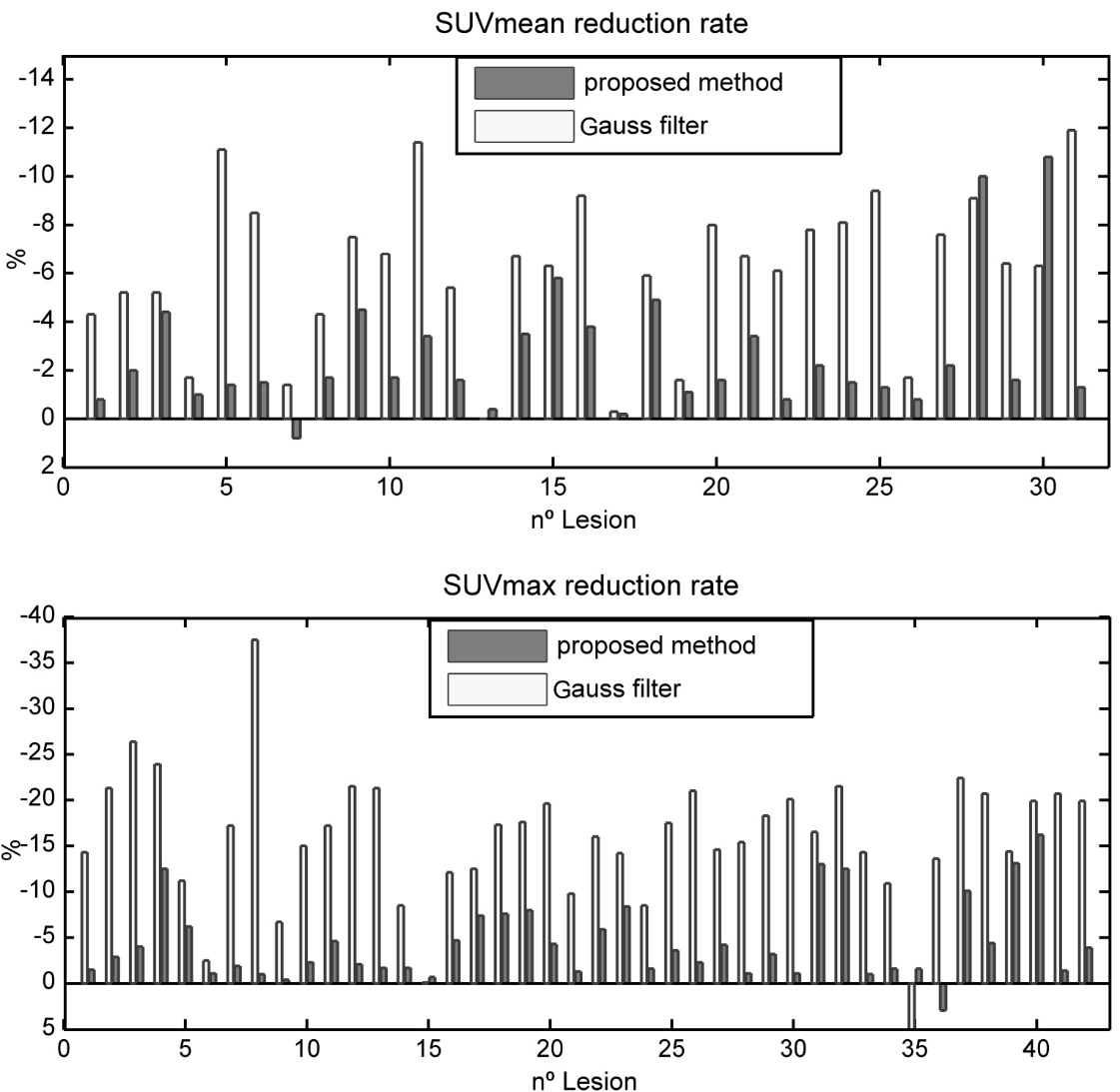


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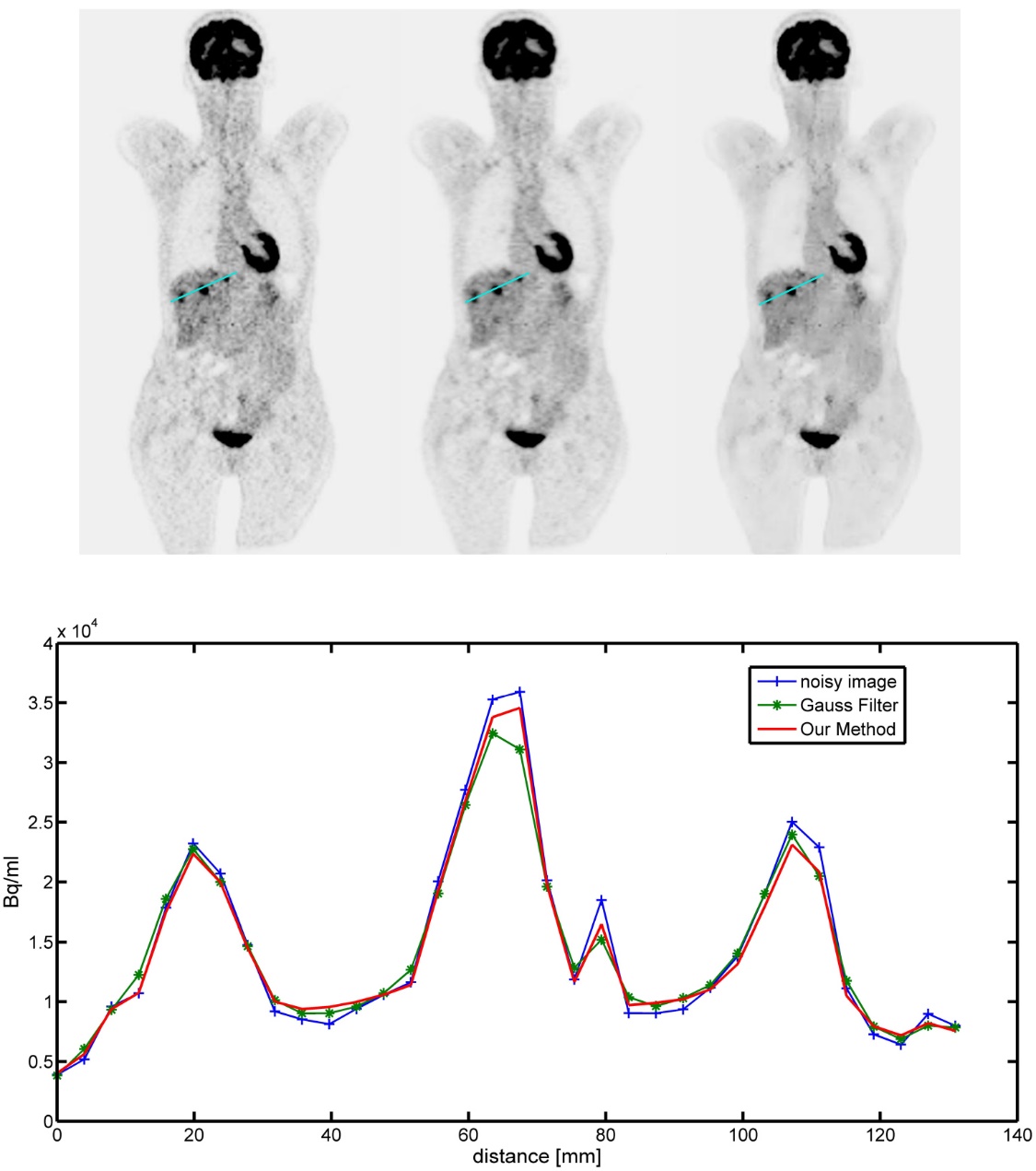


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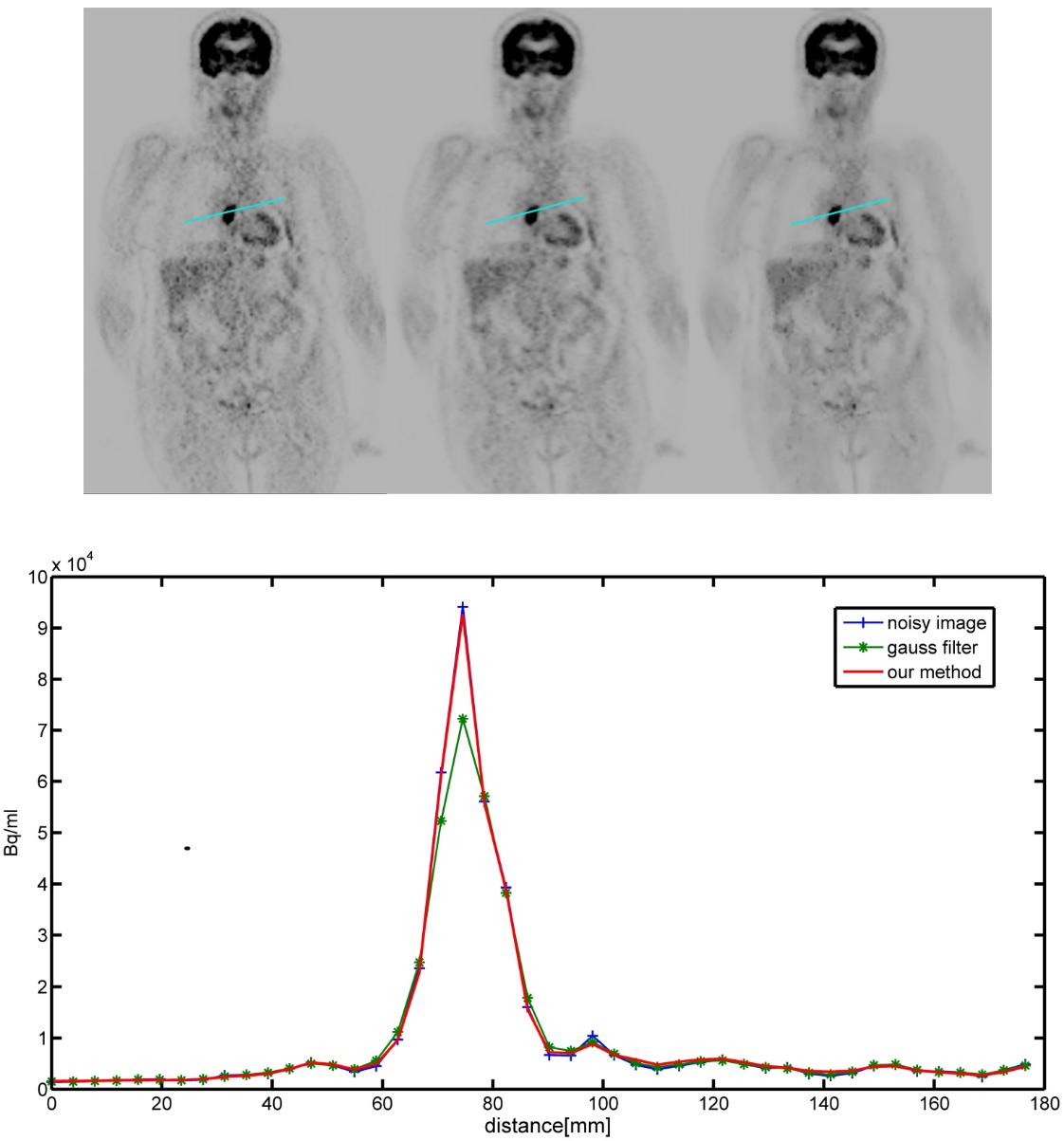


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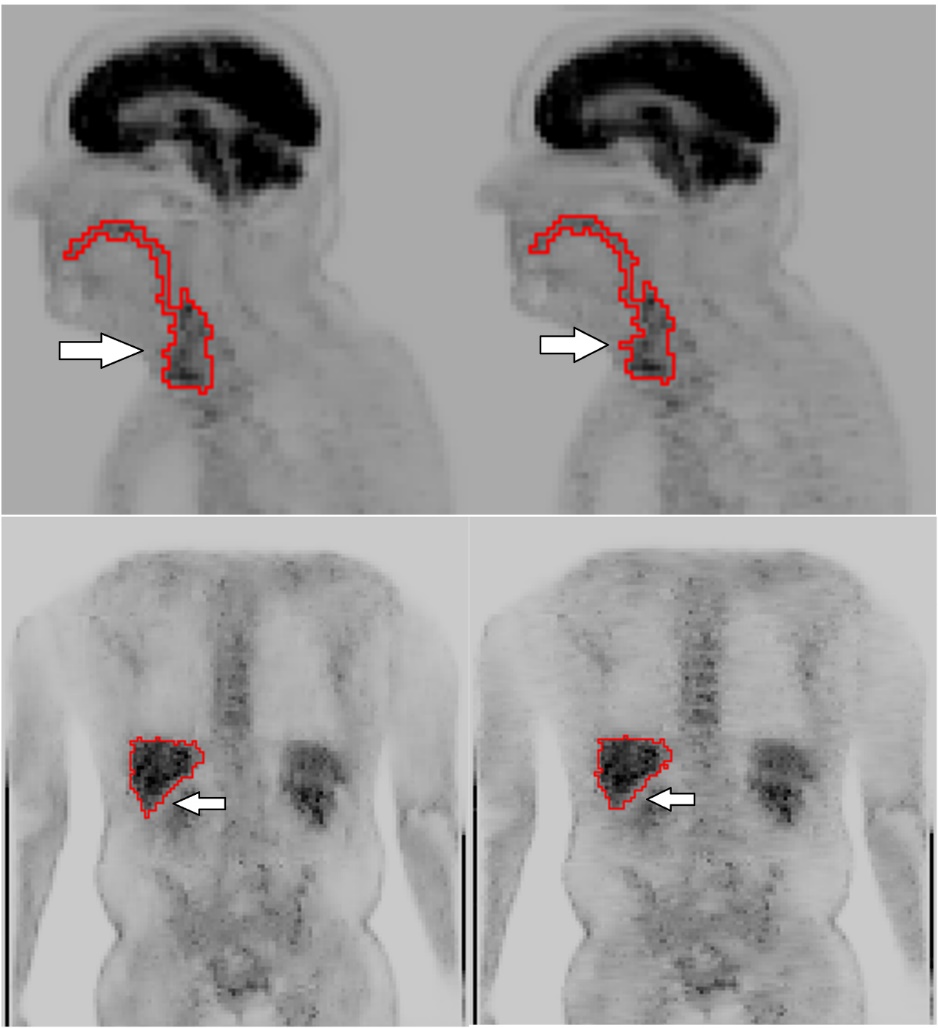


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## Discussion

## References

# Conclusion

References

Huerga, C. et al., 2017. Denoising of PET images by context modelling using local neighbourhood correlation. *Physics in Medicine & Biology,* 62(2), pp. 633-651.