

Project Description

G. Lemaître and F. Mériaudeau

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1 SUMMARY

The project of the Introduction to Image Processing (IIP) module is related with denoising method. The different papers of interest can be found inside the folder `articles` and the code corresponding can be found online.

2 DENOISING METHODS TO STUDY

Subspace-based denoising N. Yahya *et al.*, “*Subspace-based technique for speckle noise reduction in SAR image*”

BM3D The articles to consider are the following:

- K. Dabov *et al.*, “*Image denoising by sparse 3D transform-domain collaborative filtering*”
- M. Maggioni *et al.*, “*A non-local transform-domain filter for volumetric data denoising and reconstruction*”

The two papers are based on the same principle but the second paper focus on the denoising of 3D data. The code for these implementation can be found at

http://www.cs.tut.fi/~foi/GCF-BM3D/index.html#ref_software

K-SVD M. Elad *et al.*, “*Image denoising via sparse and redundant representations over learned dictionaries*”

<http://www.cs.technion.ac.il/~ronrubin/software.html>

NLM The articles to consider are the following:

- A. Buades *et al.*, “A non-local algorithm for image denoising”
- P. Coupé *et al.*, “Nonlocal means-based speckle filtering for ultrasound images”

The second paper is an extension of the first paper with an extension for speckle noise.

<http://fr.mathworks.com/matlabcentral/fileexchange/13176-non-local-means-filter>
<https://sites.google.com/site/pierrickcoupe/software/denoising-for-medical-imaging/speckle-reduction>

PGPD H. Xu *et al.*, “Patch group based nonlocal self-similarity prior learning for image denoising”

<http://www4.comp.polyu.edu.hk/~cslzhang/code/PGPD.zip>

Curvelet J.L. Starck *et al.*, “The curvelet transform for image denoising”

<http://www.curvelet.org/download.html>

3 STATE-OF-THE-ART DENOISING METHODS

Mean and median filter Some basic filtering in order to compare.

Lee filter J.S. Lee, “Digital image enhancement and noise filtering by use of local statistics”

Hard- and soft-thresholding in wavelet domain R.R. Coifman *et al.* “Translation-invariant de-noising”

<http://fr.mathworks.com/help/wavelet/ug/denoising.html#f8-22146>

4 TASKS

By group of 4-5 persons, perform the following tasks:

1. Select one method from Sect. 2 and make extensive comparisons with the methods stated in Sect. 3.
2. Denoise synthetic images: (i) Lena, (ii) cameraman, and (iii) baboon. Add synthetic noise to these images: (i) Gaussian noise, (ii) Rician noise, (iii) uniform noise, and (iv) salt and pepper noise. You can evaluate the PSNR in order to report the results.
3. Denoise real SD-OCT images. In addition segment the different layers using the code from <http://www.iibi.uiowa.edu/content/shared-software-download>. Provide a qualitative segmentation after applying this segmentation method.

4. Present a 15 minutes summary of the selected paper from Sect. 2.
5. Write a joint paper (all groups together) in which results are summarized quantitatively and qualitatively.