Project Description

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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"*

BMxD 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 A. Buades *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/softwares/
        denoising-for-medical-imaging/speckle-reduction
```

K-SVD 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
```

K-SVD J.L. Starck *et al.*, *"The curvelet transform for image denoising"*

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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 on 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 in which results are summarized quantitatively and qualitatively.