De: **EUSIPCO 2021** eusipco2021@cmsworkshops.com
Objet: EUSIPCO 2021 Review Results [Paper #6552]
Date: 4 mai 2021 à 21:16
À: Xhenis Çoba xheniscoba@hotmail.com, Fangchen Feng fangchen.feng@univ-paris13.fr, Azeddine Beghdadi azeddine.beghdadi@univ-paris13.fr

Dear Xhenis Çoba, Fangchen Feng, Azeddine Beghdadi,

Paper ID: 6552
Title: BLIND IMAGE SEPARATION FOR DOCUMENT RESTORATION USING PLUG-AND-PLAY APPROACH

The review process for the 29th European Signal Processing Conference (EUSIPCO 2021) has now been finalized, and we regret to inform you that your paper has not been accepted for publication. The review comments that have led to this decision can be found below.

We thank you for your interest in EUSIPCO 2021, and we hope that we can still welcome you as a participant. Please note that due to the COVID-19 outbreak, the event will be FULLY VIRTUAL.
Registration will soon open on the conference website, https://eusipco2021.org.

Sincerely,

Maria Sabrina Greco, Stephen McLaughlin and Josiane Zerubia
EUSIPCO 2021 Technical Program Co-Chairs

---- Comments from the Reviewers ----
Review #0D8C

Paper Format: Correctly formatted

Topic relevance: Very High

Originality of the content: High

Methodology / Research design: Average

Evaluation of results and derived conclusions: Average

References to previous work: Average

Correct English usage: High

General Comments to Authors
This paper deals with the use of processing methods related to Blind Source Separation to handle the show-through and bleed-through phenomena in (recto-verso) images.
It deserves the following comments.

As for the data model used for the considered data, the authors use a linear mixing model: see (1) (and the rotation matrix (6) after whitening).
However, a nonlinear mixing model is considered to be better suited and has indeed been used in the literature.
This is first confirmed by the fact that the following argument has been mentioned: if the recto side

following argument has been mentioned: if the recto side
is completely black, then the observation does not depend
on the verso side, which is clearly a nonlinear phenomenon
between the recto and verso images.
Moreover, the use of nonlinear mixing models in the
literature for handling the show-through effect e.g. includes:
Farnood Merrikh-Bayat et al.,
"A nonlinear blind source separation solution for removing the show-through effect in the scanned documents",
available at
https://hal.archives-ouvertes.fr/hal-00315887
(see Section 2.SHOW-THROUGH NONLINEAR MODELING).
Moreover, may the data model be altered by the alternative
denoising approaches that the authors consider?

Then, concerning the classes of Blind Source Separation (BSS)
methods from the literature
that may be used to restore source signals, the
authors cite three classes of methods. The first one is ICA,
and I agree with the authors' statement that is has major a
restriction, i.e. it requires independent sources, that
it extracts thanks to the information contained in
higher-order statistics, so that it does not allow more than one Gaussian source. But, as a consequence, the authors
should then refine what they say about the second
class of methods that they describe, namely, SCA:
- in contrast with ICA, a major advantage of at least
 one of the two main subclasses of SCA methods is that they
 allow dependent sources (whereas the authors only
 mention their advantages with respect to noise).
 This e.g. clearly appears even
 in the title of one of the main methods of that type
 that was reported in the literature, namely:
 F. Abrard, Y. Deville, "A time-frequency blind signal
 separation method applicable to underdetermined mixtures of
 dependent sources", Signal Processing, vol. 85, issue 7,
 pp. 1389-1403, July 2005.
- This has a connection with the fact that the authors state:
 "The separation problem is then formulated through an
 optimization framework" (p.1, and same on p.2):
 this is true for the second main subclass of SCA methods
 (say, those which minimize the L0 (or even Frobenius)
 norm of an error vector).
 In contrast, this is not the case of the first subclass
 of SCA methods mentioned above, i.e. the one that includes
 the above-mentioned TIFROM method by Abrard and Deville:
 that subclass is typically based on automatically
 detecting and
 then exploiting parts of the observed signals where
 only source is active.
 Simiarly, the statement "the estimation of the mixing matrix
 and the
 source images are performed simultaneously"
 does not apply to the latter class of methods.
- Finally, the authors state that SCA means
 "Sparsity Component Analysis", but this is not true:
 it means
 "Sparse Component Analysis"

"Sparse Component Analysis".
The above statements about SCA must therefore be refined in the final version of this mauscript but the authors must keep a description of SCA which, indeed, is one of the main classes of BSS methods.

Then, concernig the methods proposed by the authors to handle that problem:
these method are of interest although, in part of the description, they appear to be somewhat ad hoc, in particular:
- given how the hyper-parameter sigma is introduced, one may think that it should be set according to the noise variance, and this is confirmed by the authors: see "In the denoising scheme, the hyperparameter ... is directly related to the noise variance" (p. 2). However, it is then only selected in an empirical way: see Section B. on p. 3. The authors even mention the discrepancy that exists between the above two aspects, without solving it: "Theoretically, a small... should be chosen for noiseless mixtures. However, as evidenced by the experimental results, an appropriate choice of ... leads to a rapid convergence towards the expected source separation result."
- It would help if the authors would state more explictly which methods or parts of their methods are blind on not: see especially the use of chirality and a database in Section III: this requires a database with prior knowledge: "all the images are in the readable direction." Moreover, this probably means that the documents to be processed should belong to a given "language" at least in the sense: shape of symbols, e.g. writing from left to right, in a slanted way, and so on.

Also, Algorithm 1 states that the algorithm runs "until convergence".
Maybe I missed it, but I'm not sure the authors detailed their convergence criterion.

Finally, as for the test results: some results are provided but only for SYNTHETIC mixtures (of real images), using the linear mixing model which, as explained above is "not relevant", i.e. most likely not to be met in practice because it is too simplistic. Therefore, some additional simulations with a more relevant model, or even preferably with REAL mixtures (even if only providing resulting images for readers' perceptual evaluation) would have been appreciated in addition.

The paper various typos, e.g.:
- "gradient descend" -> "gradient descent"
- "Principle Component Analysis" -> "Principal Component Analysis"

Overall, this paper contains contributions of interest but should be refined from several points of view.

Review #0383

Paper Format: Correctly formatted

Topic relevance: Average

Originality of the content: Low

Methodology / Research design: Average

Evaluation of results and derived conclusions: Average

References to previous work: Very Low

Correct English usage: Average

General Comments to Authors
Important references are missing.
The true originality of the paper is not clearly stated.

Review #0E00

Paper Format: Correctly formatted

Topic relevance: High

Originality of the content: Average

Methodology / Research design: High

Evaluation of results and derived conclusions: High

References to previous work: High

Correct English usage: High

General Comments to Authors
The paper focuses on the problem of restoration of ancient documents. The paper proposes a modified blind source separation framework, which employs existing denoising algorithms in the source estimation process in order to capture non-local characteristics of the images. Furthermore, a dictionary learning denoising procedure is proposed to accelerate the computationally expensive denoising algorithms.

The technical novelty is rather limited, however, the paper is well written, providing sufficient experimental validation for an interesting application thus confirming the paper claims.
