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Interactive comment on "The SF3M approach to 3-D photo-reconstruction for non-expert users: application to a gully network" *by* C. Castillo et al.

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R stands for referee comment and A for authors'answer.

Anonymous Referee #2 - Specific comments R1: I do not fully understand the automatic discarding and the discarding of blurry images. According to Figure 4, the order is: 3. Reduce number of images, 4. Identify (and discard?) blurry pictures, 6. Undistort pictures. According to Table 2: If 6550 images are taken and 3275 of them are automatically discarded (3275 remain), afterwards 180 blurry images are discarded (3095 remain?), why are 3275 images distorted? If I got it right, this number is wrong.

A1: Our apologies. We will modify the term 'Identify' inside the chart in Figure 4 for 'Discard' to be consistent with the text and the interface tool names. The reviewer is

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Interactive Discussion

Discussion Paper

right also in relation with the number of undistorted pictures. We will correct this: 3095 images undistorted (from a total of 6550, we reduced to half -3275- and later 180 were discarded as blurry images → 3095).

R2: I miss additional information concerning the blur metric: Only a footnote in table 1 specifies the metric. The paper defining the metric should be cited (P. Marziliano, F. Dufaux, S. Winkler and T. Ebrahimi, "'Perceptual blur and ringing metrics: application to JPEG2000"', Signal Processing: Image Communication, vol. 19, no. 2, pp. 163-172, February 2004) and I would like to know, why especially this metric has been chosen. There are plenty of others . . . e. g. compared in Ferzli & Karam: A No-Reference Objective Image Sharpness Metric Based on the Notion of Just Noticeable Blur (JNB). IEEE Transactions on image processing. Vol. 18, No. 4, 2009.

A2: We appreciate the suggestion. The reason behind choosing this specific metric was that a Matlab script by Naccari (2011) was already available which made easier to be integrated inside the SF3M Matlab code. We will include the reference to the Marziliano paper.

R3: Processing times in Table 2 and section 3.2: It is not possible to rate the times without any information concerning the used computer. Especially the search for similar features in pairs is highly parallelizable. Thus, at least the number of cores should be given.

A3: Our apologies. We will include this information in the final manuscript: "The gully network was processed as three different PR projects (reflecting the number of gully branches) which were then merged in a single point cloud. For the computer used in this study (intel Core i7 2Ghz with 4 cores, 8GB RAM), a total of 2,960 minutes were necessary to process the entire gully network, i.e. $\sim$ 49 hours, of which 17% required operator assistance and 83% only computer time. Photo-reconstruction (54.5% of the total time) and picture undistortion (15.2 %) were the two most time-consuming stages."

R4: VisualSfM is mainly controlled by an ini-file. Does SF3M change specific settings

in this file, e. g. while using Calibration Toolbox? If SF3M changes the file: Are the remaining settings taken from a SF3M source or is only the relevant setting changed in the file?

A4: SF3M modifies automatically the VisualSFM nv.ini settings according to the user's following choices in the SF3M settings: 1. Maximum number of features (param_gpu_match_fmax in nv.ini file) for the project connectivity analysis. In this case, SF3M modifies this parameter before performing the project connectivity and, once finished, restores the former value (8192 features) into the nv.ini file. 2. The dense reconstruction level and maximum number of images in pmvs2 (param_pmvs_level and param_cmvs_max_image in the nv.ini file) in dense reconstruction.

The rest of the VisualSFM nv.ini parameters are not modified. Regarding the Calibration Toolbox (by Jean Bouguet), this feature is not integrated in SF3M. What our tool includes is the possibility of undistorting the images automatically if the Calib_Results file resulting from the previous tool is available in the project folder.

- Technical corrections: R5: P. 278, l. 2-3, sentence: "'This list includes generally much fewer image pairs that all the possible combinations among the pictures.'" that = than?

A5: Our apologies. We will correct this in the final version of the manuscript.

R6: Figure 4: Two numerations are included in the screenshot: panels (with numbers followed by points) and the relevant graphical control elements (without points). The reader might be confused, as the numbers in the workflow diagram refer to graphical control elements, though points are used in the diagram.

A6: Our apologies. We will remove the points in the diagram to facilitate the interpretation in the final version of the manuscript. We will also change the Arabic number for the Panel stages on the main window for roman numbers (e.g. 1. Settings to I. Settings).

- Comments concerning the software This section is intended as remarks for V2.0 of

SF3M. From my point of view, they do not (necessarily) need to be considered in the present article.

R7: Assuming my interpretation in the first point of the specific comments is correct: At first, every n-th image is discarded to reach the percentage given by user in panel 2. Image pre-processing. Afterwards, the blurry images are discarded. Does this order make sense? Would it not be more reasonable to rate the blurriness at first, discard blurry images and respect the discarded blurry images in the automatic image reducing? Otherwise we might e. g. automatically discard images 2 and 4 due to automatic image reduction, afterwards image 3 because it is blurry. As a consequence, several subsequent images are missing, which might result in an increased dome effect at this place. If we know that we discard image 3 due to blurriness, it might make sense to keep images 2 and 4!

A7: Thank you for the comment. The Reduce number of images tool was intended to facilitate the user the removal of images following a certain pattern to speed up processing. This is very frequent when taking time-lapse pictures that might result in some cases in an excess of images that would make the process very time–consuming. To us made more sense to reduce first and, once decided the final image set, to proceed with discarding images. Otherwise, this last stage might take a long time since you are working with a much larger dataset. However, reviewer's suggestion is also feasible by performing the Discard blurry option in the first place (only the non-blurry images will remain in the project folder) and next the Reduce images option (acting on the remaining non-blurry image set).

R8: I would introduce some intelligence in the automatic discarding. The current algorithm assumes truly constant speed of the human taking the images, resulting in a constant overlap of subsequent images. This assumption is at least doubtful and especially not valid for a completely different situation: Let's assume, an UAV is taking the images, traveling at different speeds in different directions due to wind. Thus, it would be more reasonable to rate the overlap (e. b. by simply estimating the spatial

autocorrelation (of clipped images)). Then automatically discard e. g. image 2 only if a certain overlap between the images 1 and 3 still is maintained.

A8: Thank you for the suggestion. In fact, a similar approach to that suggested by the reviewer is already working in SF3M. During the project connectivity analysis, SF3M calls VisualSFM for exporting the F-matrix, which only included image pairs with inlier matches. This file is used by SF3M to build the final image pairs file to be used in the photo-reconstruction process. Those pairs with only feature matches not turning to be inliers, are removed from the feature exporting algorithm and, therefore, not processed during the reconstruction stage. This is the main reason why SF3M operation speeds up notably the matching processing by making use of the valuable information provided by the different VisualSFM algorithms.

R9: SF3M uses several freely available third party software like VisualSfM or Cloud-compare. The latter one is being published under GNU General Public License. In the article, only the description "'freely available"' (p. 374, l. 15) has been used. Is there any additional comment concerning usage? I did not find any information on the download website, or in the software itself.

A9: Currently, at the http://sf3mapp.csic.es/ website the user can find: - the Matlab Compiler Runtime - The SF3M executable and license - SF3M instructions - SF3M video tutorials (four videos explaining the complete SF3M workflow). We will include a brief reference of the information available at the SF3M website in the final version of the manuscript. We have also uploaded the SF3M license to the website where we specify that "SF3M is free for personal, non-profit, or academic use. You may redistribute SF3M as long as you make no modifications. Commercial use of this tool is not permited".

R10: Closely connected to the previous comment: Even slightly deviating workflows will demand modifications in the software. Is there a chance to get the MATLAB files to adapt the user interface to specific workflows?

A10: For a number of reasons, we have decided not to release the source code at this stage. Nevertheless, we actively encourage feedback on the website and will be endeavouring to maintain regular updates to accommodate user requests.

R11: A comment from the software engineer's point of view: I do not understand, why sometimes checkboxes are used in the GUI (e. g. in panel 2. Image preprocessing), sometimes radio buttons (panel 3., 4. & 5.), although they do not all seem to be arranged in button groups for exclusive selection. It is possible to select several buttons in panel 3. Why?

A11: Thank you for the comment. The Project Panel buttons are not a group. For clarity purposes, they should be modified to check boxes following the reviewer's suggestion. We will modify this in the final version of the interface and the manuscript.

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