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Interactive comment on "KLT-IV v1.0: Image velocimetry software for use with fixed and mobile platforms" *by* Matthew T. Perks

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1 General comments

The author reports on a new software for computing river surface velocity and discharge from the use of video captured by fixed or mobile platforms, including webcameras installed at river gauges, and UAS. The software, KLT-IV v1.0, presents a complete processing package that would enable users to go from raw video to discharge results. KLT-IV uses a combination of feature tracking algorithms (in this case Good Feature to Track) and Optical Flow to compute trajectories of the objects of interest. Among other novel aspects of the software, this approach allows not just only for the tracking of water surface velocity features, but also for ground control features.

By incorporating this tracking functionality, the author has created a software package that can enable some new approaches to managing scene and camera orthorectification. In my opinion, this is an excellent addition to the growing suite of surface velocity tools which have appeared in the scientific literature over the past 5 or so years. The potential is there with KLT-IV to begin to standardize reach-based UAS surface velocity surveys, and yet the software also provides the necessary functions for standard fixed or mobile platform camera gaging. Well done.

This paper is well organized and coherent. It clearly states the aims of the work, and the author adequately anchors this work into the body of literature. The functionality and workflow of the KLT-IV software is clearly presented. The style and clarity of prose is excellent. Overall, this is an excellent paper that is nearly ready for publication.

2 Specific comments

I would like to see some more discussion included in the paper about how well the KLT-IV flow trajectory algorithms perform compared to other algorithms and independent measurement techniques. At the least, a little discussion of the results from the cited work by Pearce et al. (2020) would be well received. Has the author collected independent flow velocity and/or discharge measurements and compared them with the output from KLT-IV since the seminal technical note published in 2016? It would be very good to address any new findings here, even if only briefly, or by citing associated literature.

I would also like to see some text added in the discussion indicating known and common method failure points (more generically, rather than just specifically associated with the two case studies presented). What are the common minimum seeding or velocity thresholds in which the method begins to struggle? Are there strategies on balancing the input/processing frame rate and anticipated flow velocity? Any guidance or insights on these factors may help ensure the KLT-IV software is used for its intended purpose, and that results are as accurate as possible.

Finally, I would like to see some information about the processing times and expectations for compute hours for use of the KLT-IV software under certain conditions. What computer hardware was used to compute the case study results? What sort of processing time did it take to do these case studies? Have any formal bench testing experiments been undertaken (in addition to the work by Pearce et al., 2020)? Although the hardware requirements section addresses the basic needs in order to run the software, should a user plan to use cluster computers for more extensive use of KLT-IV? What about the ability to port the software to operate on edge computing devices? Perhaps, if not at least mentioned in this paper, there may be a reason to write another paper discussing these things.

3 Technical corrections

Overall, this paper is well constructed, and highly relevant to the field of non-contact remote sensing of hydrometric variables. I would have no hesitation approving this manuscript after my comments are addressed. In addition to my points above, a few minor issues are discussed below, referenced to the line numbers as indicated in the pre-print version of the manuscript.

Line 33: The Despax et al. (2019) paper was really about determining the interlaboratory uncertainty between how we do direct streamflow measurements with ADCP. I wouldn't necessarily say it is about remotely operated streamflow monitoring, as is implied by line 31.

Line 60: It is my hope that soon, we will be able to capture topographic and bathymetric observations at the same time, in a non-contact fashion, as we capture surface velocities with image velocimetry techniques. Much promise and development seems to be happening now with the use of tuned, multi-phased ground penetrating radar to capture the channel bottom characteristics (by drone or cable way). This is an exciting time for non-contact hydraulic remote sensing.

Line 120: You can also cite RIVeR here as well. The RIVeR typical workflow rectifies the results from PIV conducted on non-transformed image pairs.

- Patalano, García, and Rodríguez, "Rectification of Image Velocity Results (RIVeR): A Simple and User-Friendly Toolbox for Large Scale Water Surface Particle Image Velocimetry (PIV) and Particle Tracking Velocimetry (PTV)." 10.1016/j.cageo.2017.07.009

Line 171: Does this imply that if a UAS or fixed image scene with excessive motion is not completely corrected, the error detection result would censor data which may be valid? Or, in a more positive view, censor data which still show motion contamination?

Line 207: Any particular reason why the camera positions inputs are required as radians, rather than degrees? Use of atan2 in the conversion process within KLT-IV would easily handle any typical issues that arise from converting from a world geometry convention (degrees) to a polar geometry convention (radians), and would be much simpler for the end user.

Line 310: Please either define that mAOD is Ordinance Datum, or consider converting to some other widely recognized reference. Your international readers may not be familiar with mAOD.

Line 445: A useful point here could be made for UAS terrain-following flight planning. This functionality is capable with more sophisticated ground control stations, such as Mission Planner. Moreover, some of the newer consumer-grade UAS on the market now are beginning to incorporate Terrain-following functionality.