

Minor comments

**1) Specific instructions of the reviewer**

Q: Line 9: high instead of great

A: Thank you for your comment! We have followed your suggestion.

Q: Line 10f: Conventional sampling methods are inadequate and time-consuming for effectively capturing the variability of bed surface texture in these situations.

A: Thank you for your comment! We have followed your suggestion.

Q: Line 12: In this study, we overcome this issue by adopting an image-based, Deep Learning (DL) algorithm (delete the rest of this sentence)

A: Thank you for your comment! We have followed your suggestion.

Q: Line 13: You introduce an abbreviation for Deep Learning (DL) in line 13 and 129. Please use this abbreviation from here on.

A: Thank you for your comment! We have followed your suggestion.

Q: Line 15: that were taken along cross-sections underwater in the Danube river. 27 river bed samples were collected and analyzed for validation.

A: Thank you for your comment! We have followed your suggestion.

Q: Line 18: how dense is "very dense". Please try to make quantitative rather than qualitative statements.

A: Thank you for your comment! We have followed your suggestion.

Q: Line 23: Delete sentences: This meant a total of 27 ...

A: Thank you for your comment! We have followed your suggestion.

Q: Line 24: I wouldn't call this data outlier. Perhaps rephrase this part:

After correcting for samples affected by bed armouring, comparison of the DL approach with 14 physical samples yield a mean classification error of 4.5%.

A: Thank you for your comment! We have followed your suggestion.

Q: Line 27: From here on, there is a lot detail for the abstract.

A: Thank you for your comment! I have removed the „Furthermore, comparison with the wavelet-based image processing justified the selection of the outlier points earlier, as its results matched closely with the DL detections in these purely gravel-covered points and showed no sign of finer fractions, univocally opposing the content of the physical samples.” Line 27 – 30.

Q: Line 64: remove intensively

A: Thank you for your comment! We have followed your suggestion.

Q: Line 65: remove Major

A: Thank you for your comment! We have followed your suggestion.

Q: Line 175: The goal of this study is to ... and attempt to solve the shortcomings of previous ...

A: Thank you for your comment! We have followed your suggestion.

Q: Line 187: study instead of manuscript

A: Thank you for your comment! We have followed your suggestion.

Q: Line 190: varies instead could vary

A: Thank you for your comment! We have followed your suggestion.

Q: Line 190: in most previous studies

A: Thank you for your comment! We have followed your suggestion.

Q: Line 243: remove: Of course

A: Thank you for your comment! We have followed your suggestion.

Q: Line 619: four approaches were adopted:

A: Thank you for your comment! We have followed your suggestion.

Q: Line 669-670: Provide references for this statement.

Thank you for your comment! This section is referencing Section 1., where several previous studies have been introduced already. We now modified the sentence to make it clearer: *As we discussed in Section 1., earlier DL methods for sediment analysis (e.g., Soloy et al., 2020) all applied fixed camera heights and/or provided scaling for the AI.*

Q: Line 672-675: Delete the sentence: Hence, it is of major importance that this manuscript introduces ... Instead write: By avoiding the need for a scale, our method is faster and simpler to use. As a drawback, our method does not reconstruct ...

Q: Line 681: discriminated instead of adapted?

A: Thank you for your comment! We have followed your suggestion.

Q: Line 689: imaging techniques

A: Thank you for your comment! We have followed your suggestion.

Q: Line 692: LS-PIV? This abbreviation remains unclear.

A: Thank you for your comment! We have followed your suggestion.

Q: Line 703: please check, whether representativeness is the right word here.

Thank you for your comment! Both representativeness (Chasalow & Levy, 2021) and representativity (Booth & Gerland, 2015) are correct/used in this case.

Kyla Chasalow, Karen Levy (2021): Representativeness in Statistics, Politics, and Machine Learning. arXiv:2101.03827v3 [cs.CY] 10 Feb 2021

Heather Booth, Patrick Gerland (2015): Demographic Techniques: Data Adjustment and Correction. in: International Encyclopedia of the Social & Behavioral Sciences (Second Edition), Elsevier, 2015, Pages 126-137, ISBN 9780080970875, <https://doi.org/10.1016/B978-0-08-097086-8.31011-X>.

Q: Line 706: Consider using active wording. For example:

We introduced a novel, AI-based method for riverbed sediment analysis. The method uses underwater images to reconstruct spatial variations in sediment grain sizes. Trained and validated with ~15.000 underwater images collected in a section of the Danube in Hungary, we show that the method is able to map the riverbed along the vessel's route at a high spatial density of xxx samples per meter. The method does not require a scale and thus allows the distance between the camera and the riverbed to

vary. In contrast to conventional point samples of river-bed substrate, our method provides spatially continuous data, that can be further enhanced (e.g. by interpolation) to 2D maps. The method can be applied in studies where dense information about river-bed composition is required, such as riverine habitat studies, computational hydro- and morphodynamic models, or analyses of river-restoration measures.

A: Thank you for your comment! We have followed your suggestion.

## **2) Other clarifications and edits**

- The first paragraph of Section 3.3 has been rephrased.
  
- The last paragraph of Section 2.3 has been rephrased.
  
- The first paragraph of Section 3.2.1 has been rephrased.
  
- Line 502-508 has been rephrased.