Response to Referee #2

Response: We thank the Reviewer for the comments and for the valuable suggestions. Our responses can be found in this response letter. We updated our manuscript adding new text in **red** (***manuscript marked with changes.pdf***).

R.2.1: The authors present a review of Artificial Intelligence (AI) approaches to propose a state of the art based on the analysis of which type of data, methodology and applications geomatics data are used.

Global overview
Firstly, the authors are thanked for their work which is well structured and well explained. The objectives of the paper are clear and the reading is eased thanks to a good paper organization. The authors have made an interesting analysis of the selected publications regarding many criteria that enlighten some trends. As a consequence, their analysis is deeply linked to their selection of papers which seems to represent a tremendous task. Even though such selection could be discussed and could lead to inconsistent trends, each topic is explained in detail.

However, the paper form needs to be reviewed.

1) Section 1.3 : Maybe the paper organization should come before Section 1.2? (particularly because Section 1.2 is cited in Section 1.3)

Response: *we thank the reviewer for the thoughtful comments and recommendations. We have carefully addressed the reviewer's suggestions and the introduction is substantially strengthened. We have addressed the reviewers' specific concern by moving Section 1.3 before Section 1.2.*

R.2.2: 2) Figures : make the figures homogeneous to help the reader. Sometimes there is a title inside the figure, sometimes not.

Response: *We have redesigned the figures accordingly.*

R.2.3: Moreover, make sure you have your axes labelled and that labels are set accordingly among the different figures (e.g. Figure 6 VS Figure 8: data types are not in the same order, y-axis label on Figure 6 and not on Figure 8), etc.

Response: *We have redesigned the figures accordingly.*

R.2.4: Specific remarks / Questions

1) An introduction of Machine Learning (ML) and Deep Learning (DL) and their differences would make sense in this paper, particularly because they are mentionned together many times.

Response: *We updated the manuscript according to the reviewer's comment. The updated manuscript includes new text and refined sentences in these directions.*
In particular, a clear description has been added in section 2.1 ((lines 115-145)).

R.2.5: 2) Could you explain how you selected the pertinent papers (l.87)?

Response: *Thanks for your suggestions and it could be useful to clarify in section 1.3 that the chosen guidelines follow the PRISMA workflow diagram. As stated in "Research strategy definition" we define guidelines for the review finalisation. These guidelines are motivated by the fact that artificial intelligence approaches for geomatics dataset are quite new. In particular, if we focus on generative adversarial neural networks (GANs) for GeoAI domain, the interesting paper starting in 2017. These lead to an exclusion of paper dated before 2016 for sake of completeness. Thus we claimed that: "The following sources of information were used in this study: ieeeXplore, Scopus, Sciencedirect, citepseerx, and SpringerLink. A set of keywords were chosen in relation to the Remote Sensing domain and based on preliminary screening of the research field. The keywords considered in the research initially were as follows: geomatics data, pattern recognition, artificial intelligence, machine learning, neural networks, supervised learning, unsupervised learning, statistical methods, Active learning, Imbalanced class learning, deep learning, Convolutional Neural Networks, classification, segmentation, detection, pattern recognition, applications, remote sensing data, hyperspectral data, point clouds data, RGB-D data, thermal data, and trajectory. To obtain more accurate results, the keywords were aggregated. In a set of queries, the keyword geomatics data was combined with others related to the methodologies (ML, DL, and more), and in other sets, remote sensing data were combined with the application (classification or detection). Each query produced a large quantity of articles, which were selected based on their pertinence and year of publication. Articles considered inconsistent with the research topic and published before the year 2016 were removed from the list. The temporal distribution of works dealing with geomatics data is shown in Figures 2 and 3. The papers considered for the review were published between the years 2016 and 2021. Figure 2 shows the temporal distribution of works dealing with AI for geomatics data. Figure 3 highlights the number of papers taken into consideration divided by the year of publication and by the type of geomatics data."*

R.2.6: 3) Also, have you been able to draw a quick history of the methods and data type/size used over the years that lead the community to this point?

Response: *This is a very interesting comment. Despite the difficulty, there are several reasons that led the community to this point. We have seen a very well motivated explanation in*

- *Reichstein, M., Camps-Valls, G., Stevens, B., Jung, M., Denzler, J., & Carvalhais, N. (2019). Deep learning and process understanding for data-driven Earth system science. Nature, 566(7743), 195-204.*
- *Mehonic, A., & Kenyon, A. J. (2022). Brain-inspired computing needs a master plan. Nature, 604(7905), 255-260.*

These papers have been added to the text.

R.2.7: This could answer the following question, inherent to your paper: Why researchers are using more and more DL?

Response: *Deep learning models are gaining much popularity due to their supremacy in terms of accuracy when training with huge amounts of data. In fact, with machine learning systems a human needs to identify and hand-code the applied features based on the data type (for example, pixel value, shape, orientation), a deep learning system tries to learn those features without additional human intervention. The main difference between the preference of applying deep*

learning models instead of the machine learning once is that while standard machine learning models make insights without being explicitly programmed and improve their results progressively, they still need some guidance and adjustments from humans. Whereas, deep learning relies on neural networks. Deep Learning methods have been analyzed since given the huge amount of geomatics data Deep Learning methods achieve best performance both in terms of efficiency and time. These aspects have been added together with relevant recent literature in the field (lines 145-160 and 165-170).

R.2.8: 4) In your research, how did you considered the papers that use the fusion of data and the combination of AI-based approaches?

Response: *Thanks for the advice because this point is crucial for our future works. Image fusion using deep learning framework has shown notable achievements in geomatics disciplines such as remote sensing. Moreover, we emphasize another aspect worth investigating, i.e. multi-task learning., which is a training paradigm in which machine/deep learning models are trained with data from multiple tasks simultaneously, using shared representations to learn the common ideas between a collection of related tasks. We aim to continue advancing the field now that we have understood its low-maturity but nevertheless promising nature and we highlight this important aspect in the discussions and conclusions .*

R.2.9: 5) In your conclusion, you make a comparison of the type of data used over the years (l.625-631). Is it based on Figure 3? If so, it means that this conclusion is dependant on the paper selection criteria.

Response: *Thank you for this remark. The discussions and conclusions have been drawn according to the research questions asked at the beginning of the paper; of course, all the diagrams (and not only figure 3) contributed to the identification of the major trends between geomatic data and AI-based tasks.*

R.2.10: Did you try to compare your result with the number of matches of your queries based on the keyword and year among the different sources of information?

Response: *A systematic review of the literature was conducted using PRISMA guidelines and electronic databases listed in our review. The sequel to a set of keywords was considered. They are chosen in relation to the geomatics domain and on the basis of a preliminary screening of the research field. To get more accurate results the keywords have been aggregated. In one set of queries, keywords deep/machine learning and geomatics were combined with methodology-related others, in other sets deep/machine learning and geomatics were combined with application. Each query produced a large amount of articles, which were selected based on relevance and year of publication. Articles found to be inconsistent with the research topic and published before the year 2016 were removed from the list.*

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Geomatics Review

was edited and/or proofread by Scribendi as order number

756074

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Mon, 18 Jan 2021

Scribendi Inc

SCRIBENDI INC.
405 RIVERVIEW DRIVE
CHATHAM, ON N7M 0N3 CANADA
+1 (519) 351 1626

www.scribendi.com

Printed on 1/20/2021 at 2:37 PM