Report on the outcomes of "Spreading out the Knowledge from ISPRS Educational Events using a Dissemination Internet Platform (SKIEE-DIP)"

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1 Introduction

The project SKIEE-DIP (Spreading out the Knowledge from ISPRS Educational Events using a Dissemination Internet Platform) is an add-on of the International Summer School on Close Range Sensing Techniques in Alpine Terrain[1]. The project outcome is an online course providing assignments where participants by themselves acquire innovative, practical and methodological skills to characterise complex terrain and objects using close-, near range and remote sensing techniques. Data acquired during the summer school of 2015 and 2017 with a variety of sensor systems such as terrestrial laser scanners, unmanned aerial vehicles and spectral cameras serve as a basis for assignments dealing with mountain research questions. Monitoring and mapping geomorphologic and vegetational processes (e.g., river erosion and sedimentation, rock glacier creeping, landslide deformation, landcover changes) are the superordinate topics of the assignments. Following elements are content of the online course: planning terrestrial laser scanning acquisitions, point cloud registration and georeferencing, deformation estimation, structure from motion and dense matching for image base point cloud derivation, data integration and classification of 3D and multispectral data. Established assignments should encourage participants to accomplish each exercise in an autonomous way. This should help them to establish a workflow relevant for their own research and should further inspire them to think of possible solutions for unsolved research questions.

[1] Rutzinger, M., Höfle, B., Lindenbergh, R., Oude Elberink, S., Pirotti, F., Sailer, R., Scaioni, M., Stötter, J., Wujanz, D., 2016. "Close-Range Sensing Techniques in Alpine Terrain." In: Proc. "ISPRS Congress," 12-19 July 2016, Prague (Czech Rep.), *ISPRS Ann. Photogramm. Remote Sens. Spatial Inf. Sci.*, Vol. III, Part 6, pp. 15-22.
Rutzinger, M., Bremer, M., Höfle, B., Hämmerle, M., Lindenbergh, R., Oude Elberink, S., Pirotti, F., Scaioni, M., Wujanz, D., Zieher, T., 2018. "Training in Innovative Technologies for Close-Range Sensing in Alpine Terrain." In: Proc. "ISPRS Technical Commission II Mid-term Symposium 2018 – Towards Photogrammetry 2020," Riva del Garda (Italy), 4-7 June 2018, *ISPRS Ann. Photogramm. Remote Sens. Spatial Inf. Sci.*, Vol. IV, Part 2, pp. 239-246.

2 Definition of guidelines for the implementation of DIP

With the project start in February 2018 guidelines for the implementation of a DIP (Dissemination Internet Platform) were discussed during an internet meeting between PI (Marco Scaioni), co-PI's (Roderik Lindenbergh, Francesco Pirotti, Martin Rutzinger, Bernhard Höfle) and a technician (Jan Pfeiffer). Outcomes of this meeting concretised the guidelines and structure of the implementation of the DIP. Following points were discussed and recorded:

- A welcome page should explain background and function of the course
- The DIP should offer a forum for discussion
- Accompanied data for practical assignments must be provided either within the DIP environment or linked to an open access data publication
- Content to be transmitted should build on the content of the summer school
- Content should be licenced using a version of CC to guarantee access and copyright for authors
- The course should be well structured by assignments and subtasks
- Each assignment should be accompanied with relevant literature and existing internet documentations
- A blank template of an assignment should be created to enable the implementation of further assignments in future

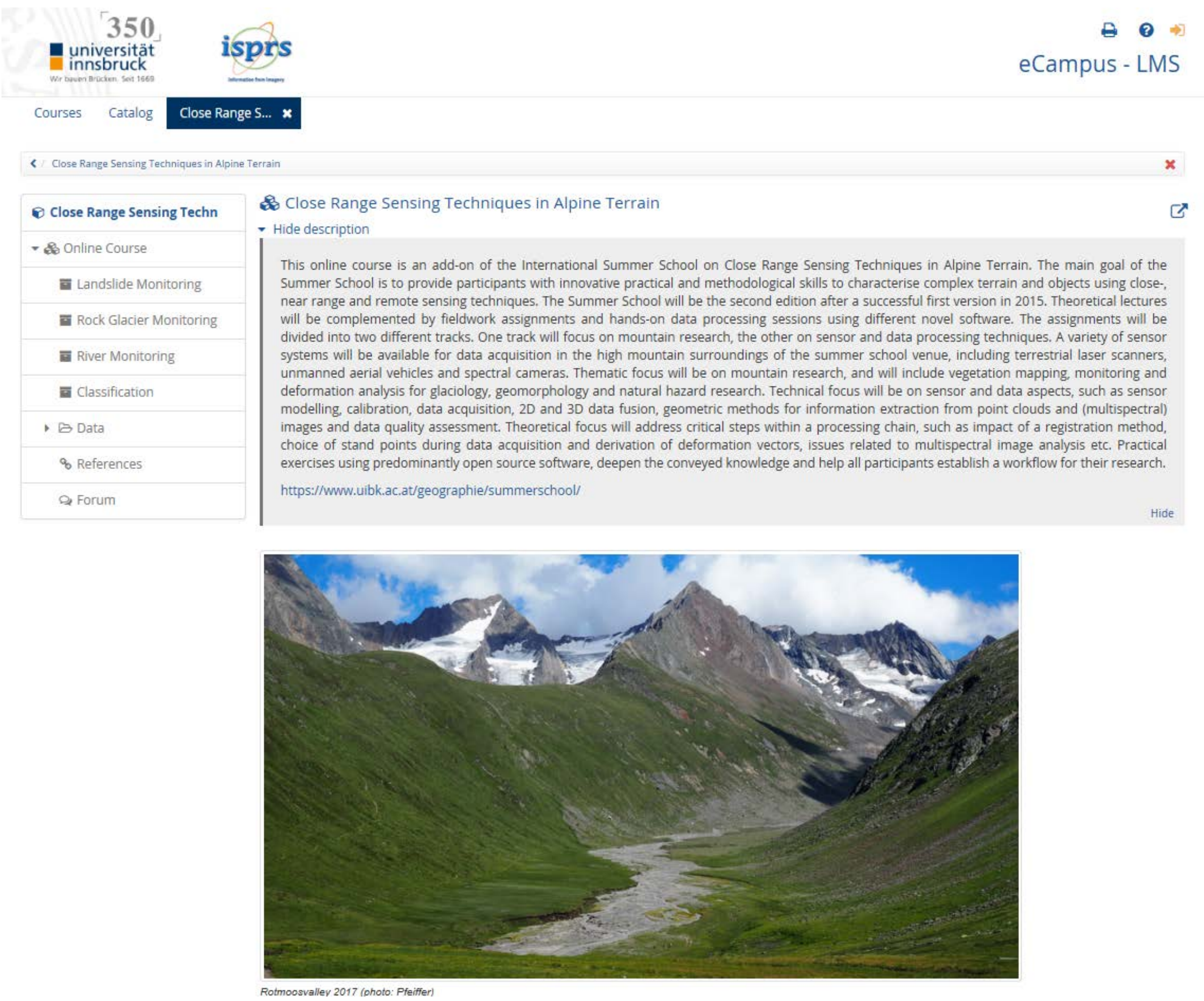

Fig. 1 - DIP welcome page

3 Implementation of a Prototype

Based on guidelines defined in the first step of the project a prototype assignment was developed using the Open OLAT web-based e-learning platform provided by the University of Innsbruck (Fig 1). This platform allows the creation of structured e-learning courses. Data provision option as well as the possibility for smaller design adaptions (e.g., placement of logos) enable a straight-forward implementation of e-learning assignments through different given course elements. For the DIP implementation a Content Packaging (CP) format embedded in the online course was used to create the assignments using an editor. Before implementing the prototype assignment, data required to perform the exercise had to be prepared and provided in a manageable size and in an open data format. Possible open source software that enable and facilitate the execution of the task had to be compiled. Based on this, a well suited open-source (or alternatively popular low-cost) software for efficient completion of the tasks is suggested within the assignment description.

The structure of the prototype assignment “Landslide Monitoring” was defined as follows:

- Introduction
- Data
- Subtask 1 “Registration”
- Subtask 2 “Deformation Calculation”
- References and Links

Every assignment should therefore contain a short introducing text where the content, objective and major challenges of the assignment are summarized (Fig 2). Additionally, a data description and explanation of where to find and download the data is given. This introducing sequence is followed by several subtasks inviting the participant to analyse and work with the data to fulfil the assignments objectives. At the end of each assignment a text giving an inspiring outlook to motivate participants to develop and implement own thoughts of how further research questions may be solved in future. References to relevant literature and links to useful software related internet documentations are stated below each assignment.

Fig. 2- Introduction section of the revised prototype assignment "Landslide Monitoring"

4 Feedback collection, prototype revision and implementation of further assignments

After Implementing the first prototype assignment in June 2018 students that are familiar with the field "close range sensing techniques" were asked to perform the assignment and return feedback to the project stuff. Based on the received feedback the conceptual assignment formulation and data provision were adapted. Further data was collected and prepared to fit in further assignment which were subsequently prepared considering the suggestion for improvements. In addition to the revised prototype assignment "Landslide Monitoring" three more assignments were implemented. An overview of implemented assignments and their major contents are summarized below:

Landslide Monitoring:

- get familiar with TLS acquired point clouds
- registration of multi epoch point clouds
- estimation of landslide induced deformation

Rock Glacier Monitoring:

- TLS data acquisition planning
- point cloud georeferencing
- determination of surface changes caused by rock glacier flow

River Monitoring:

- Surface reconstruction from UAV and terrestrial images with Structure from Motion (SfM) and dense matching techniques
- Fusion of UAV and terrestrial photogrammetry data
- Comparing photogrammetric point clouds

Classification:

- Descriptor collection
- Classification with geometrical descriptors
- Classification with spectral descriptors

For each topic three major working steps were carried out to establish a respective online course assignment. Within a first step existing lectures, assignments, data and additionally available information was collected and compiled to derive an applicable workflow, specifying the structure of an online course assignment, in a second step. The third step of the assignment creation process is responsible to implement this workflow within the DIP using an illustrative way. Fig 3 summarizes the working steps that are needed to develop an online course assignment.

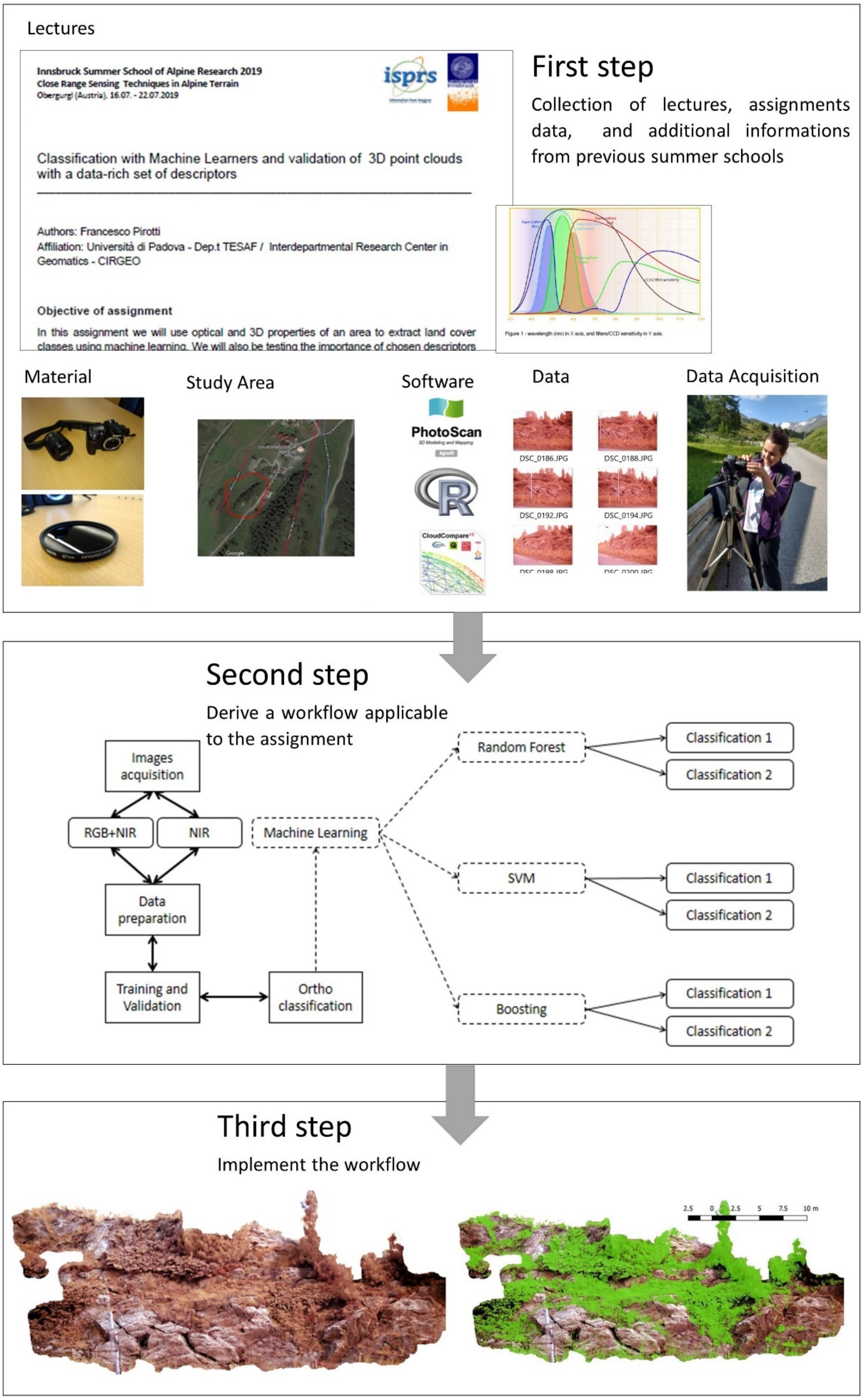

Fig. 3 - Working steps to develop an online course assignment

5 Summarized project outcome

The outcome of SKIEE-DIP is an online course dealing with close-range sensing data acquired during the ISPRS international summer school on close range sensing techniques in Alpine terrain which took place in Obergurgl, Austria in 2015 and 2017. The online course is embedded within an e-learning platform provided by the University of Innsbruck. So far, four assignments dealing with close range sensing data derived from cameras and laser scanning devices to monitor environmental process in Alpine environments are freely available and accomplishable for everyone interested in these topics.

The platform can be accessed online at (login with the guest access, last accessed: 29.05.2019):

https://lms.uibk.ac.at/url/RepositoryEntry/4345856002

6 Financial report

Description	**Cost (CHF)**
Prototype implementation: personnel cost	3,000
Cost of server maintenance, working facilities	1,000
Total cost	**4,000**

Project funding from ISPRS	3,000
Project co-funding from Austrian Academy of Sciences	1,000
Total project funding	**4,000**

The granted project budget was 3,000 CHF out of 10,000 CHF requested in the application. Such a cut-off resulted in a reduction of the activities that could be developed during the project, though the lower budget could be efficiently exploited to complete the planned activities. The main cost was the salary of a technician dedicated to the development and implementation (Jan Pfeiffer).

The Austrian Academy of Sciences contributed to the project development by granting services for a total cost estimable as 1,000 CHF.