

Final Report

ISPRS Educational and Capacity Building Initiative 2018-2019

Camera Calibration and Performance Database

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Abstract

There is a vast wealth of camera calibration and performance information available in the photogrammetric literature and in project reports by practitioners in the photogrammetric and related disciplines. A huge variety of cameras are being used for mapping and measurement tasks, especially as a consequence of the recent rapid expansion of the use of drones for mapping and inspection. The project has established an online database of camera calibration and performance information which enables anyone interested in camera calibration and performance to both contribute and extract information on cameras. Using online utilities that interrogate the database, anyone with a basic knowledge of photography can evaluate the suitability of cameras for a project or compare the performance of cameras against their own experience.

Report

Progress on the project to January 2020 is summarised as follows:

- The initial design of the camera calibration and performance database was circulated amongst calibration experts in early 2018.
- Many suggestions for amendments and additions were received up to and during the TC II inter-congress symposium at Riva del Garda in June 2018.
- The database design was amended to incorporate all of the feasible changes to the structure.
- The database structure was implemented in November 2018 and has been the subject of several revisions to adapt to these changes, but is now stable.
- The database has been implemented in MySQL on a commercial server and can be accessed directly using a phpMyAdmin interface.
- An initial data set, for the purposes of testing and evaluation, has been populated into the database. This data has been sourced from my own calibration projects and camera calibrations reported in the photogrammetric literature.
- The online, web-based access to the database is 99% complete. Some minor additions to the functionality and corrections for bug fixes remain to be completed.

- The majority of the utility functions (see the list below) have been developed, tested and incorporated.

The following list of [utilities](#) has been implemented:

- Tables and graphs of radial and decentring distortion profiles.
- Computation of the photograph scale at a specified camera to object range.
- Computation of area coverage and ground sample distance (GSD) at a specified camera to object range.
- Computation of the precision of position and height information at a specified range and baseline separation for a stereo-camera system.
- Computation of the precision of 3D information at a specified range, number of camera stations and convergence angle for a photogrammetric network.
- Generation of a simple text file of camera calibration parameters for a specific camera and lens combination that can be adapted for input to a range of photogrammetric applications. This utility includes the options for mm or pixel unit output and the origin at either centre of frame or top left of frame.
- Computation of proportional precision and accuracy.
- Computation of radial distortion coefficients based on a table of values.

The web access, still under development, can be accessed [here](#).

Problems Encountered

Implementation of the database design and web site has been hampered by difficulties in engaging suitable personnel. Commercial website and database design services were either unwilling to accept such a small project or indicated an overall cost well beyond the available budget.

As an alternative, a camera calibration expert offered to design and implement the database. Unfortunately, because of technical difficulties, this option could not proceed and consequently delayed the project by 3-4 months. The developer was unable to make any progress because of server-client access difficulties which were never resolved.

In October 2018 two sessional academics were recruited to the project from the computer science group within the School of Science at RMIT University. They offered to support the project with database and web site development expertise. Because the project is in addition to their research and teaching duties, it was expected that progress with the development work would be slow.

In parallel with the development, a part-time tutor was engaged to do some of the data entry directly into the database, using camera calibration information sourced from reports in journals and conference proceedings.

Progress during the first few months of 2019 was steady but slow. Unfortunately one of the two volunteer academics had a bout of serious illness and was unable to make any progress on the project for 3-4 months. Progress in the second half of 2019 has again been steady but slow.

Current Status

As noted above, the backend database is now stable and the web access is close to completion. The web access developer continues to work on the interface code in a volunteer capacity, incorporating additional functionality, improving the utility of the web access and of course attending to bug fixes as they arise.

The functionality of the web access to the database has far exceeded the original concept for a relatively simple system to enter, edit and search the calibration and performance data. For example, camera and lens information is provided as drop-down lists to assist anyone entering data into the system, and is refined as more information is entered. Users of the system must register and the association between individuals and their entered data is maintained by the system to ensure the integrity of the data. Different levels of access can be specified for users, ranging from guest access to 'superuser' status. Calibration records can include links to online reports or papers, a log or output file of the calibration and a sample image.

The utility functions are fully integrated into the web access. If a user has searched for a specific calibration data set then the data is automatically populated into the utility function. Output from the utility functions include both tabular and graphic information in most cases, and the user has various options for the output information.

Future Development Work

Although the formal phase of the project work has now concluded, development of the web access will continue.

The web access is now very close to the point where camera calibration experts can be invited to test the online access to the database. A simple testing guide will be provided for the experts to search, enter and evaluate camera calibration data, in order to guide their evaluation and feedback.

It is envisaged that this phase of the project will commence in February 2020.

Conclusion

Whilst there is no doubt that progress on this project has been slower than expected, the core development work has now been completed. The database is established and web access has a high level of functionality to enable users to efficiently enter data and search the database. During 2020 the system will be thoroughly tested. A summary of the project will be presented at the ISPRS Congress in Nice in the special session on ISPRS Scientific Initiatives projects and Educational and Capacity Building Initiatives projects.