The Role of Orientation and Calibration in Photogrammetry and Remote Sensing: Preface to the European Calibration and Orientation Workshop - EuroCOW 2025

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ABSTRACT:

This paper is a preface to the European Calibration and Orientation Workshop - EuroCOW 2025, held at the Warsaw University of Technology on 16–18 June 2025. The paper briefly introduces the history of EuroCOW workshops and shows orientation and calibration issues in photogrammetry and remote sensing based on the literature. The first part of the paper is a bibliographic analysis based on queries in the Scopus database, which shows a continuous interest in research activities based on calibration and orientation data, and the impact of those issues on communication channels, including the ISPRS Archives. The second part summarises abstract submissions presented during the workshop, showing their topics. The EuroCOW workshop was revived after a 6-year gap since its last organisation. This branded workshop has been organised by a dedicated working group of ISPRS and supported by EuroSDR for many years. Organisers hope that this activity will be continued in future.

1. INTRODUCTION

For years, EuroCOW has been biennial meetings that intend to bring together world experts from the public and private sectors to present and discuss the recent findings and developments in Sensor Calibration and Orientation.

Pandemics stopped organising this circular event, and separate workshops were organised at independent times and locations during Geospatial Week. Appreciating the narrow topic of the workshop, its unique character and the high level of scientific discussion at EuroCOW over the years, ISPRS officers from WG I/6 decided to reactivate this event with the help of EuroSDR, ISPRS and FIG.

EuroCOW is a specialised scientific conference that has been attracting experts and practitioners in photogrammetry and remote sensing for years, focusing on the issues of sensor calibration and orientation. This event was created as a response to the growing need to exchange knowledge and experience in the field of precise geodetic and photogrammetric methods, especially in the context of integrating multi-sensor systems.

The EuroCOW initiative was initiated by researchers from the International Society for Photogrammetry and Remote Sensing (ISPRS). In the seaside town of Castelldefels near Barcelona, Spain, subsequent editions of the workshop have been held for years, which took the form of an intensive, three-day meeting in an intimate atmosphere. However, the history of EuroCOW goes back to earlier times because EuroCOW is a continuation of the ISPRS workshops from 1995 to 2003, entitled „Integrated Sensor Orientation". From the beginning of the workshop in 2006, the organisation was handled by a team from the Institute of Geomatics. Later, EuroCOW was organised by Centre Tecnològic de Telecomunicacions de Catalunya (CTTC) (2008-2014), and later by GeoNumerics. In 2016, EuroCOW, due to internal matters, was moved and organised in Lausanne. Switzerland. In 2017, EuroCOW was included in the workshop in Hannover, Germany, and in 2019 in Geospatial Week in Enschede, the Netherlands. The pandemic has put the organisation of this conference on hold. Only the resumption of onsite events in the ISPRS calendar in 2022 made it possible to start talks on the working group's plans to reactivate this event. This was not achieved until 2025 in Warsaw.

Since the first edition of EuroCOW, the conference has gained a reputation as an event of a high technical and scientific level. Its main goal is to present the latest research results and exchange practical experiences regarding the calibration of cameras, LiDAR sensors, GNSS/IMU systems and modern UAV platforms. Participants often come with their data or systems to test solutions together and confront them with proposals from other teams.

The conference is a unique combination of the atmosphere of a research workshop and a professional conference event. In contrast to larger, often anonymous congresses, EuroCOW emphasises interactivity, collaboration and openness among scientists and industry representatives.

Thanks to its specialised formula and the organisers' commitment, EuroCOW has become a part of the calendar of international photogrammetric events, remaining a meeting place for those who develop the foundations of sensors assessment, calibration and orientation.

2. BIBLIOMETRIC AND KEYWORDS ANALYSIS

To gain an overview on orientation and calibration techniques in photogrammetric and remote sensing literature, it was examined how often the phrase "orientation" or "calibration" appears in the bibliographic databases together with "photogrammetry" or "remote sensing" and "sensor" or "system". Such a query could allow for finding records related to the topic of the EuroCOW workshop published in the whole scientific community.

There are many bibliographic databases, but only a few allow the discovery of such information through an advanced query. In this analysis Scopus database was used to illustrate how popular these topics are. In the first iteration, 12520 documents were found, but the results were limited to Computer Science, Earth and Planetary Sciences, Engineering, and Environmental Science. The result of the query is shown in Figure 1.

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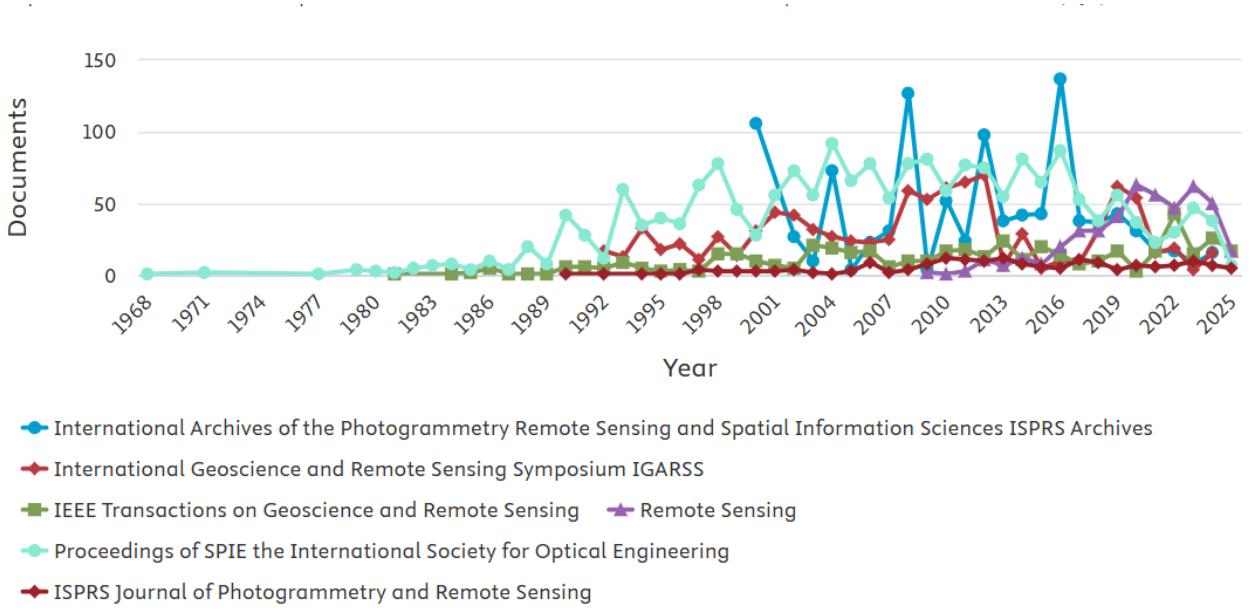

Figure 1. Subject areas of results for query: *(TITLE-ABS-KEY (orientation) OR TITLE-ABS-KEY (calibration)) AND (TITLE-ABS-KEY (photogrammetry) OR TITLE-ABS-KEY (remote AND sensing)) AND (TITLE-ABS-KEY (sensor) OR TITLE-ABS-KEY (system))* in Scopus database showing the most number of publications referring to selected journals and archives

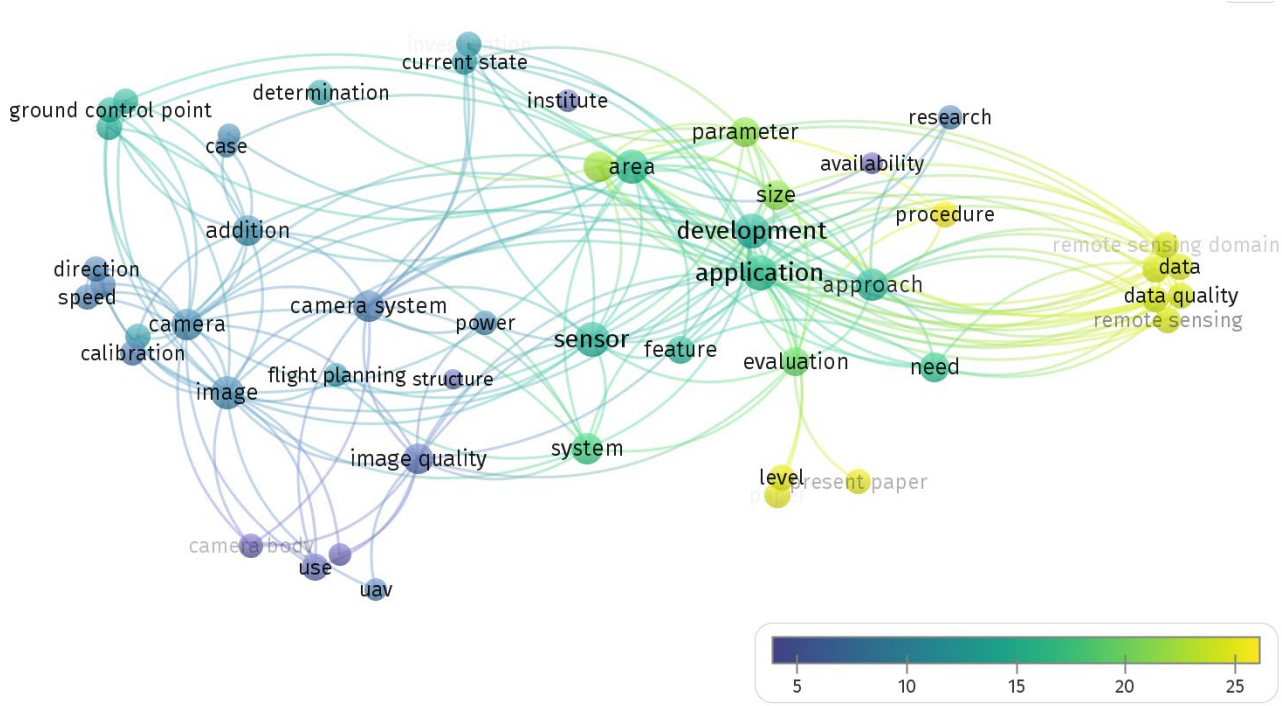

Figure 2. Visualisation in VOSViewer showing keywords and words in abstracts and their relation referring to the number of citations based on a file with a query as shown in Figure 1, limited to ISPRS Archives

In this figure, it can be seen a continuing interest in the calibration and orientation of sensors in photogrammetry and remote sensing. There is also a clear impact of conferences organised by ISPRS, in which the place of publication, ISPRS Archives of Photogrammetry, Remote Sensing and Spatial Information Science, plays a significant role. However, this contribution has decreased somewhat in recent years. There is also a visible interest in the subject of orientation and calibration of photogrammetric sensors in the IEEE and SPIE communities during their conferences and in their journals.

In Figure 2, we can notice the most common keywords and words in the abstract that refer to each other, occurring in papers related to the orientation or calibration of sensors in photogrammetry or remote sensing. We can notice that from one side issues of data collection and mission planning are important here (i.e. flight planning, direction, camera). On the other hand, we have words associated more with sensors and mentioning their size, availability, and parameters. No matter what is more interesting for us when we test or calibrate devices, we must be aware that the quality of our final product is based on those first activities, allowing us to know our measurement system.

3. OVERVIEW OF SUBMITTED ABSTRACTS

A total of 25 papers were submitted to the conference, of which 23 passed the preliminary review process, and 19 full abstracts were finally presented at the workshop. They present a wide range of geoinformatics, photogrammetry and remote sensing topics. The largest group of papers were devoted to photogrammetry and aerial imaging in the field of data acquisition and processing (Remondino et al., 2025, Kostrzewa et al., 2025; Morelli et al., 2025; Jospin et al., 2025). The second strongly represented trend was research with the use of LiDAR technology (Faitli et al., 2025; Pilarska-Mazurek et al., 2025; Pöppl et al., 2025, Rzonca & Twardowski, 2025). There was also an evaluation and comparison of the accuracy of different laser scanning systems, such as DJI Zenmuse L1 i Riegl miniVUX-3, but also low-budget sensors (Będkowski et al., 2025a; Będkowski et al., 2025b; Pilarska-Mazurek et al., 2025); as well as assessing other navigation sensors (Berbel et al., 2025), measuring systems (Daakir & Bettiol, 2025; Núñez-Andrés &. Prades-Valls, 2025).

Calibration and synchronisation of sensors also became an important research issue during EuroCOW 2025. This work concerned both the calibration procedures of industrial cameras Phase One (Ladstädter et al., 2025), self-calibration of fused camera image (Jacobsen, 2025), as well as synchronisation of spherical cameras with 3D lidars (Będkowski et al., 2025b), and calibration of LiDAR data using echo sounder in bathymetric tasks (Gasińska-Kołyszko, 2025).

During the workshop, there were also analyses of imaging data orientation methods and their analysis presented (Vultaggio et al., 2025; Perda et al., 2025). In general, workshop submissions reflect the dynamic development of methods integrating various sources of spatial data and the growing importance of low-cost, easily accessible systems for obtaining geospatial information in environmental, engineering and archaeological applications.

It is also worth noting in the conference program a paper on the status quo in aerial photogrammetry (Remondino et al., 2025), which, just after the keynote speakers, will introduce the conference participants to the state-of-the-art contemporary photogrammetry. The speakers at EuroCOW will be dr. Ismael Colomina (Geonumerics) with presentation entitled “On the 30th anniversary of EuroCOW: where does sensor fusion go?” and prof. Jan Skaloud (EPFL) introducing the topic of “Rigorous approach to bore-sight self calibration in airborne laser scanning - What's new after 20 years? “

3. SUMMARY

This paper was prepared to introduce the background to a joint EuroSDR/ISPRS European Calibration and Orientation Workshop in Remote Sensing (EuroCOW 2025). It also shows how crucial calibration and orientation issues are for the proper application of photogrammetric and remote sensing sensors. This importance has been noticed in a generally constant number of publications on this topic including those presented during previous editions of the EuroCOW workshop and ISPRS Journals.

We hope that this revived conference will return to its place in the EuroCOW and ISPRS calendar and become the platform for collaboration between scientists and industry representatives observing newly developed solutions in calibration and orientation.

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