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CAMPUS DE EXCELENCIA INTERNACIONAL

Review of the PhD thesis

“3D Surveying of Mining Environments using Simultaneous Localization and Mapping”

submitted by Pawel Trybala, Wrocław University of Science and Technology

Supervisors: Jan Blachowski, Fabio Remondino

Main Contributions

The PhD thesis performs an insight into Mining Environments using Mobile Mapping Systems (MMS) and Simultaneous Localization and Mapping (SLAM). The main contribution of the work is the critical assessment of different MMS and SLAM strategies, with special attention to develop and validate a low-cost mobile mapping system and improve open-source SLAM solutions, especially for providing a better adaptation to mining scenarios. The developed methodology and results are evaluated in various scenarios using different reference data which perform as “ground truth” and proved to be effective and precise. The PhD thesis is based on a compendium of articles, some peer-reviewed. In particular, the candidate presents 6 papers, 3 corresponding to indexed journals and 3 corresponding to indexed proceedings at conferences.

Thesis structure

The thesis is divided into two parts, which can be summarized as follows:

Part I

- Chapter 1: it includes the motivation of the research.
- Chapter 2: it presents a vast literature review and covers a wide state-of-the-art of the different SLAM approaches with special attention to mining sites.
- Chapter 3: it highlights the main contributions of the thesis and the list of publications presented.
- Chapter 4: it summarizes the main conclusions, as well as the future works that could be initiated.

Part II

- it reports the scientific contributions with the 6 papers presented and published related with the topic of the thesis.

The work comprises 84 pages for the introduction (Part I) and 94 pages of published articles (Part II). In Part I, the literature review and thesis contributions contain some 220 references making the work an incredible compilation of information for the community.

Critical remarks and recommendations

The thesis is very well done. The introductory part of the thesis proves the deep knowledge of the foundations and current trends in the topic of the dissertation of the author. The work brings for sure contributions and improvements to the state-of-the-art of in SLAM for the mining sector as well as 3D data processing. The impact of the thesis can be foreseen as vast in multiple fields (engineering, mining, heritage, energy, etc.).

As recommendation, it is suggested to investigate the replicability of the processing methodology to other LiDAR sensors or platforms. Furthermore, modern deep learning solutions could be further considered and analysed.

<p>Taking into account the overall assessment of the work, I conclude that the PhD dissertation of Mr Pawel Trybala titled “3D Surveying of Mining Environments using Simultaneous Localization and Mapping” meets the criteria set out in Art 187 item 1 and 2 of the Act of 20th July 2018 Law on Higher Education and Science.</p>



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The doctoral dissertation presented by the PhD Candidate contains general theoretical and practical knowledge for the scientific discipline, including environmental engineering, mining, and energy, as well as the Candidate's ability to conduct scientific research independently.
Therefore, I submit the motion to the relevant scientific council to allow the dissertation for a public defense.

Avila, 29/05/2024

Prof. Dr. Diego Gonzalez-Aguilera

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