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TOWARDS TRANSPARENT AI-SYSTEMS: BENEFITS OF MLOPS PIPELINES FOR SPACE SYSTEM DEVELOPMENT

Abstract

Artificial Intelligence (AI) and Machine Learning (ML) has found its way into different disciplines in the Space Industry. At the moment the biggest research area is within satellite and rover control. Currently, most of the research is still in an early development phase and has not been deployed as productive systems. Prototypes often lack transparency when it comes to the data preparation steps, data versions and model parameters, even though minor modifications in the workflow can lead to major changes in model performance. Especially in prototype phases these changes are often documented manually. These challenges resulted in a novel research area called MLOps. Focused on adjusting DevOps (known as the combination of development and operations in software engineering) principles to the complex requirements of ML. MLOps provides automation and monitoring of all steps of ML system development and deployment. These steps include the integration, testing, release, deployment, and infrastructure management of the system. A big variety of open-source tools are available offering solutions for different workflow stages in MLOps.

So far continuous monitoring and continual learning or efficient logging of experiments in early development phases have not been addressed in the context of AI-based systems within the space industry. In light of the recent aspirations to perform human deep space operations in the near future an increase of smart support systems can be expected. The International Space Station (ISS) and the Gateway function as important testing environments for the systems. Through the use of MLOps developers can increase reproducibility and transparency of their ML models. This work aims to demonstrate and discuss the benefits of using MLOps tools for different workflow stages. By applying a pipeline to telemetry data of Columbus Control Center (COL-CC) we extend MLOps to space applications, promoting its use in future research.