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Author: Ms. Alice Pastor
HE Space, The Netherlands

5 PILOT STUDIES TO ENHANCE ESA HUMAN AND ROBOTIC EXPLORATION LESSONS LEARNED WITH NATURAL LANGUAGE PROCESSING AND KNOWLEDGE GRAPHS

Abstract

For the past 4 years, the Humans and Robotic Exploration (HRE) Directorate of the European Space Agency (ESA) has been collecting knowledge on the management of space projects. Recurring challenges include the efficient production of content, the smooth access to the accumulated knowledge, as well as its increased re-use. This mostly non-technical content consists of Lessons Learned (LL) from various HRE projects, clustered by themes on a Knowledge Portal. For this study, we have identified 5 promising applications of AI-based methods to enhance our LL process. The first three pilot studies target time-consuming tasks usually done manually, thus alleviating the workload of the Knowledge Management (KM) team:

- **Pilot 1: the automatic generation of lessons learned from interview transcripts.**
- **Pilot 2: the automatic generation of key recommendations and checklists** by topic from a collection of lessons.
- **Pilot 3**: a systematic **trend analysis** to identify the common challenges faced by the HRE projects, highlighting the main pain points to tackle within the projects.

The last two pilot studies would take KM benefits to the next level, ensuring that the right knowledge is provided at the right time to the right person:

- **Pilot 4**: the identification of the project development phase(s) the lesson is referring to or will impact. This use case is critical as this would help to **better spot when the decision-makers and experts should be made aware of the lessons.**
- **Pilot 5**: the creation of a **Knowledge Graph (KG)** would reveal unexpected connections and insights from the lessons learned due to their complexity and often unexploited metadata. Combined with Pilot 4 it could be a very powerful tool and entry point to explore the available knowledge.

For each of these pilots, the methods used, e.g., Topic Modelling and Language Models such as OpenAI GPT-3 or BLOOM, will be detailed, and preliminary results presented. These results will help us assess the feasibility and relevance of the 5 pilot studies. In parallel, a survey among the various stakeholders will help us identify which pilots would bring the most added value and will be worth developing further with the support of ESA.