WHITE PAPER

Rapid, Accurate and Traceable Detection of Changes in Information Critical to Industrial Operations

Riza C. Berkan, Babür Özden, David Kuhn

1A1 Inc., R&D Division,
220 Front St. New York, NY, 10038, USA
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Abstract

This paper outlines the recent applied science, research and development work conducted at 1A1 Inc. The resultant novel software product, 1A1 Tool, automates (1) extraction of knowledge from complex industrial documents, (2) detection of changes in parameters critical to operations, workflows, procedures, and safety regulations, and (3) reporting of the changes for downstream applications. 1A1 Tool is entirely based on deterministic AI which is not generative and does not use LLMs. 1A1 Tool as a solution is comprised of automated layers of PDF format resolution, document layout analysis, entity extraction, knowledge formation, information change detection, and reporting. The AI technology underlying 1A1 Tool is fully traceable as the inner workings of each layer are transparent and traceable. The computational footprint of 1A1 Tool is orders of magnitude smaller than that of generative or LLM-based AI approaches. In our benchmark study measuring the efficacy of 1A1 Tool, publicly available aviation documents and well-established industrial workflows were used in human-conducted tests. The success rate was over 98% for 1A1 Tool. Further, 1A1 Tool may reduce by a factor of 7,000 the study and labor costs involved in detecting, verifying, and reporting changes to industrial documents with minimal computational expenditure and a miniscule carbon footprint.

1. Introduction

Most industrial documents are published as PDFs with complex format and layout structures, then revised multiple times per year and subsequently re-published. Such PDFs contain information critical to operations, procedures, workflows, engineering, maintenance, inspections, repairs, emergencies, safety, logistics, compliance, regulations, etc. Content from PDF documents needs to be extracted correctly and migrated to relational databases for downstream applications. Although laborious, it is easy for subject matter experts (humans) to read and understand such content, albeit replete with the expected human errors. It poses a significant challenge for computers to do the same, that is, to accomplish formation and migration of knowledge from data in documents. This is a well-known problem across industries such as aviation, power generation, oil & gas, transportation, logistics, construction, law, and engineering. There is no clear solution to date, and this is the problem we seek to solve.

The complexity of the problem emerges from the involvement of multiple disciplines, each of which are generalist and not specialized for knowledge extraction from industrial PDF documents. For example, the format resolution of a PDF file is the subject of Optical Character Recognition (OCR).

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