4 AI Service in Module 4
in the Service Life Cycle:
On-site processing

SERVICE MEISTER

VISUAL RECOGNITION OF KROHNE PRODUCTS AND INTELLIGENT SEARCH FOR RELEVANT DOCUMENTS

Through a visual recognition of technical devices in combination with an intelligent search, documents relevant for maintenance and repair can be found and provided quickly and efficiently. This shortens maintenance intervals and reduces costs.

The maintenance of technical equipment by service technicians poses many different challenges. Defects are not obvious at first glance, the correct manual is not immediately available for many different devices from one or more manufacturers, or maintenance reports on similar devices that have already been repaired are not clearly structured (if available). This leads to delays in repairs and maintenance work and thus to increased costs due to operational downtime. An intelligent search on different data sources can shorten maintenance intervals and reduce costs.

FOR THE FOLLOWING CHALLENGES
- Quick retrieval of maintenance reports and manuals
- Usability of historical maintenance information
- Intelligent search on text and image information
- Shortening of maintenance intervals
- Reduction of service costs

THE USE CASE
Nowadays, service technicians often look after a large number of different technical devices from one or more manufacturers. In the event of specific defects or as part of periodic maintenance intervals, they are therefore always dependent on further information from the relevant device manuals. Furthermore, information from maintenance reports with similar error patterns can also provide information on the repairs to be carried out.

Until now, maintenance reports and manuals have often only been available in formats that are difficult to automate and search specifically, for example as PDFs.

The conversion of these available formats into a structured, machine-readable form enables the use of intelligent search algorithms for the service technician. For example, a photo taken with a smartphone can be used to automatically determine and return the correct manual for a device as well as the page relevant to the image content. With the help of synonym or keyword searches using NLP models, relevant content can be extracted from maintenance reports and displayed to the technician.

In this way, relevant information for the maintenance and repair of a device can be determined quickly and efficiently. Maintenance intervals are shortened and costs are saved.

THE SOLUTION IN DETAIL
With the help of a web crawler, relevant content (for example, KROHNE manuals and maintenance reports) is automatically downloaded and then stored in structured, machine-readable form. Vector embeddings are extracted from image information, which are mapped to associated textual information.

In the context of visual search, associated vector embeddings can also be calculated for new images of technical devices. The similarity of these vectors to the information available in the database can be determined using distance comparisons. Thus, documents with the highest similarity to a provided image can be determined and returned.

The intelligent search enables the retrieval of relevant manuals based on NLP-supported search models as well as on keyword search and synonym search.

In this way, important information can be determined easily and quickly. By making this available to the service technician, for example via app or website, information relevant to maintenance is immediately available and work can be carried out quickly and efficiently.

PROJECT STATUS
There is a service for visual search as well as for intelligent, text-based search. Both are currently being evaluated and improved and can be used via a website. Work is also underway on a barrier-free front end that can also be used via an app.

REQUIREMENTS
- Content to be searched is already available in structured, machine-readable form or can be automatically crawled and transformed accordingly.
- A cloud infrastructure exists that provides the resources for the models and algorithms needed for search.

AVAILABILITY
Trained models and information on the developed infrastructure are available upon request and can be customised for the given use case.

CONTACT PERSONS:
- **Dr. Robert Pesch (inovex, rpesch@inovex.de)**
- **Dr. Martin Krawczyk-Becker (KROHNE Messtechnik, M.Krawczyk-Becker@KROHNE.com)**

SPECIFICATION

	Input data	Preprocessing	Data storage	Algorithms	Interfaces
High-level description	Manuals and other relevant technical documents	Extraction of images, text, tables, etc. from documents and conversion into a machine-readable format	Storage in NoSQL database	CNN	Web interface with interactive search
Configurability	Source location (e.g., website)	What kind of documents and language		Possibly model parameters	Presentation of the results
Technical implementation	Web crawler for downloading all relevant documents	Python script executed via GitLab CI in Kubernetes cluster	Elasticsearch	Python script executed via GitLab CI in Kubernetes cluster	React web application with Rasa Webchat
Specific example from the speedboat project	Download all manuals, certificates, quick start guides and other PDF documents from the KROHNE website for all devices	Complex workflow for extracting information from PDF documents (incl. logical document structure recognition)	PDF documents are transformed into a JSON structure with machine-readable content and persisted in Elasticsearch	Recognition of KROHNE devices (components) on images and retrieval of relevant documentation	Search page for uploading images and displaying results incl. chatbot with dialog tree

CONTACT PERSONS
- **Dr. Robert Pesch (inovex, rpesch@inovex.de)**
- **Dr. Martin Krawczyk-Becker (KROHNE Messtechnik, M.Krawczyk-Becker@KROHNE.com)**