PRISMA

Symbolic artificial intelligence – the coach for tailored training on the job

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A new dimension of knowledge.

Dramatic headlines like "Digitalization and AI will steal our jobs" are being used time and again to illustrate the profound impact that digitalization and automation are having on the world of work. Yet the changes they are introducing are affecting more than just simple jobs and routine tasks – they are also changing the face of numerous research activities that are highly analytical in nature and can be automated using AI approaches.

The result of this is that the jobs remaining in automated processes or the maintenance of digitalized products are becoming more flexible and more challenging.

The ever-increasing pace of change is also making it necessary for workers to learn new skills on a regular basis. In short, employees need to become "continuously learning professionals" [1].

KI – "for me"

The fact that knowledge quickly becomes out of date once learned and that routine is difficult to build on means that, in the future, people will be more reliant than ever on information and assistance. Yet the classic approach of giving staff thorough training and helping them with handbooks, manuals and instructions has already reached its limits: On the one hand, documentation is frequently ignored because it takes too long to search through. On the other, work instructions are often aimed at a company's least experienced staff and more seasoned professionals have trouble finding the information they need amongst all the details.

How can companies help their employees in a way that is user-friendly and makes them more productive at the same time? Many people think the solution lies in new forms of communication such as animated instruction videos, augmented reality and voice assistants. It has been proven that media such as these improve the learning experience, as well as the efficiency and quality of the work itself [2].

These attractive methods do not solve the problem of information overload, however – regardless of the medium, information needs to be situational, application-specific, tailored to the employee's capabilities and imparted without "unproductive" searching time.

The following example illustrates how these goals can be achieved using concepts from artificial intelligence.

Using AI to make sense of compliance issues

In a large multinational company, the instructions and guidelines governing financial processes run for thousands of pages and apply to several hundred thousand staff. The sheer number of guidelines makes it impossible to ensure that everyone has read and understood them, let alone applied them correctly in practice. Although specialists are on hand to answer any questions, there are simply not enough of them and much of their time is taken up with administering the guidelines in the first place.

This puts the company in a dangerous situation because the risk of non-compliance increases if these guidelines are not followed to the letter, which could be tremendously damaging and trigger a loss of confidence on the market. Even seemingly small mistakes can cause accounting errors that quickly

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necessitate high back payments of tax when they are made multiple times.

The logical conclusion of this is that guidelines can only be used productively and followed ("compliance") if their content is streamlined in a personalized way, i.e. users are only shown the information they need for their particular business case.

The search for the perfect solution

An agile project team comprising end users, compliance experts, IT professionals and AI specialists tested different solutions for displaying tailored information effectively. They evaluated the following alternatives:

Decision trees and intelligent chatbots?
Too time-consuming.

The first approach the team took was to analyze catering requests and procurement orders to find out which parameters the guidelines to be applied depend on (e.g. catering for internal staff vs "mixed catering" for internal and external people).

They used this analysis to create decision trees for determining which guidelines were relevant for each combination of parameters. This entailed asking the end users lots of questions until a business case was ascertained in sufficient detail. To reduce the number of questions, an AI system was trained using machine learning of "solved" business cases and chatbots were linked to it.

The quality of the suggestions was well below 100%, however, and critical for a regulated process. Furthermore, maintaining the decision trees proved to be too time-consuming and the AI system had to be retrained every time the decision trees were changed in order to update the logic it had learned.

Metadata and machine learning?
Too complicated.

The project team's second method consisted of breaking the guidelines down into components and saving them as metadata in Excel along with usage parameters (e.g. "mixed catering"). The parameters could be queried to filter out the applicable guidelines.

The approach was tested using a production-release pilot system (MVP: "Minimum Viable Product") and real-life business cases. As in the first method, machine learning in conjunction with a chatbot was used here too.

Although the MVP enabled more case data to be gathered for machine learning purposes, the results were still less than satisfactory, in that creating, managing and validating the metadata and the interdependencies was extremely complicated. Moreover, it was not possible to copy the guidelines from Excel to the required PDF publications.

Semantic information?
A success!

The project team therefore began looking for a way to explicitly model the relationships not only between the guidelines and business case parameters but between the guidelines themselves. When conducting their research, the project team came across the artificial intelligence knowledge representation technique, which uses "knowledge graphs" to define concepts and their interrelations with the help of ontologies. For example, a service is a business case with the roles of a recipient and a provider.

Contexts that define the scope of a guideline can also be defined. There is "mixed catering", for instance, when the service provider is an employee and the recipients are both employees and external staff.

In contrast to the "flat" metadata approach, this makes it possible to define complex areas of validity and spheres of application for guidelines. The unmanageable array of business cases and parameters is reduced to a manageable number of semantically defined concepts, which are then used to characterize a current business case and ascertain which guidelines apply.

Knowledge graphs – an intelligent way to represent knowledge

This approach was put into practice using the PRISMA platform and an information model based on knowledge graphs developed by the STAR Group.

Knowledge graphs were originally created to represent the meaning of spoken statements, which makes them ideal for depicting knowledge objects and the relationships between them. This means knowledge graphs are often used in intelligent assistants, chatbots and voice assistants.

Using this information model now enables all the guidelines relevant to a business case to be prepared and displayed. Instead of having to sift through thousands of pages, end users only see the small amount of content that is actually relevant to what they are doing. The correct workflow for processing the business case, such as details of what needs to be approved by whom, can be specified as well.

A second stage in the development process will see machine learning used to translate users' speech into knowledge graph concepts, which will enable chatbots and voice assistants to be turned into virtual guideline experts: In the future, users will simply be able to describe the business case using everyday language rather than define it via a question-and-answer process.

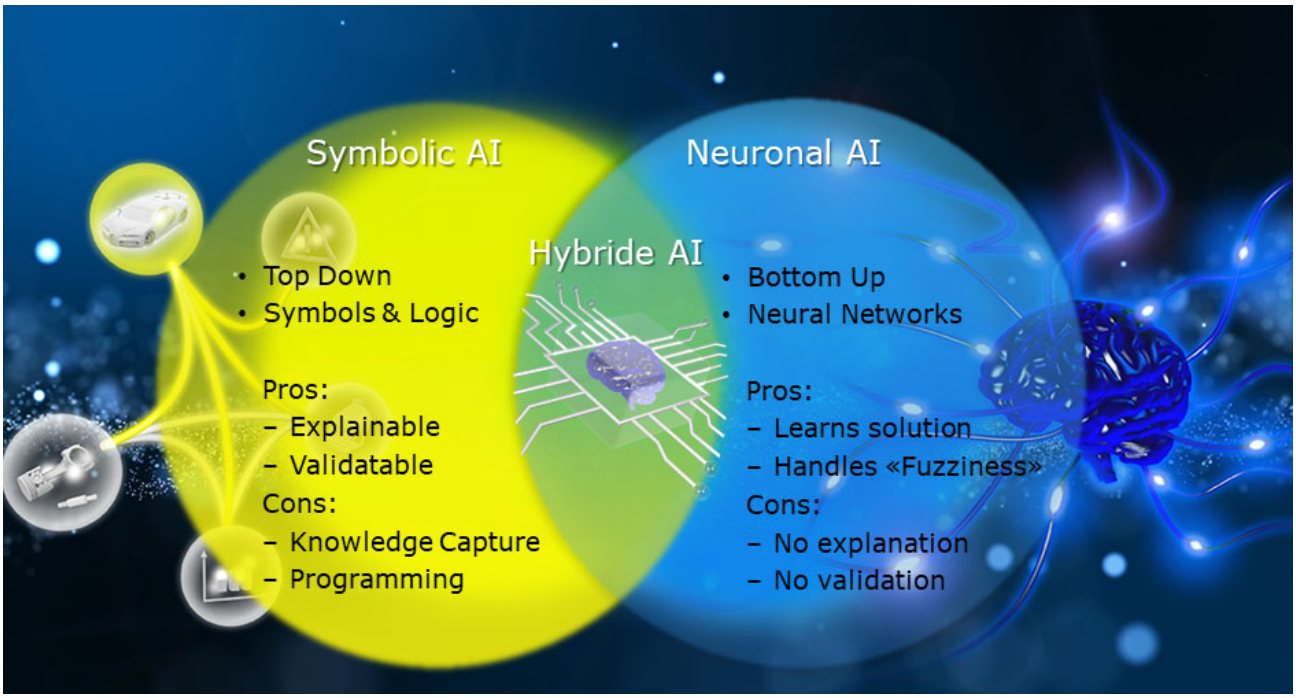
Limits of neural AI for regulated processes

When the use of AI is spoken about in the media or at conferences, it is usually in terms of neural AI, machine learning, deep learning and other similar concepts that enable patterns and formulas to be extracted from large volumes of data without the need for complicated and time-consuming programming.

Yet although this approach works for a great many tasks, it does not work for all of them because there are no explicit rules or interrelations, meaning that the results and suggestions put forward by such systems are extremely difficult to interpret. It is also rarely possible to validate these systems 100% – all that can be done is to take a high number of successfully resolved representative test cases as an indicator of learning success.

Symbolic AI as a validatable alternative

This is why neural AI cannot be used in highly regulated processes and application areas. This is where the combination with symbolic AI comes in: Unlike neural AI, symbolic AI is based on rational-logical thinking and the human ability to apply symbols using rules. Examples from real life include written language and logical conclusions. Symbolic AI offers suggestions that are easy to understand and can be validated and communicated – but it does require programming work.



Focus on users: Agile development of smart services

Rational conclusions and understandable suggestions also form the basis of useful smart services that support routine tasks in an automated way. Known as "microservices", they can be integrated into comprehensive digitalization solutions and existing systems as modules.

In addition to helping with regulated processes as detailed above, smart services ease the load on employees in a technical environment too. With its sophisticated knowledge graph models, the PRISMA smart service solution, for instance, offers user-centered AI to help with various different after-sales scenarios. The specifics have already been described in detail in DIGITUS [4], but a few examples include:

- Calculating costs and times for personalized activities and resources
- Checking spare parts and consumable materials against stocks
- Creating an adaptive diagnostics tree based on error frequencies
- Generating a maintenance schedule for a custom-configured product
- Updating product/maintenance histories

This enables personalized AI-assisted help services for customers and employees to be created agilely, rolled out quickly and continuously adapted to meet new business requirements.

Summary

The classic approach of giving staff extensive documentation to help them with their work has had its day and is not suitable for a digitalized world. Searching through documents, files and instructions is time-consuming and unproductive; such materials are usually aimed at inexperienced users and the deluge of information leads to mistakes and misunderstandings.

User-focused assistance services provide a workable new solution by eliminating the need for searching, providing the exact content required and tailoring information to the user's knowledge, skills and experience. Automated smart service modules also relieve users of routine tasks. This makes user-orientated assistance services an excellent tool for digitalizing workflows and incorporating employees into digitalized processes.

References

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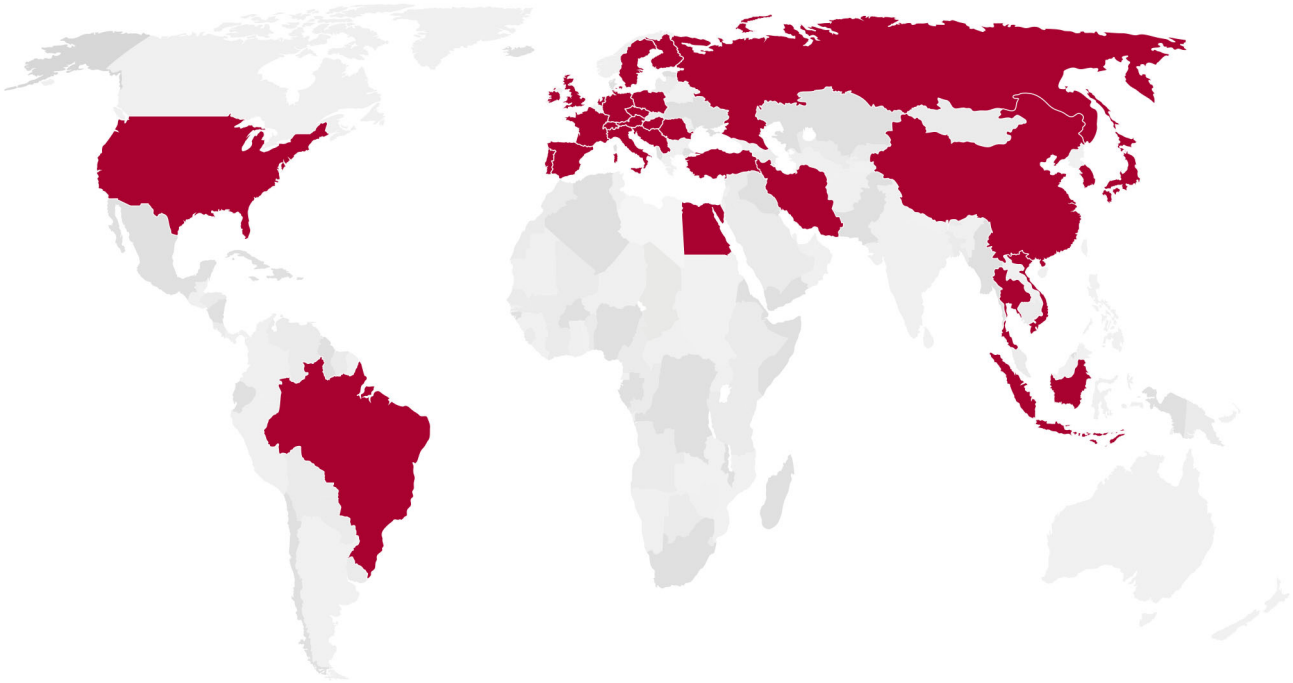

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