

## The SPELL Platform

Germany has one central number for medical emergency services and for the fire brigade, the 112. This number, when called, automatically connects to the closest control center. If a person calls on a landline, the routing isn't hard, since the position is fixed. When using a cell phone however, the cell tower to which the phone is connected to, routes the caller to its nearest control center. When a person is in the middle of two towers, that would route to a different center, it is possible that they are connected to the wrong tower and call the wrong center. This won't always be a problem, but if the person calling connects to a center of a different state, communication can cause problems. Since Germany is federally organized, the sixteen states can individually decide how they organize their emergency responses. This leads to different software used in different control centers (this can even happen in a single state, if centers are managed by different organizations). Most of the commonly used software is unable to communicate between the vendor barriers and forces control centers to either make expensive contracts with all vendors or to buy new software and retrain the personnel working with it. Most of the time the centers simply call each other. Commonly a control center has direct phone numbers of the centers directly near them, so they can call them to exchange information. Larger industrial sites in Germany also have their own fire

stations and rescue services. Communication with their control centers is only possible via telephone, fax or email. The systems are not compatible and no information can be exchanged via the control center systems. The police and rescue services are also strictly separated, and the same applies to the crisis teams of the federal states or local authorities; there has been no possibility of exchanging information with each other or with the control center. Our platform solves this problem.

The German Red Cross Rhineland-Palatinate takes part in the research project "SPELL" which is a semantic platform for intelligent decision and operations support in control and situation centers (translated from German: Semantische Plattform zu intelligenten Entscheidungs- und Einsatzunterstützung in Leitstellen und Lagezentren). The Project aims to connect control centers across Germany for easy data transfer. Additionally, it provides the base for AI services running on the platform, while consuming and producing data. This helps the control centers, which are currently isolated from the outside world and need to communicate via telephone calls to exchange dispatching information. It also expands the capabilities of the dispatchers by providing support through AI. As the German Red Cross, we are significantly involved in the design, development and implementation of the products and platforms that have been created and are in the pipeline, together with our own experts from IT, emergency medicine and disaster control. Using a knowledge graph created through expertise that the Red Cross provided the project partners, different

AI services can suggest possible diagnoses and what type of vehicle and crew would fit them best. Other services then can use weather, traffic and historical data to calculate efficient routes. Another service is the live translation of foreign languages, highlighting special key terms that indicate a possible illness or vital threat, for example. In the area of crisis teams, the connected AI services can also make predictions about the direction and speed of spread of hazardous material clouds, for example, and can quickly process the large amounts of data generated in order to relieve the burden on staff.

These services are created with the dispatcher in mind. They aren't supposed to replace them, but rather to optionally enhance their workflow.

The center of the platform is constantly changing knowledge graph, which contains definitions for various sicknesses, possible diagnoses, regulations for scenarios, but also what type of vehicles exist, what type of equipment they carry and what crew members usually are on the vehicle. Based on this graph symbolic Artificial Intelligence can then build logic chains to arrive at their result. Most AI services currently developed employ symbolic AI, which mostly use information out of the platform. However, the platform aims to be expandable for new AI services, which can either also use the knowledge graph or be standalone. These services can be developed by people outside of the project consortium.

Using a knowledge graph as a base for the services ensures reliability. Since all knowled-

ge in the graph is backed by either specific regulations followed by paramedics or fire-fighters or historical knowledge by experts, the AI produces logical suggestions, that can in the last instance still be vetoed by a human. No service can cause decisions on its own and always requires human verification, before any action is taken.

Services that don't use the knowledge graph and employ machine learning algorithms that enables them to learn in real time, come with the specific governance. Thus, a service that identifies EU regulated plaques that identify Carriage of Dangerous Goods has an "uncertainty wrapper", which quantifies output of the image recognition service as a percentage of certainty, that the identified plaque was interpreted correctly.

Third party services developed outside of the consortium need to follow a narrow rulebook on service safety and security. The consortium will then verify that the service is reliable enough to be employed on platforms.

The platform is designed and created in accordance with the European standard "GAIA-X", which aims to implement regulation by the European Union. GAIA-X aims to create a digital governance where users stay in control of their data. This helps to employ EU data privacy laws, while keeping the processes transparent and open, but secure. This is especially important, since the data in the platform contains highly sensitive medical data.

To ensure that control centers can navigate every situation, the SPELL Platform is running

as multiple instances, where each center has their own instance running on their personal server. The platform then connects with the other instances enabling communication, while AI services remain operational if the network connection fails. Every control center has their own emergency generator, thus keeping the platform instance alive in any case of blackout. If the platform itself fails, operability is still guaranteed, since the platform does not replace current software for dispatching, but instead connects to it. Thereby only the data transfer and AI services won't work if the platform fails, but the "traditional" dispatching as it is done now, will not be affected.

Operating the AI on a knowledge graph avoids the problem that generative AI faces with biases. Since there is no large amount of training data, but rather logical connections are made, the AI cannot replicate bias in the training data. However, it can still show bias encoded in the German health system that is mirrored in the knowledge graph. Since the information in the graph is based on regulations, the bias cannot be migrated and will be employed until the healthcare system in Germany recognizes these biases and fixes them collectively. The platform can reproduce health biases against non-white and/or disabled people. However, it should be noted that the emergency system in Germany mostly ensures a patient's stability until they can be handed over to a hospital, where the patients are treated and diagnose more in detail. This means most biases that show up during special diagnosis and treatment can be avoided. The AI mostly judges if a doctor is needed or

a paramedic suffices, it will not make a final diagnosis on which patients will be treated.

Since the project is still running, the impacts have not yet been researched, but almost every dispatcher that gets presented with SPELL returns positive feedback. Additionally, research conducted during the project shows that some AI services in SPELL can improve the arrival time of ambulances, which saves time, money and most importantly lives.

In the future, artificial intelligence will continue to expand and more and more information (personal sensors, smartwatches, electronic data) will be available. Humans, i.e. dispatchers in control centres, will no longer be able to process all this information. Artificial intelligence will make a valuable contribution here and, with the connection to our platform directly to the control centre systems and the control centre systems to each other, will make an important contribution to making the work in the German rescue service more effective and thus saving lives.