FOURTH - IR
APPLIED INTELLIGENCE

Using AI to derive insights from healthcare-acquired infection (HAI) Case Records

4th-IR used Natural Language Processing to analyze over 100 HAI cases and IBM Watson technology to understand the unstructured and structured information embedded in the HAI reports. The 4th-IR team collaborated with a hospital in the Midwest and an established company in the hospital construction & safeguarding segment in the USA.

Company Info:

Name: Medical Center

Location: Michigan, USA

Industry: Healthcare

Challenge

A healthcare-acquired infection (HAI), also known as a nosocomial infection, is an infection that is acquired in a hospital or other healthcare facility. In the United States, the Centers for Disease Control and Prevention estimate roughly 1.7 million hospital-associated infections, from all types of microorganisms, including bacteria and fungi combined, cause or contribute to 99,000 deaths each year. Nosocomial infections can cause severe pneumonia and infections of the urinary tract, bloodstream and other parts of the body. Many types display antimicrobial resistance, which can complicate treatment.

Solution

4th-IR analyzed over 100 HAI cases against several IBM Watson corpora of knowledge specifically trained for this purpose. The resulting information was combined with a limited set of structured hospital information to find the potential source of pathogens leading to HAI cases.

Specific Benefits for the medical institution

- **Life-saving adjustments**

Reduction of physical space defects that lead to HAI cases

Accelerated remediation of existing defects

- **Cost Reduction**

Preventive, targeted maintenance vs big interventions

Performance-based fines reduced

- **Quality Improvement**

Patients' length of stay reduced

- **Innovation**

Existing data assets used in new ways

Viewing the medical facility through a new lens

Microscopes are used to look at pathogens on a different scale. An MRI is used to look deep into the human body without physical trauma. Artificial Intelligence can be used in the same way to look at existing documentation in a different way. 4th-IR's solution allows medical facilities to look at their floor map with an understanding of how it relates to the documented HAI cases.

HAI Case Reports in Context

HAI Case Reports are full of information gathered by multiple departments. Much of the information is structured, however it lacks quality. By using IBM Watson's Natural Language Processing (NLP) capabilities, the team was able to cut through the ambiguity by creating a concept space; thereby normalizing the language used in the reports. To do so, 4th-IR and its partners trained two corpora. One by processing over 10,000 articles on HAI prevention research, and one by analyzing nearly 3000 documents on how to manage the containment of infections in hospital facilities.

Spatial context was added by digitizing hospital floor plans and adding the physical movement of patients for radiology exams.

> **"You can't just look at what happens in the OP, you have to understand what maintenance is doing as well."**
> **– Facility Manager**

Analyzing the Connections

By using AI to upload all the information, documents, articles, cases, and their connections in a Graph database, the 4th-IR team was able to query and analyze the linkages and create causation between a HAI case and a potential physical location.

Seeing every new case in the context of all other past cases

The past may contain the answers to today's instance of a HAI. By looking at each case through the lens of insights gained from processing these past events, future re-occurrence can be avoided.

Knowledge-based prevention

Combining NLP with Graph Databases and the emerging Block Chain technology, will enable healthcare operators to establish a clear chain of evidence in each instance of an infection. This knowledge will be the first step towards prevention.

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