cortical.io

SEMANTIC SUPERCOMPUTING

The Next Generation of Natural Language Understanding

Vienna, November 2019

THE UNSTRUCTURED DATA CRUSH

The world created an astounding 33 zettabytes of data in 2018.[1] To put that number into perspective, if you were to burn all of the information created last year onto 50-gigabyte Blu-ray discs, you would need to invest in 660 Billion of them.

This data onslaught presents tremendous opportunities, as well as challenges. According to projections from IDC, 80 percent of worldwide data will be unstructured by 2025.[2] Examples of unstructured formats include real-time streaming data from IoT "smart" devices, search engine queries, geographic data, documents, emails, images, and videos.

There is tremendous value trapped inside all this unstructured data, but most businesses aren't able to realize it. As the amount of data continues to grow, it becomes more difficult, time-consuming, and expensive to make sense of it all. The upside is that organizations that can figure out a way to properly collect, synthesize, and use unstructured data can improve their bottom lines, reduce costs, and respond quickly to changing market and customer sentiment.

EXTRACTING VALUE FROM UNSTRUCTURED DATA

To date, however, organizations have found it difficult to harness the full value embedded in unstructured data for several reasons. Computers were initially designed to process transactional, structured data, but that type of information represents a dwindling percentage of all the data being generated today.

Unstructured information is typically text-heavy, although it may contain data such as dates and numbers as well. This results in irregularities and ambiguities that make it difficult to analyze using traditional programs, compared to data stored in database fields or semantically tagged in documents.

[1] https://www.statista.com/chart/17723/the-data-created-last-year-is-equal-to/

[2] https://solutionsreview.com/data-management/80-percent-of-your-data-will-be-unstructured-in-five-years/

Most current technologies for understanding text-based data, commonly referred to as Natural Language Processing (NLP), rely on statistical modeling. These approaches involve building large-scale statistical models that are trained through machine learning (ML) using massive amounts of training data. In many instances, sufficient amounts of training data are not readily available. The process is slow, costly, and complex, involving data preparation, stacking, ontology evaluation, classification, segmentation, and indexing. Even if more data is thrown at the model so it can become more accurate, there is still about 20 percent of text-based information that the model cannot precisely identify and analyze.

However, imagine the possibilities if your organization had a solution for analyzing complex, unstructured information with a fraction of the training data, much higher accuracy, and extreme efficiency. With this type of solution, you could quickly and easily in real time:

- **Analyze social media feeds** at scale to pinpoint hate speech, negative customer sentiment, or fake news and take steps to mitigate it.
- **Collect, consolidate, and analyze customer feedback** to spot trends, maximize satisfaction, and capitalize on opportunities.
- Automatically **analyze, classify, and route emails** and messages to filter and classify customer messages and send them to the appropriate individuals, or prevent sensitive intellectual property from leaving the organization.
- **Pick out precise, relevant information from** hundreds of thousands of your company's **customer support documents**—previously solved support cases, user forum posts, technical manuals, and other related knowledge sources—and put that information at the fingertips of your support personnel, for quick, accurate responses to customer requests.
- **Dissect contracts** and other legal business documents in minutes to drastically increase contract management efficiency, while bringing cost savings to your legal department.

ENTER SEMANTIC SUPERCOMPUTING

These and other business challenges can be addressed in real time through Semantic Supercomputing, a powerful solution that combines Semantic Folding, an innovative approach to Natural Language Understanding (NLU), with hardware acceleration to process and analyze natural language. Semantic Folding is a procedure for encoding the semantics of natural language text in a sparse distributed representation called a semantic fingerprint. This unique approach provides a framework for analyzing unstructured data based on how the human brain processes language data. The technique can be applied not only to single words, but also to sentences, paragraphs, books, collections, or entire libraries.

Semantic Folding is inspired by and based on the principles of cerebral processing and neuroscience. By applying neuroscience tenets discovered by scientist and author Jeff Hawkins to the realm of NLU, Cortical.io can identify and analyze language faster and more accurately.

Semantic Folding is distinct in several ways from statistics-driven, ML approaches. Instead of building a statistical model and training it using data and ML over time, a Semantic Folding solution is trained up-front on the data it needs to process using reference information. For example, if the system needs to analyze oil and gas information, it is trained in an unsupervised way using a collection of textbooks, manuals, and other materials on petrochemistry, oil drilling techniques, and geology. Once the system has ingested the information and is trained, it produces the semantic fingerprints.

Using Semantic Folding, an artificial intelligence (AI)-driven algorithm can quickly determine the meaning of the text under analysis. The result is an intelligent, efficient way to process and analyze text so organizations can tap the value of unstructured data that exists in social posts, emails, customer support information, contracts, or any other type of text-based data. Cortical.io is already using this approach with several large enterprises, helping them solve NLU challenges involving meaning-based filtering of terabytes of unstructured text data. Detailed technical information on Semantic Folding can be found here.

SEMANTIC FOLDING + HARDWARE ACCELERATION = SEMANTIC SUPERCOMPUTING

As the body of knowledge being analyzed grows, hardware acceleration provides orders of magnitude performance improvement. This is the idea driving Semantic Supercomputing. By implementing Cortical.io's AI-based Semantic Folding technology with hardware acceleration, organizations can process streams of natural language content at massive scale in real time. Cortical.io's Semantic Supercomputing solution uses Xilinx FPGA-based Alveo Accelerator cards, which are well suited to Cortical.io's Semantic Folding algorithms and can speed up operations by orders of magnitudes. Results are delivered quickly—without the need for humans to complete tedious, repetitive cognitive tasks. And, Cortical.io's solutions work with and across any language.

Cortical.io's first Semantic Supercomputing-based solution, delivered in partnership with Xilinx, Inc. and Super Micro, is an appliance that can filter, classify, and route streams of messages in real time at a massive scale by understanding the semantic content—the meaning and intent of the messages. The new Semantic Supercomputing solution is delivered as an appliance, with pre-configured hardware preloaded with Cortical.io software that can be integrated with an enterprise's IT infrastructure through REST APIs.

The next planned Semantic Supercomputing appliance will offer rich search functionality. It will be capable of discovery search across large collections of social media profiles and topics, as well as legal documents. Message filtering and routing and search across massive bodies of text are just the first two use cases. The goal is to make possible the broad implementation and deployment of AI solutions for automating business processes and solving the most challenging use cases that depend on human understanding, decision making, and execution.

CONCLUSION

In a world where the economy is increasingly digitized and interactions happen using unstructured data, understanding natural language has become increasingly important. Because of the exponential growth of text data, enterprises need to shift from analyzing numeric data towards understanding textual information. They also need to automate repetitive cognitive tasks to improve productivity and profitability. The industry's current NLP solutions are not efficient or sufficiently accurate. The ability to filter terabytes of unstructured text data at scale in real time is quickly becoming a competitive imperative. This is where Cortical.io and Semantic Supercomputing come into play.

For more information about Semantic Supercomputing and Cortical.io, visit www.cortical.io or contact info@cortical.io.