An aerial photograph showing a large container ship with a white hull and a deck covered in colorful shipping containers (red, blue, green, orange, and white). The ship is positioned above a multi-lane highway bridge. Two semi-trucks are visible on the bridge: a green one on the left and a white one on the right. The background is a deep blue sea.

How natural language
processing (NLP)
can be used to build
supply chain resiliency



Building a better
working world

CONTENTS

- 3 Why existing supply chain strategies fall short during a crisis
- 4 Understanding natural language processing
- 6 How supply chain organizations can benefit from the use of NLP
- 7 Case study: how the EY team helped deploy NLP

Why existing supply chain strategies fall short during a crisis

Supply chain organizations are getting smarter in using internal data to optimize their networks, improve customer satisfaction and reduce costs. However, with the onset of COVID-19 in early 2020, it is clear that most supply chain organizations are not yet resilient enough.

Supply chains came across unprecedented challenges such as shortages of raw materials, unplanned operational shutdowns, labor shortages, delays in transportation, and a sudden rise or fall in demand. This caused major supply chain disruptions, which had a cascading effect. Products such as toilet paper, bread makers and home exercise equipment saw a sudden spike in demand, in some cases by as much as 600%. This resulted in temporary shortages for these products. At the same time, the demand for gasoline plunged due to a mix of geopolitical factors and COVID-19-related stay-at-home orders enacted around the world. The shock to oil and gas supply chains was both unforeseen and immediate.

Since most supply chain organizations use internal data to track their demand-supply balances, they were not able to foresee the external events that impacted supply chains. The challenges related to COVID-19 forced supply chains to react to the situation instead of being proactive. Most organizations took too long to recover from this shock, which impacted their operations and bottom line.

Supply chain organizations must look beyond their current landscape and use digital capabilities to build resiliency to handle challenges around crises like the COVID-19 pandemic. Natural language processing is one of the emerging artificial intelligence applications that can help build supply chain resiliency.

“

Since most supply chain organizations use internal data to track their demand-supply balances, they were not able to foresee the external events that impacted supply chains.





Understanding natural language processing

Natural language processing is a type of artificial intelligence technology, and it's a component of text analytics. It focuses on understanding unstructured human language and transforming voice or text communications into normalized, structured data suitable for analysis.

NLP has a wide range of applications, and below are some familiar examples from our daily lives:

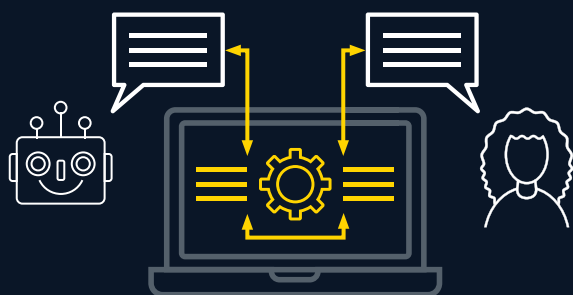
FAMILIAR APPLICATIONS OF NLP

- 1 Voice recognition via virtual assistants, such as Siri and Alexa
- 2 Voice-to-text messaging
- 3 Amazon product recommendations

Siri and Alexa recognize and interpret human voice commands. Similarly, voice-to-text messaging interprets the human voice and converts it to text. Amazon, on the other hand, uses algorithms to “scrape” a user's purchase history, along with items the user has liked and rated to make product recommendations. These are all applications of NLP.

Web scraping means extracting web content to track events and data that can have potential impact on business operations.

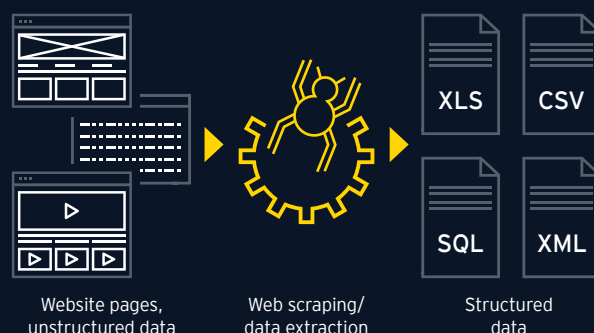
NATURAL LANGUAGE PROCESSING



Natural language processing focuses on understanding unstructured human language and transforming voice or text communications into normalized, structured data suitable for analysis.

WEB SCRAPING

Extracting web content from online sources





“

One example of web scraping is tracking the news for hurricanes, tornadoes and storms to assess the impact of these weather events on business operations. This helps businesses to take proactive measures before the actual event.

One example of web scraping is tracking the news for hurricanes, tornadoes and storms to assess the impact of these weather events on business operations. This helps businesses to take proactive measures before the actual event.

Other applications such as **social media listening** can provide valuable insights on analyzing data to gain business intelligence.

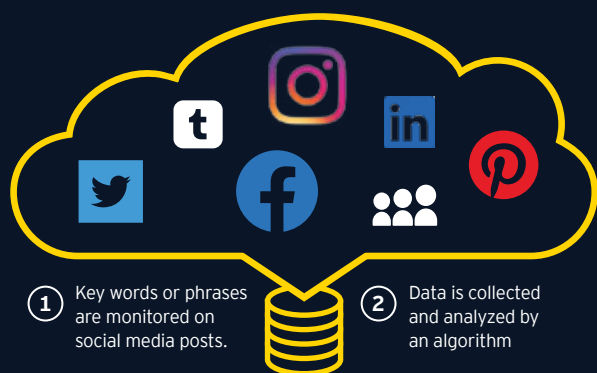
Social media listening means tracking mentions and conversations on social media platforms such as Twitter and Facebook. Software is used to monitor certain

key words or phrases in social media posts, and an algorithm is used to analyze the data.

One example of social media listening is when marketing companies track social media conversations regarding their brand. This helps them to understand why, where and how these conversations are happening, and what people think about their brand.

Social media listening and web scraping can provide valuable insights that help businesses to be proactive and adjust their strategy.

SOCIAL MEDIA LISTENING



“

Social media listening and web scraping can provide valuable insights that help businesses to be proactive and adjust their strategy.

How supply chain organizations can benefit from the use of NLP

Supply chain organizations can gain many benefits from the use of NLP. Some examples of use cases of NLP are listed below:

USE CASES OF NLP

- 1 Automate manual processes:** NLP can be used to read thousands of shipment documents to provide valuable summary information for making targeted logistics improvements.
- 2 Monitor data changes:** NLP algorithms can track real-time changes in internal data, which can help in accurately maintaining master data.
- 3 Gather industry benchmarks:** Web scraping can be used to gather industry benchmark data for transportation rates, fuel prices and labor costs. This data helps organizations to benchmark their performance against industry standards and identify cost-saving opportunities.
- 4 Reduce language barriers:** Most organizations have global operations, and language barriers can hinder process efficiency. NLP can be used to translate documents from one language to another to reduce regional language barriers.
- 5 Conduct compliance tracking:** NLP can help verify compliance with ethical practices by web scraping publicly available information for potential breaches by suppliers.

In addition to the above benefits, supply chain organizations can use NLP for building resiliency to handle crisis situations such as the COVID-19 outbreak. The benefits of NLP can be realized in end-to-end supply chain processes, from supply side to logistics side.

Web scraping can be used to track critical external information related to key suppliers. Tracking a supplier's stock market performance and assessing its financial statements can provide data on the supplier's financial stability. Furthermore, web scraping and social media listening can provide other useful supplier data points in areas such as labor relations, regional governmental restrictions, local news regarding

strikes or riots, and weather events that can impact operations of suppliers and may result in supply risk. Further analytics can be built on this data to create early warning indicators. With these valuable insights, supply chain organizations can take proactive measures to rely more on alternate suppliers for risk mitigation. This can be helpful in crises such as the COVID-19 pandemic, when some suppliers went out of business while others had to shut down operations due to governmental restrictions.

In addition to assessing supply risk, NLP also can be used to evaluate the impact of external events on manufacturing operations and logistics. During the COVID-19 crisis, certain states noticed a spike in the number of infections, leading them to take measures such as closure of retail establishments and stay-at-home orders, which had a cascading effect on other supply chains. The COVID-19 pandemic also impacted logistics operations due to a shortage of trucks for shipments and shipping port congestion, resulting in delayed shipments. NLP can be used in these situations to track news about COVID-19 cases and local government restrictions where an organization has operations. These data points can provide insights into potential future disruptions to operations. Similarly, NLP can be used to scrape data from logistics carriers' websites and shipping port websites to assess the impact of a crisis and inform measures such as increasing safety stock inventory levels, using alternate modes of shipment and finding different routes to ship products.

NLP enables supply chain organizations to gather and monitor external data that can cause potential disruptions. Supply chains can mitigate risk by taking preventive measures and build resiliency to handle crises.

“

Supply chain organizations can use NLP for building resiliency to handle crisis situations such as the COVID-19 outbreak.

Case study: how the EY team helped deploy NLP

We deployed NLP at a Fortune 50 global manufacturing client to help protect its supply chain during the COVID-19 crisis.

The project team primarily used NLP for internet news, social media and document searches to identify and interpret content that could have an impact on the client's business. We applied this technique to understand what journalists are reporting and what users are saying at the web-scale level.

For social media content, we focused on analyzing tweets from Twitter. We identified and categorized tweets using an application programming interface that allowed us to see what vendors were officially saying, their employees' sentiments, updates regarding the COVID-19 pandemic, news on relevant material production in the local facilities, regional government restrictions and the general sentiment of the community in the client's geographic area. This equipped our client to have more targeted conversations with its vendors with a fuller

understanding of current business conditions, and to plan accordingly.

The EY team helped position the client for future opportunities in this rapidly evolving field, including the following:

BENEFITS OF DEPLOYING NLP

- 1 Ability to have targeted conversations with suppliers to provide continuity of supply
- 2 Insight-driven data to build further analytics to forecast demand and supply
- 3 Review of real-time data for shipping port congestion to make necessary changes to priority shipments



Contacts



Sven Dharmani

EY Global Advanced
Manufacturing & Mobility
Supply Chain Leader

McLean, Virginia

+1 703 747 1077 | sven.dharmani@ey.com

Bryant Ives

Senior Manager, Performance Improvement
Ernst & Young LLP

Chicago, Illinois

+1 312 879 2319 | bryant.ives@ey.com

Mihir Khare

Senior, Performance Improvement,
Supply Chain & Operations
Ernst & Young LLP

Dallas, Texas

+1 214 756 1185 | mihir.khare@ey.com

Tina Liu

Senior, Performance Improvement,
Data & Analytics
Ernst & Young LLP

New York, New York

+1 212 773 5824 | tina.liu2@ey.com

EY | Assurance | Tax | Strategy and Transactions | Consulting

About EY

EY is a global leader in assurance, tax, strategy, transaction and consulting services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

EY refers to the global organization, and may refer to one or more, of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. Information about how EY collects and uses personal data and a description of the rights individuals have under data protection legislation are available via ey.com/privacy. For more information about our organization, please visit ey.com.

About EY's Global Advanced Manufacturing & Mobility Sector

Urbanization, changing consumer expectations and emerging digital technologies are reshaping what's possible, from the production and distribution of goods to the transportation of people. To succeed in this new world of mobility and smart manufacturing, incumbents must transform themselves at unprecedented speed – to think like an innovative start-up, tap into new talent and engage the customer. With experience across the value chain and key technology alliances, our teams show clients how to create efficiencies now while adopting digitization and optionality for long-term growth. Automotive, transportation, aerospace, defense, chemicals and industrial products companies can draw on the strength of our network of cross-industry players and put our diverse range of approaches to use today to equip their businesses for tomorrow.

© 2020 EYGM Limited.

All Rights Reserved.

EYG no. 005776-20Gbl

CS no. 2006-3520338

ED None

This material has been prepared for general informational purposes only and is not intended to be relied upon as accounting, tax, legal or other professional advice. Please refer to your advisors for specific advice.

The views of third parties set out in this publication are not necessarily the views of the global EY organization or its member firms. Moreover, they should be seen in the context of the time they were made.

ey.com