MIT SLOAN SCHOOL OF MANAGEMENT

MIT COMPUTER SCIENCE AND ARTIFICIAL INTELLIGENCE LABORATORY (CSAIL)

ARTIFICIAL INTELLIGENCE:
IMPLICATIONS FOR BUSINESS STRATEGY

ONLINE SHORT COURSE

MODULE 3 UNIT 2
Casebook

DELIVERED IN
COLLABORATION WITH getsmarter

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Learning outcomes:

LO2: Illustrate how natural language processing is currently deployed in industries and across functions.

LO3: Investigate how an organization can use natural language processing to achieve cost leadership, differentiation, or focus.

LO4: Decide if an application of natural language processing is appropriate in an organization.

1. Introduction

An enormous amount of data in the form of unstructured human language is currently being generated every minute through a variety of channels, such as news articles and blog posts, tweets, and posts on platforms like WhatsApp and Facebook. Business communications include those between people working together, and online interactions between companies and their customers. This module focuses on how companies can deploy natural language processing (NLP) to derive value both from understanding some of this vast amount of unstructured language and from generating natural language responses to it.

2. How is NLP used in business today?

In Video 1, Professor Thomas Malone talks about three things that artificial intelligence programs can do with natural languages. The three functions of natural language processing are then explored through the examples that follow the video.

Video 1: Introduction to NLP in business.

> **Optional reading:**
>
> For an introduction to NLP, read about five ways that business can apply NLP: for customer service, reputation monitoring, ad placement, market intelligence, and regulatory compliance.

2.1 Natural language understanding

In the following videos, Professor Malone interviews MIT Professor Emeritus Frank Levy, to discuss how NLP can be used in call centers and to understand documents.

2.1.1 Call centers

In Video 2, Professor Malone and Professor Levy discuss how NLP is used in call centers. Professor Levy elaborates on the use of automated responses for customer queries and how this process works. They discuss what types of questions are hard for AI to answer in the call center context.

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Video 2: AI in call centers.

Key points and strategy

NLP is being used in call centers in service of two potential strategies: cost or differentiation. Text- or voice-based chatbots can do some of the work previously performed by human customer service representatives, making it possible to reduce the number of people needed, thereby lowering costs. Most companies installing customer service chatbots, however, are doing so in service of a differentiation strategy. In this case, the chatbots take care of routine matters while more complex requests are transferred to human representatives, leading to a higher quality of service.

2.1.2 Understanding documents

In Video 3, Professor Malone continues his interview with Professor Levy to find out what is easy and what is difficult when it comes to automatically understanding documents in legal work. Professor Levy notes that repetitive and routine processes are easy for AI and discusses how progress is being made in using AI for contract management.

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Video 3: AI in the legal world.

Key points and strategy

As Professor Levy explained, NLP can be used in the legal discovery process to identify responsive documents that must be turned over to the opposing party (or that clearly do not need to be turned over). The NLP system gives its confidence rating on each document, and the documents that have a high confidence rating can be automatically turned over. If the NLP system is uncertain about a document, a human can step in to make the final decision. By automating routine tasks, NLP can support a lower-cost strategy. But more often, time is freed up for higher-value tasks, supporting a law firm's differentiation strategy to provide a higher level of service to its clients.

2.1.3 IBM Watson

In the next two videos, Professor Malone interviews Dr. Dario Gil, Vice President of AI and of IBM Q at IBM Corporation, to talk about IBM Watson and its real-world applications.

In Video 4, Dr. Gil gives some high-level insights into how the IBM Watson technology can be used for NLP and outlines the key business benefits. He uses the example of information stored in a PDF document and talks about how Watson can automatically extract concepts from a PDF. Additionally, Professor Malone and Dr. Gil delve into the concept of knowledge graphs and the value they have for business.

Video 4: The benefits of NLP for business (Part 1).

In Video 5, Professor Malone asks Dr. Gil to provide insight into which tasks would be easy and which would be hard for an NLP-based AI application to perform. Dr. Gil highlights the areas where NLP has shown much progress and areas where NLP is not sufficiently advanced for business applications today. The interview also touches on examples of how people and computers can work together using a tool like Watson, which relies heavily on NLP. Professor Malone asks Dr. Gil to provide some tips on how to successfully use AI. Lastly, they discuss whether there are any reasons to fear AI.

Video 5: The benefits of NLP for business (Part 2).

Key points and strategy

NLP technologies are currently good at parsing, extracting, and analyzing sentiment, as well as creating knowledge graphs. Once a knowledge graph is created, it can be reused for other tasks, which means that machines can learn from prior knowledge instead of having to start from scratch each time.

For business uses, NLP is furthest advanced in translation and in customer service applications like call centers. For example, NLP could be applied to call center data to help customer service representatives respond to customer queries, thereby supporting cost leadership or differentiation strategies.

NLP technology is far less developed in being able to "understand" a given document, such as an article, the way a human would understand it. But, even without fully understanding a given document, a machine could tell a human whether one article is similar to another by computing their similarity, using statistical features such as the frequency of overlapped words, thereby helping a person determine whether to read a given article or not. In this way, the machine can improve the human's productivity as the two collaborate on a task.

Optional reading:

Read the *MIT Technology Review* article that looks beyond the hype to show how IBM Watson can be a powerful new way for organizations to apply NLP and other AI techniques. In addition, look at a demonstration of how a standard version of Watson's NLP capabilities can analyze any text you give it.

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2.2 Natural language generation

Example 1: Narrative Science

Narrative Science uses natural language generation (NLG) to produce documents, such as articles about sporting events. In Video 6, a co-founder of the Narrative Science explains how the system works, and talks about the company's origins.
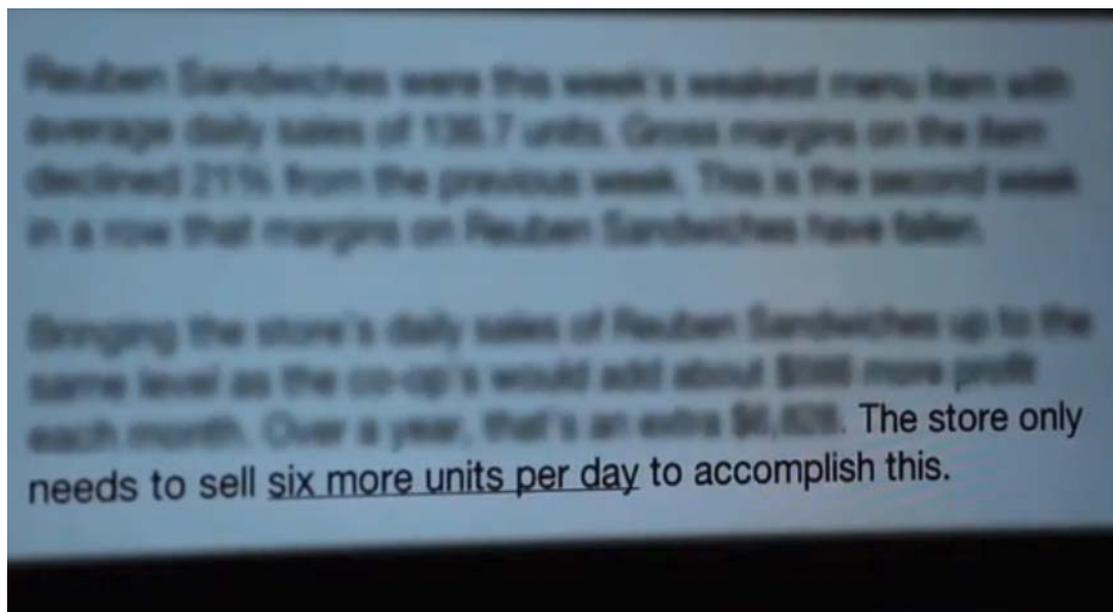
Video 6: Turning numbers into a narrative for an audience of one.
(Source: https://vimeo.com/130711623)

Key points and strategy

Companies can use NLG to support several of Porter's generic strategies. NLG can support a cost-leadership strategy by producing text much more inexpensively and quickly than human writers. On the other hand, NLG can also support a differentiation strategy by freeing up writers to focus on higher-value tasks.

> **Optional reading:**
>
> For more information, read about Narrative Science as an organization and how its Quill software can produce texts in natural language.

2.3 Interacting in natural language

Example 1: x.ai

x.ai built a virtual assistant that can interact by email to schedule meetings. In Video 7, Founder and CEO Dennis Mortensen explains how the system works.


Video 7: Virtual personal assistants, AI, and workplace productivity.
(Source: https://www.youtube.com/watch?v=dfHqZ-sWe6o)

Key points and strategy

Virtual assistants like x.ai can be used in a low-cost strategy, to reduce costs of customer interaction, or in a differentiation strategy, by freeing up staff to do higher-value work, thereby improving quality. However, some of what x.ai is doing today is still done by people.

> **Optional exploration:**
>
> In 2016, x.ai developed the conversational smartbot, Amy, to function as a virtual assistant. Read more about Amy, and watch Video 8 to see how a journalist from *The Telegraph* puts her to work.
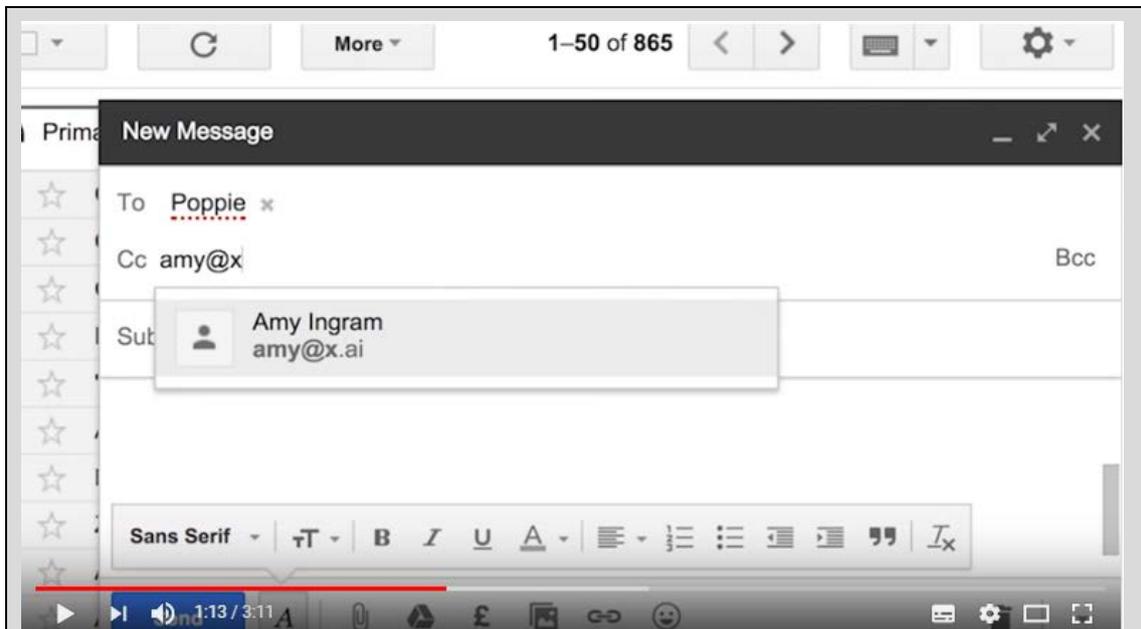
Video 8: x.ai's personal assistant, Amy.
(Source: https://www.youtube.com/watch?v=0xFGU3vs1iQ)

Explore the application of virtual assistants as labor-saving, revenue-generating additions to organizations. Facebook is developing M, an advanced virtual assistant, which relies on human help to complete complex or difficult-to-understand requests; the idea is that M will learn from the human-generated responses and eventually be able to handle ever higher-level assignments on its own.

Example 2: Alexa

Amazon's Alexa is a voice-based assistant that shows what is possible with NLP. Users can speak out loud into Amazon's Echo speaker to ask Alexa to perform any number of a growing number of tasks, such as to tell a joke, play a song, give the weather forecast, lead an exercise routine, or order products on Amazon. Google, Microsoft, Apple, and China's Baidu also have voice-based assistants of this kind.

Amazon can also mine the queries that Alexa cannot yet understand or satisfy. If enough people ask for sports scores, for example, it is likely that this kind of functionality would be popular, and Amazon may decide to build it. Amazon also lets other companies such as Uber, Fitbit, 1-800-Flowers, and Campbell Soup build apps on the Alexa platform. As of June 2017, Alexa had 15,000 such apps, although many of them remain quite simple.

Video 9 shows how Uber has integrated with Alexa to make ordering an Uber a simple task.
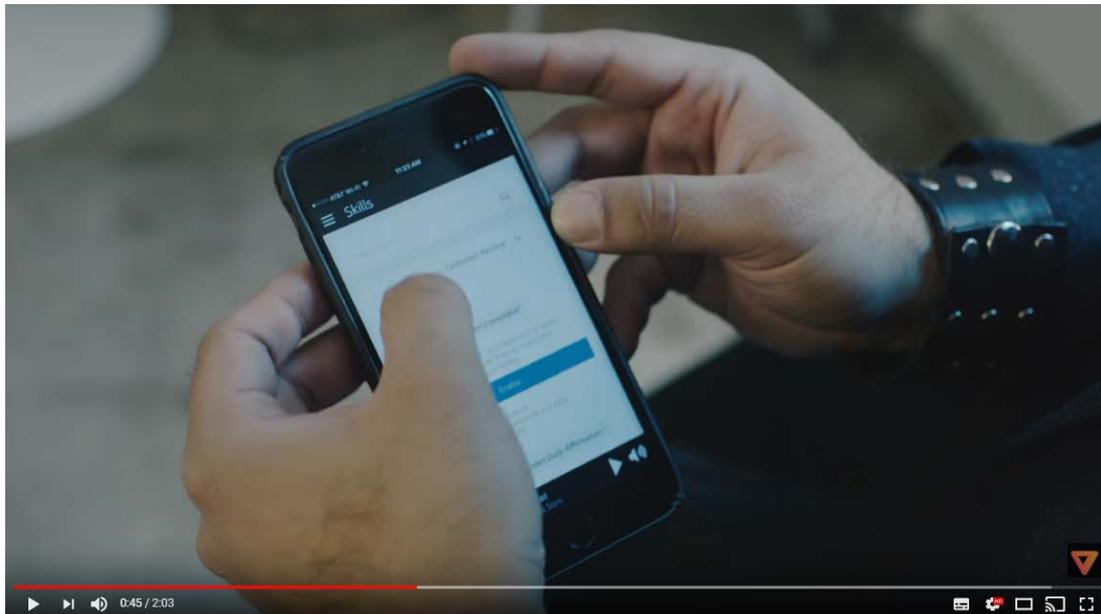
Video 9: Ordering an Uber ride with an Amazon Echo.
(Source: https://www.youtube.com/watch?v=o26xCTP6n2Q)

Key points and strategy

As this example shows, NLP can be used to support a strategy of differentiation, whereby companies that build apps on Alexa make it easier and more convenient for their customers, thus increasing the quality of the goods or services they provide.

> **Optional reading:**
>
> Read more about how Amazon's Alexa is poised to bring NLP to businesses.
>
> Additionally, have a look at how Amazon, Microsoft, Apple, and China's Baidu are using terabytes of spoken human speech to teach computers how to understand and respond to natural language.
>
> This article discusses Voysis, a startup that can generate spoken output that sounds like a person, instead of like a machine. It's based on technology originally developed by Google; Voysis sees great potential to apply its spoken voice capabilities to call centers, video games, and advertising.

3. Additional optional resources

Note:

The following resource is included for your enrichment and to provide deeper insight into the topics you have learned about in this casebook.

To understand more about the technical aspects of NLP, have a look at this general overview, which focuses on applications in the medical sector.

4. Conclusion

As a technology, natural language processing is making daily life easier by automating tasks, sorting through data with a level of speed and accuracy that humans are not capable of, and making connections between data to enhance and personalize the online experience. It is being applied to a wide range of business problems to deliver tangible business value and will continue to transform how people live and work.