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Application of Semantic Networks in Communication Management

Zastosowanie sieci semantycznych w zarządzaniu komunikacją

SUMMARY

In the post-covid world, communication within companies has become even more important than before. The management and communication crisis that emerged during the pandemic created the need for more effective communication strategies. The article focuses on the framework for creating such strategies based on Natural Language Processing techniques with particular emphasis on semantic networks. The COVID-19 pandemic drew attention to communication in the enterprise, as it was indicated as a key activity. It is of great importance for human mental health, but it is also a key factor in overcoming the crisis in the company. At the same time, many studies have been published that focus on applying the achievements of Natural Language Processing to solve problems that have arisen during and after the pandemic. It is reasonable to try to apply these technological achievements in the field of communication in order to improve the quality and effectiveness of communication, with particular emphasis on companies. Important data in the light of such rapid changes has become a key success factor.

Keywords: data, communication, management, semantic networks.

STRESZCZENIE

W świecie postcovidowym komunikacja w firmach stała się jeszcze ważniejsza niż dotychczas. Kryzys zarządzania i komunikacji, który pojawił się podczas pandemii, stworzył zapotrzebowanie na bardziej efektywne strategie komunikacyjne. W artykule skupiono się na ramach tworzenia takich strategii z zastosowaniem technik Natural Language Processing, ze szczególnym uwzględnieniem sieci semantycznych. Pandemia COVID-19 zwróciła uwagę na komunikację jako kluczową czynność w przedsiębiorstwie. Przekazywanie i odbieranie informacji w bezpośrednim kontakcie z drugą osobą ma ogromne znaczenie dla zdrowia psychicznego człowieka, jest również kluczowym czynnikiem w przezwyciężaniu kryzysu w firmie. Opublikowano wiele badań, które koncentrują się na zastosowaniu osiągnięć Natural Language Processing do rozwiązywania problemów, które pojawiły się w trakcie i po pandemii. Zasadne jest podjęcie próby wykorzystania tych osiągnięć technologicznych w dziedzinie komunikacji w celu poprawy jakości i efektywności komunikacji, ze szczególnym uwzględnieniem firm. Pozyskanie ważnych danych w świetle tak szybkich zmian stało się kluczowym czynnikiem sukcesu.

Słowa kluczowe: dane, komunikacja, sieci semantyczne.

1. MODEL OF A CONVERSATION WITH A PURPOSE

Before we can start the communication process, we need to have certain information, usually in the form of data that is often very messy; collating and sometimes even sanitizing it are prerequisites to doing anything useful with it. In the case of very large data sets, it is important to note that they are susceptible to direct human examination, and that they may require computational methods, if only to discover what pre-processing steps are required. When optimizing model performance, a typical data pipeline requires much more time to be spent on feature engineering and selection than on selecting and writing algorithms (Ryza et al., 2015).

Conversation with a purpose can be defined as conversation where at least one of the participants tries to achieve specific goals during the communication act. Usually at any given

moment conversation revolves around a specific topic. Thus, the act of purpose-driven communication can be depicted as a graph where each node represents a specific topic, and each edge represents whether the topics are related semantically to each other. Though the goals of the conversation may vary from achieving a certain amount of psychological satisfaction to obtaining specific information, most of those goals can be realized through achieving certain topics during the conversation. Many of those goals can be fulfilled only on the condition that participants of the conversation understand that topics aren't forced on them and that each topic has been achieved naturally. Otherwise, many goals that couldn't be reached as participants who feel observed, controlled or influenced tend to act more hostile. This implies that changes between topics should be natural or at least feel that way to other participants. The simplest way to achieve that goal is to move only between topics which are directly related to each other.

Area of all possible conversations can be therefore represented by the network where nodes are related to all the possible topics that can be even remotely relevant to the conversation. Edges of that network would be related to semantic relations between topics. Essentially two nodes would be connected if one can move naturally from one topic to another.

2. SEMANTIC NETWORK AS THE MODEL OF CONVERSATION WITH A PURPOSE

The closest existing models to the one presented above would be semantic networks of specific languages. Nodes of such networks are usually representations of designates of specific words in a given language. As most words with specific designates can be either a direct topic of a conversation or lead to one when connected to another neighbor node, such networks can be treated to some extent as a valid representation of space of all possible conversations. Properties of such a network can be therefore applied and interpreted as properties of space of conversation. Average path length can be interpreted as the average number of side topics necessary to move from one topic to another. Average path length of the semantic network for the English language is 10.56 for Wordnet semantic network and only 5.6 for Roget's Thesaurus (Bochkarev & Solovyev, 2019). That leads to the conclusion that if one would move between topics optimally most topics can be connected by just a few side topics.

Another factor that is important is that though already existing semantic networks usually have a lot of connections that aren't viable for everyday conversation, those networks don't include hundreds if not thousands of connections between subjects that result from the context of the conversation and shared cultural contexts of the participants. Those connections are often crucial in the conversation and allow for very dynamic changes in the subject of the conversation. Therefore, if properties of pure semantic networks suggest that any two topics can be connected through no more than 6 side topics then the actual number may be even smaller.
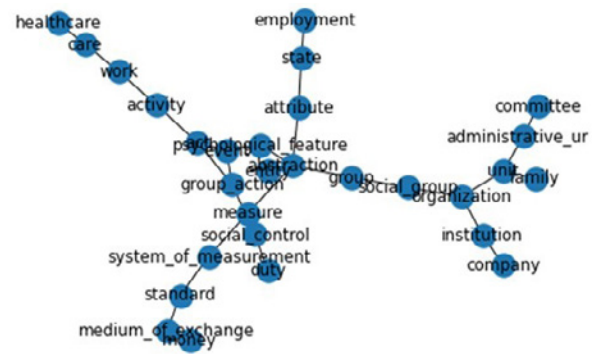

Figure 1. Example of Wordnet semantic network segment
Source: Own research.

Furthermore, during many conversations there are new connections created which from then on can be relevant for all the participants. For a strategy to include such factors it must be able to dynamically adjust the current optimal path to the desired topic with every change of topic and with every new connection that would appear (Figure 1).

3. COMMUNICATION STRATEGIES BASED ON SEMANTIC NETWORK APPROACH

All strategies that may be proposed should follow a specific structure. Firstly, they need to consider the different goals of the participants and their respective conversation initiatives. Then it also must be able to update the semantic network with every new semantic connection that transpires during the conversation. Such a strategy should be able to route the shortest path of topics leading to the closest goal topic at any given moment of the conversation. As in most cases there would be more than one path of the given length. The final route should be picked based on two factors – naturality of the topic and degree of fulfillment of the goal of the other participant or participants. Then other participants will be more likely to give in to the next proposed topic as it would be both natural in the context of the conversation and beneficial to their own goals. Method of the evaluation of each path to the goal topic based on mentioned before criteria would vastly vary based on the other participants' goals and type of conversation, i.e., some topic changes would be very natural during the evaluation or the job meeting but might be inappropriate in negotiations. Therefore, this article describes the framework of creating the strategy rather than any specific one.

However, even though the theoretical concept of a strategy seems straight forward, the strategy is dedicated to humans, not machines. So, each process described above must be taught and adapted to a conversational environment in a specific culture, place and situation. No human can keep an actual complete semantic network in their head. Therefore, applying such a strategy would firstly consist of training people in approaching the conversation with the network

approach in mind and then teaching them how to create the semantic network of topics that would be suited for the conversations which the strategy is meant for. The methods of evaluation of side topics to choose may be intuitive in many situations. However, choosing side topics that would lead to the goal-topic in as few side topics as possible and that would simultaneously feel natural and would be somehow fulfilling goals of other participants might often be very hard or even barely possible without a dedicated approach.

4. SEMANTIC NETWORK BASED STRATEGIES FOR EMPLOYEE EVALUATION, NEGOTIATIONS AND PERIODIC STRATEGY BUILDING

Though there are many applications of Semantic Network based strategies, one of the most useful is employee evaluation. Confronting an employee's opinions about himself with the employer is often stressful and difficult for both sides. It's important to mention that the psychological comfort of one employee can greatly influence the entire team. Therefore, any difficult conversation with the employee shouldn't be invasive and should pay attention to employee well-being. Employees usually don't know the topics that will be raised during the evaluation. It makes an evaluation even more stressful and uncomfortable which is why it is so important to make this conversation as natural and comfortable as possible. Using a Semantic Network based strategy can fulfill those goals. It decreases stress and its impact on the employee as well as improve motivation and focus problems. However, such preparation for the employee, at least for the evaluation process requires the creation of a system of structures to redress the stress factor just before the evaluation interview.

Many managers as well as employees are often required by large corporations to identify strategic goals over a certain period of time. What about automating this process on the basis of a semantic web built on experience? Setting short-term goals is very often the bane of middle managers. Although they operate according to certain patterns, formalization in the organization forces them to set these goals "on paper". An appropriately parameterized semantic web would allow them to be generated automatically. The manager would then be given a specific objective to achieve. How does this differ from the generation of goals by top management? The fact that such a network, based on experience, will generate realistic goals since it would be more unbiased at evaluating company's resources and capabilities.

When we are planning the structure of systems for an organization, software architects should have a basic knowledge of not only their company's capabilities, but in particular its strengths and weaknesses. Very often they are not responsible for finding new opportunities or defining measures. They merely perform the task. However, responsible and reliable management should involve them intensively in these activities in order to get valuable feedback, but also ideas. Ultimately, it is the architects who are responsible for creating concrete products from business goals and requirements (Stal, 2014).

Another aspect worth considering is the negotiation process. When we are in the business, we are able to find successive elements in the negotiation process. If the aim of our discussions is to reach a compromise, the semantic web is a recipe for reducing the negotiation time. A well-built web will allow a position to be presented very quickly, with a high probability of being accepted immediately. Of course, when we are forced to use an offensive strategy in a negotiation, such a network will help us find arguments when "the man fails".

CONCLUSIONS

The COVID 19 pandemic has brought attention back as its crucial activity. It has a great significance for human mental health, but it is also a key factor in overcoming the crisis in the company. Simultaneously many researches have been published that focus on applying Natural Language Processing advances to solve problems that emerged during and after the pandemic. The pandemic thus sparked important reflections on how to simplify our world and make it more accessible. The use of semantic networks can be a tool to help us shift the stressful tasks of everyday life onto the web in favor of building sincere interpersonal relationships and focusing on the job at hand. This article is just the beginning of the authors' work on building these networks and will find its continuation in further publications in this field.

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