

Improvements in the detection of drug interactions researched

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A group of researchers at the Universidad Carlos III de Madrid (UC3M) recently organized an international science competition on information extraction techniques to more accurately detect the pharmacological interactions described in biomedical texts.

A pharmacological interaction occurs when the effects of one drug are modified by the presence of another. The consequences can be harmful if the interaction causes an increase in the toxicity of the drug or a diminishing of its effect, which, in the worst cases, can even lead to the patient's death. At present, there are data bases to check possible interactions between medicines administered to patients, but the main problem is that many interactions are not recorded in these data bases, since it may take up to three years to update them. "As such, biomedical literature is still the best way to keep up to date on information about new interactions. It is important to note that every year, some 300,000 related articles are published in the sphere of pharmacology alone, so medical personnel are overwhelmed by such an avalanche of information," remarks one of the researchers, Isabel Segura, from the Advanced Data Bases Laboratory (abbreviated "LaBDA" in Spanish) at the UC3M.

In an attempt to solve this problem, for years they have studied how to use Natural Language Processing (NLP) techniques to create tools that can automatically find interactions by analyzing these enormous quantities of information. "In trying to create a system for detecting interactions between drugs, we are faced with the richness of human language and the difficulty that a scientific text entails," explains Segura. The challenge lies in designing a system capable of "understanding" the technical language used in biomedical texts and processing complex grammar structures and the terminology of the field itself.

To this end, she has participated with Paloma Martínez and María Herrero in organizing the latest edition of SemEval (Semantic

Evaluation), an annual competition devoted to evaluating NLP systems that treat semantic information in different types of tasks. In their case, they have organized a task of evaluating systems designed to detect pharmacological interactions described in scientific publications. "In this type of competition, resources are provided, allowing researchers to construct their systems, evaluate them and, of course, compare them to other researchers' systems," explains Segura, who stresses how important these events are to discover the point at which science and technology meet in order to solve specific problems.

In the competition, which took place last June in Atlanta, Georgia (the United States), 14 research teams hailing from Germany, Spain, the United States, Finland, Italy and Portugal participated. "Among the 14 tasks organized in SemEval, ours was second with the highest number of participants and we're very satisfied with the results," the researchers note. In fact, the systems presented achieved a substantial improvement compared to other years, as they reached an accuracy rate of 83% and coverage of almost 84%. As such, they note, they are useful tools that can help clinics, researchers and the pharmaceutical industry to filter the great quantity of published information on pharmacological interactions.

One essential step in extracting interactions is to previously identify the drugs that participate in the interaction. The participating teams achieved better results in the recognition of generic medicine, commercial medicines and families of drugs, while they made more errors with active substances not approved for human use. As for the classification of each type, it was observed that commercial medicines were easier to recognize than the others. This is perhaps because, when a drug is marketed by a pharmaceutical company, the name of the brand is carefully selected so that it is short, unique and easy to remember. Moreover, medicines not approved for human use imply more difficulty, owing to the greater variation and complexity of their names. With regard to the task of extracting interactions, the systems had more

problems when processing those sentences that described information related to the mechanism of the interaction.

A social problem

Currently, our society consumes many medicines and there is a strong trend towards polypharmacy (prepared with two or more active ingredients) or polytherapy (a combination of two or more medicines). Both are factors that influence the appearance of pharmacological interactions, since the more drugs a patient takes, the greater the probability there will be an adverse interaction. The main groups at the highest risk are elderly persons and multi-medication patients. In our country, the 65-and-over age group, which represents 11.37% of the total population, has prescriptions which consist of an average of four medicines, and the number of medicines prescribed increases with the patient's age. In addition to affecting the patient's safety, these pharmacological interactions entail a significant increase in medical expenses.

The LaBDA researchers at the UC3M have been working on NLP for more than ten years and for more than five years have focused on the development of systems of this type for the biomedical field. They have led several research projects in this area, such as MultuMedica, a project funded by the National Research and Development Plan, whose goal is the development of techniques for recovering and extracting information in biomedical texts. In the coming months, they will begin work on the European project TrendMiner (Large-scale, Cross-lingual Trend Mining and Summarisation of Real-time media Streams), whose goal is to apply techniques for generating summaries and extracting information from social media in different fields (finance, politics, health, etc.) One evaluation scenario will be to try to detect unknown adverse effects of medicines, that is to say, those that were not detected during clinical trials nor have been recorded in any report by the European Medicines

Agency. "What we will do is process messages that many patients post in forums and social networks about interactions between medicines and adverse effects," explains Paloma Martínez, head of the LaBDA.

Provided by Carlos III University of Madrid

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