STUDENTS

Healthcare app to reduce harm from drug combinations

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Improvements in healthcare, including better drugs, mean that we live 25 years longer than we did sixty years ago. Ironically, incorrect drug combinations lead to more than 300,000 deaths annually in the EU and the US. Can technology mitigate this peril?

Over half of people who medicate daily take at least four different drugs. The phenomenon is called polypharmacy, and it increases adverse drug reactions exponentially. To prevent fatalities, healthcare professionals need to be aware of harmful interactions.

Portals like DrugBank and Drugs.com already provide detailed information about known drug-drug interactions, but they lack the latest knowledge. Under Dr Charlie Abela's supervision, I created a platform that uses biomedical literature to help healthcare professionals identify harmful interactions between two drugs.

Our system is called medicX and consists of two main components. The first is responsible for the automatic identification of drugs from biomedical texts. The second checks whether a sentence is explaining an interaction between the identified drugs.

Both components rely on several handcrafted features, as well as different natural language and machine learning techniques. medicX finds a mention of the targeted drugs, then leverages the sentence structure to process the mentions. I used bi-directional Long Short-Term Memory Networks (a variant of neural networks) to process the mentions of the drugs in context. Support Vector Machine classifiers were used to automate the process of distinguishing between negative and positive drug-drug interactions.

A healthcare professional interacts with medicX by inserting two drugs into the search bar on the medicX portal. Then the system automatically identifies whether the two drugs can interact, based on a confidence score.

The application has been well-received, and publishing my research has given me the confidence to continue pursuing this study in my Masters. This time, we want to focus on predicting unknown drug interactions and showing those quickly and easily to professionals. The drugs will be shown graphically as nodes linked to other drugs. Then, based on existing knowledge, we will establish new interactions within the graph using graph learning – deep learning techniques applied on graphs. The results will support healthcare with information about incorrect drug combinations and limit the risk for patients.

This research project was part of a B.Sc. in Artificial Intelligence (Honours), Faculty of ICT, University of Malta. The research paper titled 'medicX: Mining drug-drug interactions for healthcare professionals' has been presented at the Applications of Intelligent Systems (APPIS) 2020 conference.