Visual Analytics in Biomedical Applications

INTRODUCTION

Biomedical tasks often require working with very large and complex information spaces (e.g., scientific articles, gene databases, phenotype ontologies, microarray data, and others).

It can be very challenging and time-consuming to navigate through such a space in order to find and make use of the relevant information for a given activity.

Visual analytics combines the strengths of computers and humans to support information-intensive complex activities. Interactive visual representations are employed to amplify perceptual and cognitive tasks of users.

We are developing an interactive visual analytics system that supports the complex activities of biomedical researchers and practitioners. On the computational side, we are engaged in natural language processing research, in an attempt to extract useful biomedical entities and relationships. On the human side, we are engaged in research on visual representation design and interactive cognition, to best support users as they work with the information.

INDEXING AND SEARCH

Biomedical researchers and clinicians often need to consult and work with scientific articles.

There are approximately 24 million articles in PubMed. For any given biomedical activity, there may be thousands of relevant articles.

In addition to NLP, we are indexing all PubMed citations (metadata) to enable fast and accurate search of biomedical entities and relationships.

During indexing, we perform natural language processing to identify important concepts, such as gene and phenotype names. This is not a trivial task, as many concepts (e.g., genes) are written in a variety of ways. We are also finding implicit relationships in the text, such as genotype-phenotype relationships.

We are using IBM Watson technology, as well as popular open-source products, for indexing and search. Users can search for terms and retrieve results in a matter of seconds. Results are then visually represented for the users to work with.

FURTHER READING


VISUAL REPRESENTATIONS

The human visual system has a higher bandwidth than any other perceptual system.

Unlike descriptive representations of information (e.g., natural language, mathematical formulae), depictive visual representations (VRs) can be perceived in a parallel fashion, which enables much information processing to be offloaded onto the visual system, decreasing cognitive load while working with information.

VRs, especially if they are interactive, can greatly assist in understanding and working with complex information spaces.