

PATENT: 10,108,604

AUTOMATIC GENERATION OF CONCPET MAPS FROM TEXT IS USEFUL IN A VARIETY OF EDUCATIONAL APPLICATIONS

One of the world's leading experts on educational data mining at the University of Memphis has invented a way to automatically extract knowledge representations from raw textual sources, including textbooks, and create concept maps from them. Concept maps are graphical knowledge representations that represent a concept, question or process. Concept mapping is a common pedagogical exercise in which students generate a graphical model of some domain. The invention can be used for a variety of purposes, including the creation of questions in an intelligent tutoring system (ITS). In ITS, the representation of subject matter knowledge is referred to as a domain model. A domain model is an integral part of an ITS, however, the creation and development of a domain model is very challenging and time – consuming. Thus, there is a desire to keep domain models as simple as possible to ease authoring, while keeping

them as complex as effectively possible to maximize learning. The invention minimizes the time needed to author the domain model without compromising the comprehensiveness required for effective learning.

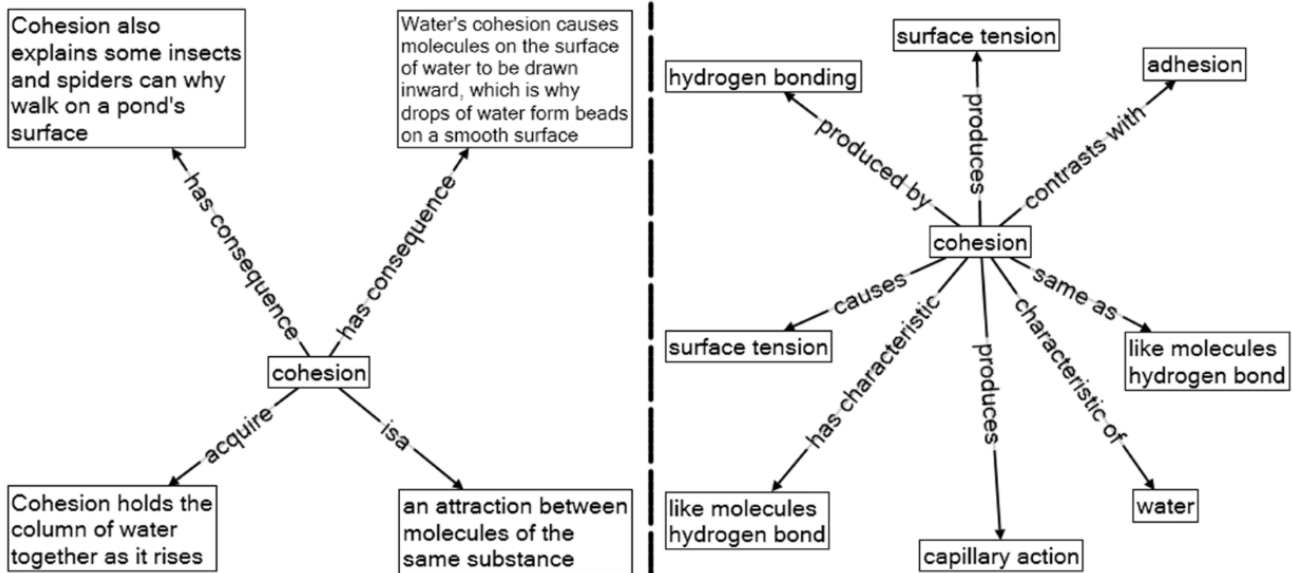
APPLICATIONS

- » Automated content creation for interactive Intelligent Tutoring Systems, including the generation of test questions and test-prep study guides.
- » Science education for both enhancing student learning and assessment of the learning.
- » Auto-generating “skeleton concept maps” for difficult topics, or for students new to concept mapping.
- » Creating concept maps for collaboration between corporate teams through analysis of internal documents, for use in ideation, brainstorming, planning session and similar activities

ABOUT THE OFFICE OF TECHNOLOGY TRANSFER

Research and innovation are rewarding, but it is the application of those ideas that truly brings them to life. The Office of Technology Transfer (OTT), housed within the FedEx Institute of Technology, excels in this process, guiding innovations from big ideas to licensed intellectual property and breakthrough commercial products. By generating revenue for the University and advancing fields from water treatment to neuroscience, the OTT supports both start-ups and established corporations, driving progress and improving products and processes across industries.

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Comparison of computer and human generated concept maps for “cohesion.” The computer generated concept map is on the left, and the human generated map is on the right.

ADVANTAGES

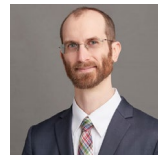
- » Generates concepts maps quickly without requiring extraordinary compute resources
- » Maps' quality compares favorably with human-generated, “gold standard” maps on scales of accuracy, completeness and pedagogy.
- » The system may be used to extract conceptual graphs of differing granularity.

TECHNOLOGY

The system processes text files to extract and create conceptual graphs. It identifies key terms, defines edge relations, and uses a semantic parser to extract conceptual graphs. Key terms are terms in the domain that are pedagogically significant. While key term extraction is very challenging in the general case, in the pedagogical context, the extraction of key terms is less difficult since the terms

are usually already present in a glossary or index. The system is designed to work with any subject matter and can handle different levels of granularity in the conceptual graphs.

THE INVENTOR



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Dr. Andrew M. Olney presently serves as Professor in both the Institute for Intelligent Systems and Department of Psychology at the University of Memphis. Dr. Olney received a B.A. in Linguistics with Cognitive Science from University College London in 1998, an M.S. in Evolutionary and Adaptive Systems from the University of Sussex in 2001, and a Ph.D. in Computer Science from the University of Memphis in 2006. He is the former editor of the

Journal of Educational Data Mining (2017-2022) and former Director/Associate Director of the Institute for Intelligent Systems at the University of Memphis (2006-2017), where he oversaw tenure track faculty, staff, and approximately 40 faculty affiliates. Dr. Olney has over 100 publications in the fields of artificial intelligence, education, and psychology, with a particular focus on using natural language processing to assess and enhance learning from text and learning through conversation. He has been an investigator on \$18M in federal grants (\$6M as PI) in these fields. His primary research interests are in natural language interfaces. Specific interests include language and knowledge acquisition (both human and AI) with applications in learning and performance support systems.