Chapter 1.27
Data Mining Medical Digital Libraries

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INTRODUCTION

Given the exponential growth rate of medical data and the accompanying biomedical literature, more than 10,000 documents per week (Leroy et al., 2003), it has become increasingly necessary to apply data mining techniques to medical digital libraries in order to assess a more complete view of genes, their biological functions and diseases. Data mining techniques, as applied to digital libraries, are also known as text mining.

BACKGROUND

Text mining is the process of analyzing unstructured text in order to discover information and knowledge that are typically difficult to retrieve. In general, text mining involves three broad areas: Information Retrieval (IR), Natural Language Processing (NLP) and Information Extraction (IE). Each of these areas are defined as follows:

- **Natural Language Processing:** a discipline that deals with various aspects of automatically processing written and spoken language.
- **Information Retrieval:** a discipline that deals with finding documents that meet a set of specific requirements.
- **Information Extraction:** a sub-field of NLP that addresses finding specific entities and facts in unstructured text.

MAIN THRUST

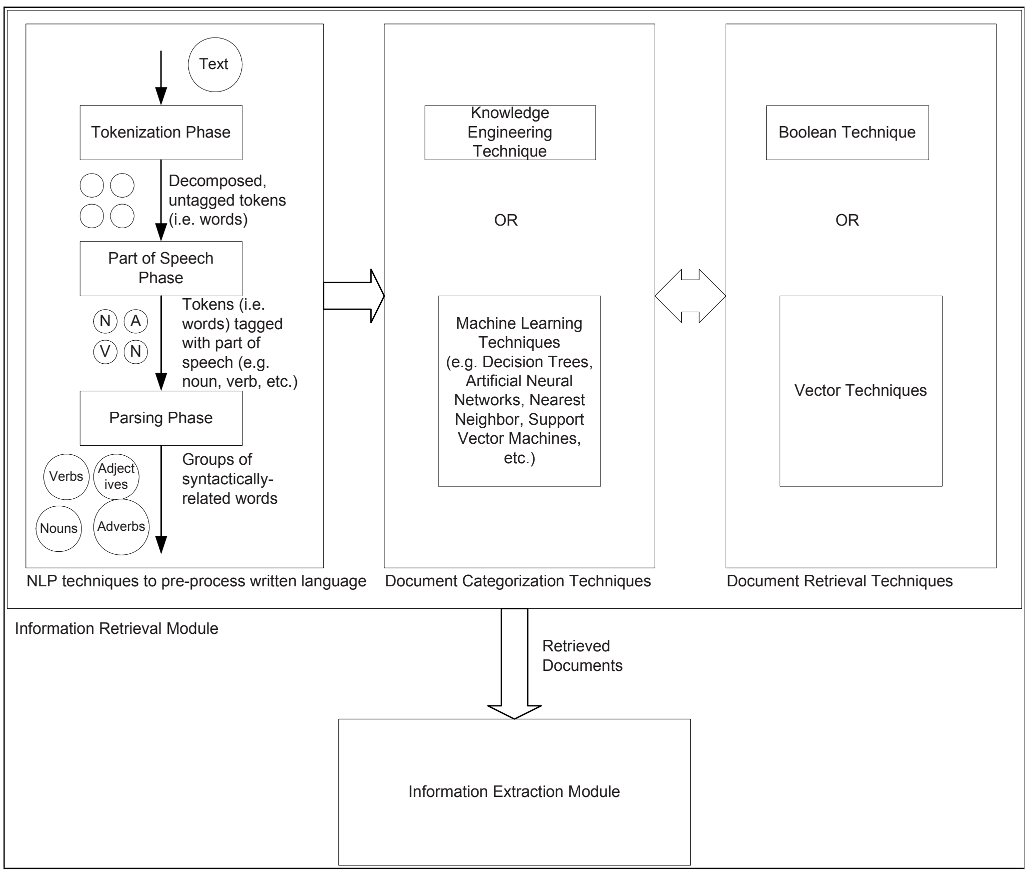
The current state of text mining in digital libraries is provided in order to facilitate continued research, which subsequently can be used to develop large-scale text mining systems. Specifically, an overview of the process, recent research efforts and practical uses of mining digital libraries, future trends and conclusions are presented.

Text Mining Process

Text mining can be viewed as a modular process that involves two modules: an information retrieval module and an information extraction module. presents the relationship between the modules and the relationships between the phases within the information retrieval module. The former module involves using NLP techniques to pre-process the written language and using techniques for document categorization in order to find relevant documents. The latter module involves finding specific and relevant facts within text. NLP consists of three distinct phases: (1) tokenization, (2) parts of speech (PoS) tagging and (3) parsing. In the tokenization step, the text is decomposed into its subparts, which are subsequently tagged during the second phase with the part of speech that each token represents (e.g., noun, verb, adjective, etc.). It should be noted that generating the rules for PoS tagging is a very manual and labor-intensive task. Typically, the parsing phase utilizes shallow parsing in order to group syntactically related words together because full parsing is both less efficient (i.e., very slow) and less accurate (Shatkay & Feldman, 2003). Once the documents have been pre-processed, then they can be categorized.

There are two approaches to document categorization: Knowledge Engineering (KE) and Machine Learning (ML). Knowledge Engineering requires the user to manually define rules, which can consequently be used to categorize documents into specific pre-defined categories. Clearly, one of the drawbacks of KE is the time that it would take a person (or group of people) to manually construct and maintain the rules. ML, on the other hand, uses a set of training documents to learn the rules for classifying documents.

Figure 1. Overview of text mining process



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