Chapter 13
Review on Knowledge-Centric Healthcare Data Analysis Case Using Deep Neural Network for Medical Data Warehousing Application

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ABSTRACT

Data in medical data warehouses are often used in data analytics and online analytical processing tools. OLAP techniques do not process enterprise data for hidden or unknown intelligence. The data analytics process takes data from a medical data warehouse as input and identifies the hidden patterns; i.e., data analytics process extracts hidden predictive information from the medical data warehouse through the deep neural networks tools. In this work, the authors attempt to identify the hidden patterns in context to healthcare data analytics case analytics using deep neural networks for medical applications. The authors have experimented with the deep network algorithms for the healthcare data set used through controlled learning that is to be carried out with the medical data set.

INTRODUCTION AND BACKGROUND REVIEW

A traditional medical data warehouse is a central store of data that has been extracted from operational data sources. Data in a medical data warehouse is typically subject-oriented, non-volatile, and of a historic nature, as contrasted with data used in an online transaction processing system. Data in medical

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data warehouses are often used in data analytics and online analytical processing tools. Online analytical processing techniques do not process enterprise data for hidden or unknown intelligence (Gabrys & Bargiela (2000) (Demuth & Beale, (1993) With the obsolescence of traditional medical data warehouses, new emerging technologies are progressively integrated to gain a better return on investment at the enterprise level. Medical data warehouses offer organizations the ability to gather and store enterprise information in a single conceptual enterprise repository. Basic data modeling techniques are applied to create relationship associations between individual data elements or data element groups. These associations, or "models," often take the form of entity relationship diagrams (ERDs). More advanced techniques include the star schema and snowflake data model concepts. Regardless of the technique chosen, the goal is to build a metadata model that conceptually represents the information usage and relationships within the organization.

Leveraging the metadata model, enterprise users can then apply elementary data analysis techniques to gather business knowledge (Mishra, Lin, & Chang, 2014). For example, ad hoc queries can be run against the medical data warehouse to extract enterprise-level information. These queries would supply information that was impossible to obtain under the legacy system of disparate information silos.

More advanced medical data warehouse toolsets incorporate the concept of multidimensional data or data cubes. This data structure allows information to be multi-indexed, which allows for a rapid drill-down on data attributes. Data cubes are usually used to perform what-if scenarios over-identified data indices. For example, suppose Company X sells jewelry and has offices in Detroit, Pittsburgh, and Atlanta. If the proper attributes were chosen as indices, a user could perform the analysis. This multidimensional analysis of multiple business views is called Online Analytical Processing (OLAP). The primary function of OLAP systems is to provide users the ability to perform manual exploration and analysis of enterprise summaries and detailed information. It is important to understand that OLAP requires the user to know what information he or she is searching for. OLAP techniques do not process enterprise data for hidden or unknown intelligence (Demuth & Beale, 2000.) (Mishra, Lin, & Chang, 2015) (Nørgård, 1997).

Enter the concept of data analytics. During the mid-to-late 1990s, commercial vendors began exploring the feasibility of applying traditional statistical and artificial intelligence analysis techniques to large databases to discover hidden data attributes, trends, and patterns. This exploration evolved into formal data-mining toolsets based on a wide collection of statistical analysis techniques. For a commercial business, the discovery of previously unknown statistical patterns or trends can provide valuable insight into the function and environment of their organization. Data-mining techniques allow businesses to make predictions of future events, whereas OLAP only gives an analysis of past facts. Data-mining techniques can generally be grouped into one of three categories: clustering, classifying, and predictive. Clustering techniques group information based on a set of input patterns using an unsupervised or undirected algorithm. One example of clustering could be the analysis of business consumers for unknown attribute groupings. Input to this example would be well-defined consumer attributes over which the algorithm would search. Classifying techniques group or assign objects to predetermined groupings based on well-defined attributes. The groupings are often clusters discovered using the above techniques. An example would be assigning a consumer to a particular sales cluster based on their income level. Predictive techniques take as input known attributes regarding a particular object or category and apply those attributes to another similar group to identify expected behavior or outcomes. For example, if a group of individuals wearing helmets and shoulder pads is known to be a football team, we can expect another group of individuals with helmets and pads to be a football team as well (Mishra, Lin, & Chang, 2014).

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