

Architecture of a Gene Expression Data Warehouse

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INTRODUCTION

Biomedical researchers are rapidly generating vast amounts of genomic data that need to be modeled, organized, stored, and shared among researchers and practitioners. Genomic data is quite different than the data types ordinarily found in relational databases. The raw data consists of long strings of letters (A, T, G, C) representing the four nucleotide bases that constitute the gene. However, the raw data is not the only data type used in biomedical research. Technological advances such as microarrays have made it possible for researchers to study large numbers of gene expressions, which was previously been an intractable task. With this new technology comes the challenge of being able to store, retrieve, and analyze gene expression data stored in microarrays and linking them with other data such as clinical records and even other microarray data. This poses an interesting challenge for data management, warehousing, and mining. In this paper we develop an architecture for a data warehouse that would allow researchers to store microarray data using multidimensional cubes.

METHODOLOGY

The datawarehouse design is shown in Figure 1. It consists of a relational database that stores microarray data, bacteriological data, and clinical data in relational tables. These datasets are then fed into a multi-dimensional database and converted into data cubes. The end-users query and visualize the data by interacting with a multi-dimensional (MDDB) server.

The microarray data comes from gene expression data of affected cells and no-affected cells. The bacteriology data represents DNA sequences of bacteria that are found in the infected host. Clinical data includes relational records describing patient characteristics.

Issues that are addressed in this paper are as follows:

1. How to store microarray and bacteriological data in a relational database.
2. How to provide linkage among datasets such that they can be compared and combined to generate meaningful information.
3. How to develop aggregate measures from relational tables into multi-dimensional cubes.
4. How to visualize data from multi-dimensional cubes in response to user requests.

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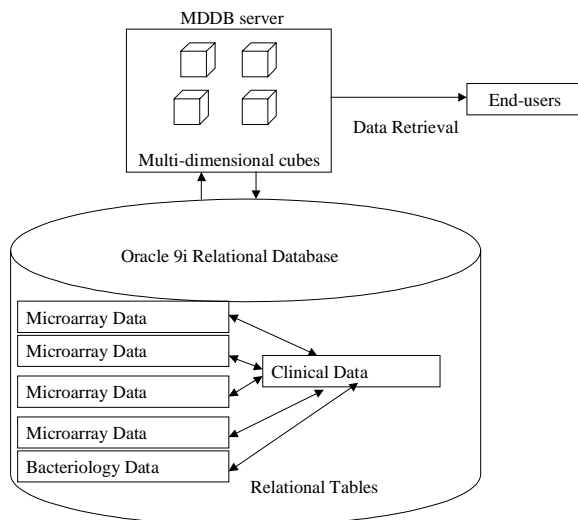
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Figure 1. Data warehouse Architecture



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