Multimedia Database

Provide features that allow users to store and query different types of multimedia information

- Images – photos or drawings
- Video clips – movies, newsreels, home videos
- Audio clips – songs, phone messages, speeches
- Documents – books or articles

The needed database queries involve locating multimedia sources that contain certain objects of interest; like all video clips in a video database that include a certain person. Or where a goal is scored by a certain player or team.

These queries are called CONTENT BASED RETRIEVAL. Identifying the contents of multimedia is done with two approaches:

1. Automatic analysis of the multimedia sources to identify certain mathematical characteristics of their content. This approach users different techniques depending on the type of source.
2. Manual identification of the objects and activities of interest in each source and using this information to index the sources. This approach can be applied to all types of sources, but requires a manual preprocessing phase where a person has to scan each multimedia source to identify and catalog the objects and activities

Image

Stored either in raw form (pixel values) or in compressed form. Compression standards such as GIF/JPEG use various mathematical transformations to reduce the number of cells but still maintain the main image characteristics. Applicable mathematical transforms include Discrete Fourier Transform(DFT), Discrete Cosine Transform(DCT), and wavelet transforms.

Video

Represented as a sequence of frames, where each frame is a still image. Storing a video also requires storing sound.

Text/Document

Is basically the full text or some book, article, or magazine typically indexed by identifying the keywords that appear in the text and their relative frequencies.

Audio

Include stored recorded messages, songs etc. using similarity based indexing and retrieval. Audio characteristic features include volume, intensity, pitch, and clarity.

Multimedia Database Applications

- Documents and records management
- Knowledge dissemination
- Education and Training
- Marketing, advertising, retailing, entertainment, and travel
- Real time control and monitoring

Nature of multimedia data and applications

Some more type of multimedia data

- Animations
- Structured Audio
- Composite or mixed multimedia data

Nature of multimedia applications:

Multimedia data can be stored, delivered, and utilized in many different ways. The multimedia applications can be categorized based on their data management characteristics as follows:

- Repository Applications: large amount of data along with metadata is stored for retrieval purposes. Eg: repo of satellite images, engineering drawings, space photographs etc.

- Presentation Applications: delivery of multimedia data subject to temporal constraints.
- Collaborative work using multimedia information: involve multiple users simultaneously.

Spatial database concepts and architecture

Provide concepts for databases that keep track of objects in a multidimensional space. Most likely used in GIS; Map related applications (2d) for environmental, emergency, and battle management. Some other applications may be meteorological databases (3d) for weather information. In general, a spatial database stores objects that have spatial characteristics that describe them.

Some typical categories of spatial queries are:

- Range query
- Nearest neighbor query
- Spatial joins or overlays

Deductive databases and Query processing

In Deductive databases the rules are typically specified using declarative language which deals with what to achieve rather than how to achieve something. In these type of systems, an Inference engine – also called deduction mechanism – can deduce new facts from the database by interpreting these rules.

A deductive database uses two main types of specifications: facts and rules. Facts are specified in a manner similar to the way relations are specified, except that it is not necessary to include the attribute names.Rules are somewhat similar to relational views, specify virtual relations that are not actually stored but that can be formed from the facts by applying inference mechanisms based on the rule specifications.

These database model are related to the field of logic programming and Prolog language. The evolution of Prolog programs is based on backward chaining, which involves top-down evaluation of goals.

A variation of Prolog called Datalog is used to define rules declaratively in conjunction with an existing set of relations, which are themselves treated as literals in the language. It uses bottom-up approach.

Prolog/Datalog notations

The notation used in Prolog/Datalog is based on providing predicates with unique names. A predicate has an implicit meaning as suggested by its name and a fixed number of arguments. If arguments are all constants, the predicate states that a fact is true; if arguments are variables, it is either a query or part of rule or constraint. A rule is in the form head :- body, where :- is read IF AND ONLY IF. Head is conclusion of the rule. Body has one or more predicates, which is premise(s) of the rule.

Predicate: Supervise(Ram, Shyam)

Rules:

Superior(X,Y) :- Supervise(X,Y)

Superior(X,Y) :- Supervise(X,Z), Superior(Z,Y)

Subordinate(X,Y) :- Superior(Y,X)

Queries:

Superior(Hari,Y)?

Superior(Sita,Gita)?

Casual form and Horn clauses

Casual form: Universal qualifiers(for all) =>(implies) information[p1 and p2 and … pn => q1 or q2 or … qn]

Horn clause: has only one positive literal at RHS.[p1 and p2 and … pn => q]

Interpretations of Rules

Proof theoretic: find the fact at the run time from known facts

Model theoretic: derive all true facts from known facts and store, all others are false