Project Summary

Award No: 9972883	
Project Title: Multimedia Support Infrastructure	
Investigators: PI: Ahmed Elmagarmid Co-PIs: Arif Ghafoor, John T. Korb, Kihong Park, and Eugene Spafford	
Institution: Purdue University	
Website: http://www.cs.purdue.edu/msi	**Description of Graphic Image:** The OpenSesame tool allows users to view real-time content over resource limited networks.

Project Description and Outcome *(Provide content for one or more of the following outcome goals)*

Ideas:

We have developed the first online incremental algorithm to discover periodic patterns in real-time data streams. Real-time data streams occur in a variety situations, including telecommunications and video surveillance networks. Our algorithm allows, for example, a telephone company to analyze telephone calling patterns and predict periods of high and low traffic so that resources can be allocated efficiently.

We define periodicity mining as the detection of frequent, periodic patterns of unknown rate in a stream of data. Since the periodicity rate is unknown, the first step is to discover potential rates, called *Periodicity Detection*. The second step is to detect the frequent periodic patterns of each periodicity rate, called *Mining Periodic Patterns*.

Traditional perodicity mining algorithms assume an underlying database without real-time services, so cannot be applied to data streams. Because our algorithm operates incrementally it does not have this limitation.

While visual inspection of a data stream may lead to the identification of periodic patterns, this approach not only requires human interaction it is impractical for large, long-running streams. Hence, automatic detection of potential periodicity rates is vital for fully automated periodicity mining in data streams.

We have completed a number of experiments with both synthetic and "real" data to perform an empirical analysis of our algorithm. These experiments confirm that the algorithm is correct, discovers periodic patterns in a practical manner, and shows that the patterns are highly accurate.

The discovery and refinement of our periodicity mining algorithm would not have been possible without this support from the National Science Foundation.

Tools:

We have developed, deployed, and benchmarked two prototype systems that enable the integrated Quality of Service (QoS), multimedia database, and security services vision of the MSI project. The systems are open source, platform independent, and will be released to the public.

The most recent tool, OpenSesame, is a legacy-compatible scalable real-time content distribution system that allows turnkey, high-performance, user-sensitive multimedia streaming. Presently, OpenSesame is available to selected members of the Purdue Computer Science Department who use it to receive cable TV on their desktop, laptop, or handheld computer.

OpenSesame allows resource contention algorithms to be benchmarked and evaluated with real users, continuing in the broadband wireless arena where Berkeley's influential INDEX project left off. Resources under contention include shared cable channels, bandwidth, and QoS. System-wide stability, efficiency, and user satisfaction are being studied under a range of policies, including market-oriented priority control.

People:

EduMed is a prototype of a medical education system to support rapid classroom access to online, interactive multimedia medical materials for teaching and learning. The system handles ad hoc video queries based on keywords assigned to video clips, returning representative (key) frames to identify selected clips, and providing quality streaming playback for retrieved video clips.

The EduMed project has brought together researchers, medical practitioners, educators, service providers, and product developers to create an infrastructure for the research, development and delivery of multimedia medical data that could support (1) management and use of multimedia data, (2) annotation of medical video data with text and audio commentaries by physicians, (3) content-based search and retrieval of video data using indices built from the annotations, (4) image-based search and retrieval of video data using meta-data generated by image processing techniques, and (5) coordinated storage and retrieval of video data from remote sites.

The development of this prototype was based on four separate activities: (1) the technology transfer of advanced multimedia functionality to the database engine, TITANIUM, marketed Micro Data Base Systems, Inc., (2) joint efforts with Indiana University Centers of Medical Education to produce relevant, high quality medical education videos, compress them into MPEG format and apply semantic- and image-based processing to create appropriate medical meta-data to describe video clip content, (3) collaborations with faculty from the IU School of Medicine to determine user requirements and functional specifications, and (4) multidisciplinary applications-oriented research and development at Purdue University to create a viable prototype. Cooperative efforts with the Technology Transfer Initiative (TTi) of the Krannert Graduate School of Management produced a commercialization plan for EduMed.
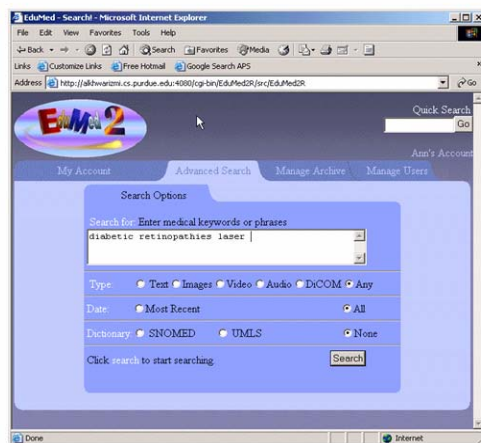
Additional Graphic Image
You may insert a second graphic below with a description (photos, video, etc.) supporting one of your outcomes

**Web-based Multimedia Databases for e-Learning in Medical Education**

EduMed

Multimedia database research serving medical education and the practice of medicine

Browse, Query, Search and Discover
across Distributed Multimedia Medical Databases

Users enter keywords for content-based search of videos, images, audio and other multimedia forms. Medical knowledge bases like UMLS are accessed to help with the search.
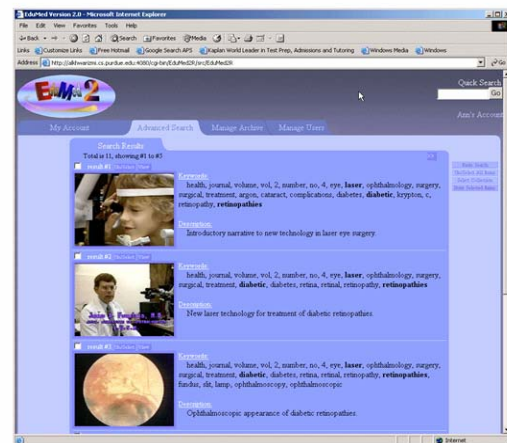
Videos are pre-processed to attach keywords, image-based and semantic metadata to logical scenes within the video. Users search against video scenes to extract clips that match the image or semantic search criteria.

Indiana Center for Database Systems

Description of Graphic Image:

The EduMed system provides medical students and educators with content-based access to a database of instructional video sequences.