Fall 2016 Course

Multimedia Systems

Faculty: B. Prabhakaran

Multimedia applications have become part of everyday life through devices and tools such as cell phones, iPods, game interfaces such as Kinect and search engines. As an example, let us look at YouTube Statistics at: https://www.youtube.com/yt/press/statistics.html

- YouTube has more than 1 billion users
- Every day people watch hundreds of millions of hours on YouTube and generate billions of views
- The number of hours people are watching on YouTube each month is up 50% year over year
- 300 hours of video are uploaded to YouTube every minute
- ~60% of a creator's views comes from outside their home country
- YouTube is localized in 75 countries and available in 61 languages
- Half of YouTube views are on mobile devices
- Mobile revenue on YouTube is up over 100% y/y

"300 hours of new video getting uploaded every hour" implies that data servers needed to be added to the YouTube data centers every day. These servers need to be fail-safe, disaster-safe, and handle 1 billion users who not only upload and view videos, but also search the humongous database of videos – i.e., handle "watching hundreds of millions of hours on YouTube and generating billions of views". And these billion users are all over the world. So the servers need to be distributed all over the world to deliver the video content in real-time manner. This example analysis of YouTube is a perfect use-case for Big Data and Cloud Computing techniques.

Hence, multimedia information poses several challenges for software as well as hardware aspects – at different layers such as Operating System, Big Databases, and High-speed Networking. The primary reasons are their binary content, bulky sizes, and real-time requirements.

From a real-time perspective, users' expectations have also "sky rocketed": similar to getting cues to be given as we type in our search intentions on Google, we expect real-time detection of events in video using devices such as Google Glass, or Microsoft's Hololens, and other multi-modal data such as Kinect, so that we can have more natural user interfaces to applications.

The objective of the course on multimedia systems course is to understand how different media data (such as text, audio, images, video (both 2D and 3D video), haptics, and 3D graphics) can be stored, queried, and delivered. The course will cover the following topics in depth:

1. *Media Characteristics*: different compression strategies and how they influence storage, retrieval, querying, and delivery of multimedia data.
2. *Operating System*: bandwidth requirements, scheduling, and resource management.
3. *Metadata Generation*: how descriptions of the contents of different media can be automatically/semi-automatically generated.
4. *Indexing Techniques*: what are the techniques that can be used to search multimedia data in a faster way
5. *Query languages*: different features that are needed in the query languages for multimedia data access.
6. *Streaming Media*: techniques for delivering different media types over a network to different types of client platforms.
7. *Security & Privacy*: techniques for copyright protection, tamper proofing, and privacy protection for different media types.

This course will have a term project (60% credit). The project will be done over the entire semester. Students can choose a project in one of the above topics, based on their interest. Students can also work on some of the research projects going on in the Multimedia Systems & Networking Laboratory. Quizzes and homework will have 15% credit. There will also be an "open information" final examination (25% credit). Typically, students use laptops with Internet access for their final exam.

Previous project topics include image annotation, Kinect and haptics based game programming, Google glass based applications, Oracle multimedia databases, peer-to-peer video streaming, multimedia security (watermarking), collaborative multimedia platform, etc.

Intended Audience: Graduate Students - both MS and PhD

Helpful Skill Sets: Programming skills in databases, networking, and threads.

Further Questions?: bprabhakaran@utdallas.edu