Spring 2018 CSCI 576 Multimedia Project

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Demo date: Wed May 2nd & Thu May 3rd 2018 (exact day/time to be decided)

The course project is meant to give you an in depth understanding of some of the areas in multimedia technology. Also, I have often found that a large project can be successfully accomplished via collaboration. Additionally, working together to design and integrate code can be a rewarding exercise and you will frequently need to work in teams when you set out to work in the industry. Accordingly, please form groups of exactly two or at the most three students. We have started a discussion board to help you make groups, where you may post your preferred language of implementation, availability etc. *Once your group is decided, please send the TAs an email so we can assign a time for demo on the due date.* If you are a remote student and are having trouble finding a partner, please send an email to the TA/me and we will try to help. Also, if you are a remote student, we normally allow you to do a remote demonstration. Details on this will be decided soon.

This semester, the proposed project is in the area of implementing multimedia queries. The motivation, description and the expectation for the project follows on the next page.

Multimedia Queries

Text based searching today has become a natural part of how we access information and there are many ways to search and rank textual information. For instance, you can search using a specific text string query while browsing a big text document and just as easily bring up other documents that contain the same query text string. Search engines like google, bing, yahoo etc. enable you to search the whole world wide web of textural web pages for specific strings and rank them in an order of importance using various classes of search algorithms.

Now with the advances in inexpensive digital video (and audio) capture devices, media data is common place now. There is a lot of digital video information everywhere – streamed to you via the internet and cable networks, hosted on websites and social media networks, your own personal hard disks etc. With a lot of video/audio/image information, there needs to be a search paradigm to make sense of it. However, the search paradigms and methodologies for media data are as well formed and are still related to text information and/or metadata that is annotated around the media data.

Rather than using text to query media, another natural paradigm might be to use media itself – for instance given short video clip, you want to search through an entire database of videos to find the video which contains the "same" query or "similar" content as in the query clip. The motivating question here is - what is involved in developing a system that takes a short video clip as input and very quickly produces a ranked list of videos (from a database) that either contains the queried short clip or contains similar queried short clips. This is no doubt a complex problem with many nuances to consider, but a practical and useful one. Although this is a hard problem to solve for all general cases, for the purpose of this project we will constrain the problem space well enough with easier datasets so that you can get results that should be rewarding.

You will be given a list of video files and corresponding audio files. These will all be the same image size, same number of frames, and the same format. You will need to develop an *offline* process that will query these files and extract semantics based on principles that we have learned in class (or other ideas that you might have). You will need to develop an *online* program that will take a short query video (examples will be provided) and create a list of matched videos which contain the "same" or "similar" query. You will need to develop a user interface that will show the query video and the list searched videos produced by your program and play the video/audio upon selection. Consequently, there are three big parts to this project detailed below.

Offline process to extract video/audio semantics:

This is an offline step that should be run prior to running your query. You can analyze all the frames of video and audio for every file and extract semantics that will help you run a query. These could be quantitative measures based on concepts learned in class. Suggestions are listed below. Please give thought to how you would extract them, and organize them to be used for searching. You are not limited to using these, and you may think of creating descriptors based on other metrics.

- Color – For every video you can find a color theme: e.g. extracting the most dominant colors per frame as a list of numbers and collating this information.
- Motion – For every video you can compute motion statistics. Every frame can be given a quantitative number depending on how much motion you perceive in that frame.
- Sound – Based on the wave PCM samples, you could compute audio threshold levels or even frequencies that give allow you to compute a quantitative assessment of how much sound/frequency there is in an audio segment.

Querying your database with a clip

This should be a process that takes a short video/audio clip and queries the semantics generated above. An example invocation might be

MyQuery.exe queryvideo1.rgb queryaudio.wav

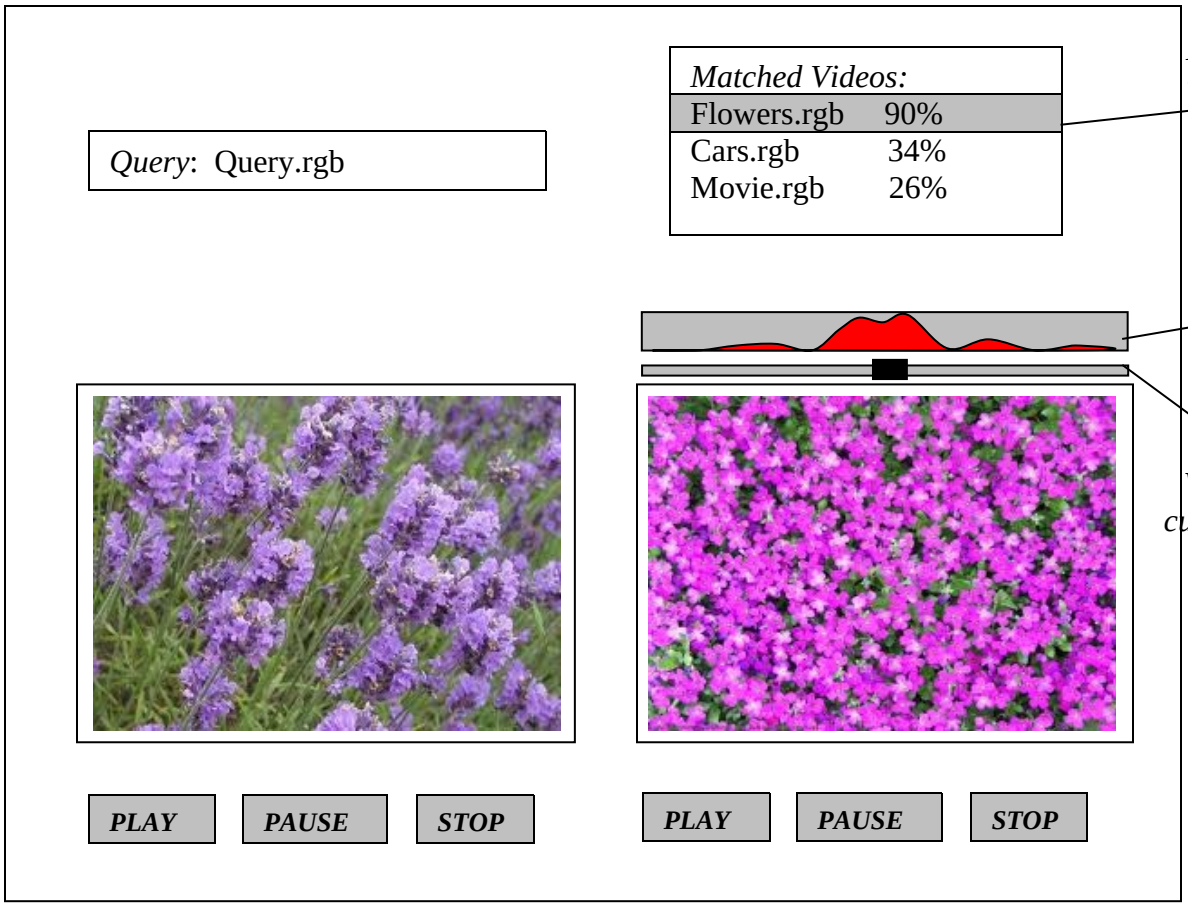
This should search and create a list of videos that either contain the query media elements or contain similar elements in a ranked order. At end of your search, you should open and interface to show your results or you could start you interface and run a query. An example interface is shown below in the next subsection.

A/V Player and Query Interface

Design a simple interface that shows the short query video clip and a list of matched videos that contain the query clip or similar clips in some ranked order. Here are a few requirements that you need to implement

- You should be able to play, pause and stop the query clip (and its corresponding audio)
- You should be able to show a list of video files that contain the matched query in some ranking order. You should be able to select a video from this list and be able to play, pause and stop the video (and its corresponding audio)
- Additionally, for all selected videos, you should display a visual indicator that shows you where in the video you found a match with the query clip.

An example of such an interface is shown below. You don't need to create the exact same interface, but whatever you create should have the above functionality and allow us to evaluate your result clearly and easily.



Expectations and Evaluations:

We do expect that you analyze the problem space and produce a solution. The answers are subjective (when there is no exact match) depending on what parameters and descriptors you extract and how you justifiably use them to compute a quantitative distance measure. Consequently, rather than perceptually making sense, we will be evaluating if your results match the descriptors you have extracted. Therefore, it is essential for you to help the evaluation process by showing a visual descriptor of where in the video you have a matched clip as shown above. You don't need to create the same interface as shown above, but as long as it helps us evaluate your result – that is fine. When it comes to playing audio and video, we do expect them to be synchronized. Extra credit – will be given to good correct results and fast queries.