CLASS PROJECT : Fall 2021
Assigned: Nov 1, 2021
Due Date: During Exam week - Thu Dec 9 / Fri Dec 10, 2021

The course project is meant to give you an in depth understanding of some of the areas in multimedia technology. Since this is a broad field, there can be a variety of interesting projects that can be done depending on your interests which can also extend to related and complementary topics that are taught in class.

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 *two students, or utmost three students.* We have started a discussion board to help you make groups, where you may post your preferred language of implementation, availability etc. so as to facilitate making groups.
- Once your group is decided, please send the TAs an email by no later than **Mon Nov 29th 2021**, so we can account for a time slot for your evaluation.
- 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.
- Details on the exact times for submission/demonstration will be decided soon after we get groups formed.

Hypermedia – Creation and Consumption

Description

One of the necessary properties of digital multimedia content is that it needs to be interactive. Interactive Multimedia Content is available in different forms today. We only text is involved, we are all familiar with hyper linked text documents and the http protocol enabling browsing of text in a non linear manner. The same metaphor can be extended to create hyper linked images, video and media. In particular, this project will allow you to explore the creation and consumption of interactive video - *Hypervideo*, or *Hyperlinked* video. *Hypervideo* video is a displayed video stream that contains embedded, user-clickable anchors allowing navigation between video and other hypermedia elements. Hypervideo is thus analogous to hypertext, where a reader clocks on a word in one document to retrieve information from another document, or from another place in the same document. Hypervideo thus combines video with a non linear information structure, allowing a user to make choices based on the content of the video and the user's interests.

The defining difference between hypervideo and hypertext is the element of time. Text is static, while a video is necessarily dynamic; the content of the video changes with time. Consequently, hypervideo has different technical and aesthetic requirements. For example, hypervideo might involve the creation of a link from an object in a video that is visible for only certain duration. It is therefore necessary to segment the video spatially and temporarily appropriately and add the metadata required to link a defined region in the video to other media elements. Also the behavior of interactivity could also be different – you could browse to another media element, or have a pop up widget that shows linked information. Another difficulty is that automatically segmenting video of all kinds is not easy and as yet, an area of research in computer vision. In this project you will explore the problem space of hypervideo. Consequently, you have two tasks:

- Create an authoring tool to setup hyper linked videos
- Create an interactive video player to interact with hypervideos.

Both of these are explained in detail below with example user interfaces/workflows. However, the implementation that your group designs will be specific to your skill sets and efforts. Remember, there will definitely be no wrong answer or wrong implementation and you are not even asked to follow strict guidelines, but your tools will be measured by *how easy it is to create interactive hypervideo content* and *how seamlessly and quickly you can navigate the content in your player*. This will depend on your design, architecture and workflow principles. So give it a respectful thought!

Part 1: Create a Hyper-Linking Video Authoring Tool.

Here you will write an application that needs to load videos and setup hyperlinks. Your authoring tool should have the following capabilities:

1. Import video(s). There should be a minimum of two videos that can be imported in your interface – one primary video that you are creating hyperlinks for and the other secondary video which helps set up your hyperlink target. The latter is more to help you visually see your hyperlink target and the frame number to link to.
2. Navigate through all frames of the video a timeline with a slider (or something similar). This should allow random access to any frame
3. Define and edit areas to track in the main video and setup up hyperlinks for this tracked area. Tracking areas represent semantic regions of interest, which could be automatically detected in future by advance vision algorithms, but for now we will resort to manually defining these areas in your setup.
   - Use bounding boxes to setup an area of interest on a frame. The area of interest could be visible for a short (or long) time segment in the video.
   - They could change position and shape while they are defined, mostly to follow the object of interest.
   - For each area, you should be able to setup a hyperlink pointer to point to an video with a frame number. This hyper link specifies how your video will change and jump to a new video when interactively viewing in your player.
4. On conclusion of your authoring session, your setup should have a save data button, that will save a metadata file which encapsulates all the setup hyperlink information for the current primary video. You may choose your own design/format for this file.

Here is a simple, but functional setup for such an authoring tool. You are free to design your own. The menus and options suggest possible functionalities that your setup should provide in order to create hyper linked videos. While user interface design is not something that will decide your grade, do give it ample thought so as to make easy workflow metaphors to create hyperlinked videos.
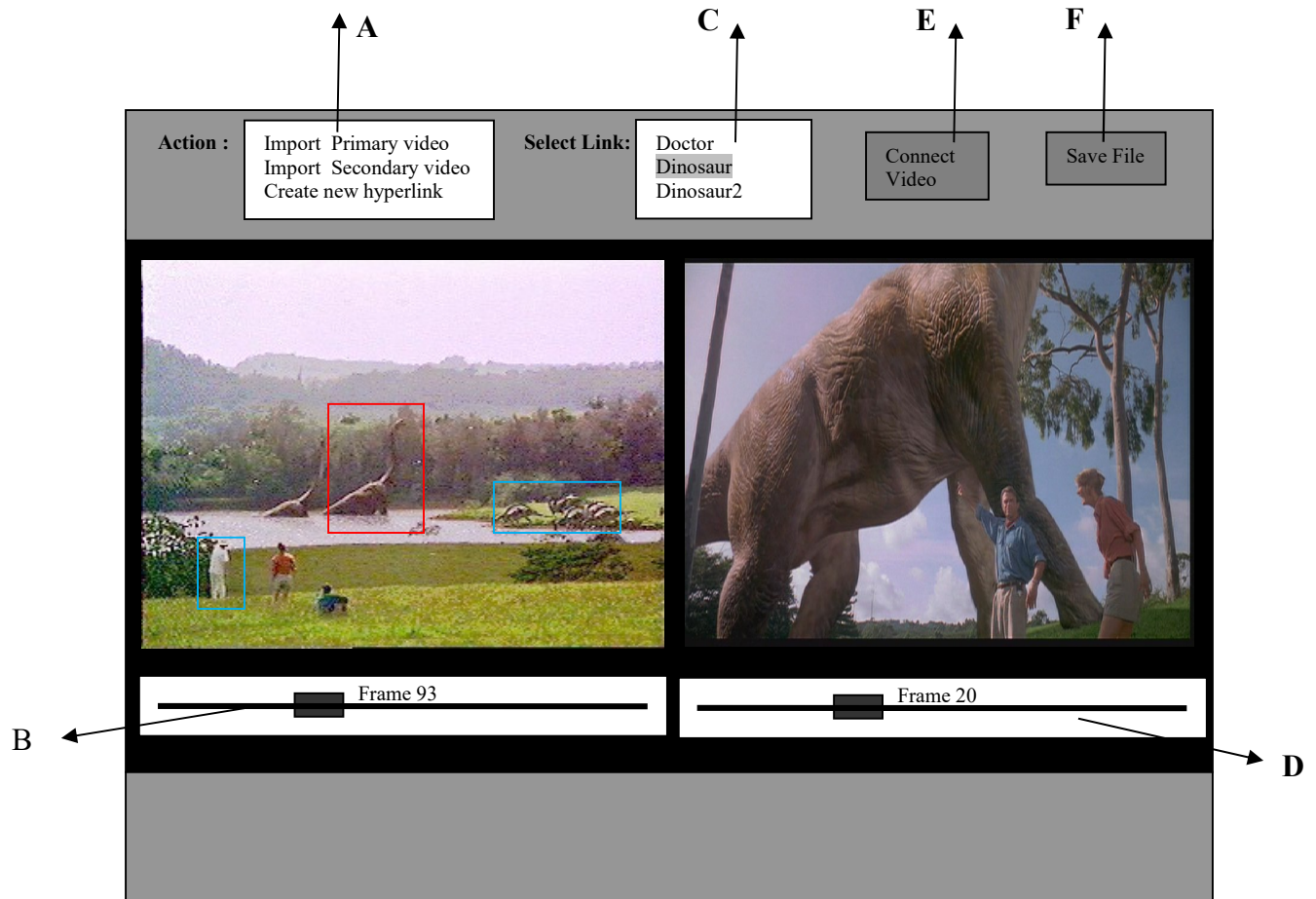
In the above figure

A) Shows you the actions to perform.
- Import video – loads the primary video on the left.
- Import link video – loads the secondary video to the right, you may load secondary videos multiple times in session because different links may need different videos.
- Create new hyperlink – creates a new link with an editable name, centers a default bounding box (which you may edit) and adds it to a list of links which are displayed in C

B) Slider to move across frames for primary video

C) Shows you a list of links that you might have created during a session. You could have their names editable so you can name them contextually. Selecting a link should highlight the link selected (in say red) and also move the primary video to the first frame where it is setup.

D) Slider to move across frames for linked video

E) Define Link – defines the hyper link for the selected item to the video frame of the video currently in D. Note – you should be able to load any secondary video on the right during a session to define your links. For example, you might create a

link, edit it to fit to an area and then load a video on the right which you think you want to link to , and may have to visualize several before you choose the right one.

F) Save file – This will create an auxillary meta data file, of the same base name as the primary video that contains all the hyperlinks. Note you are to follow the same file format for this file shown below and an example be posted on the website.

Part 2: Interactive video player.

Your player should load the specified video and its corresponding meta data file. You should be able to play the video and audio at frame rate. Below is a simple interface for a player – you have a video playing at frame rate with a play, pause and stop button (A, B and C respectively).
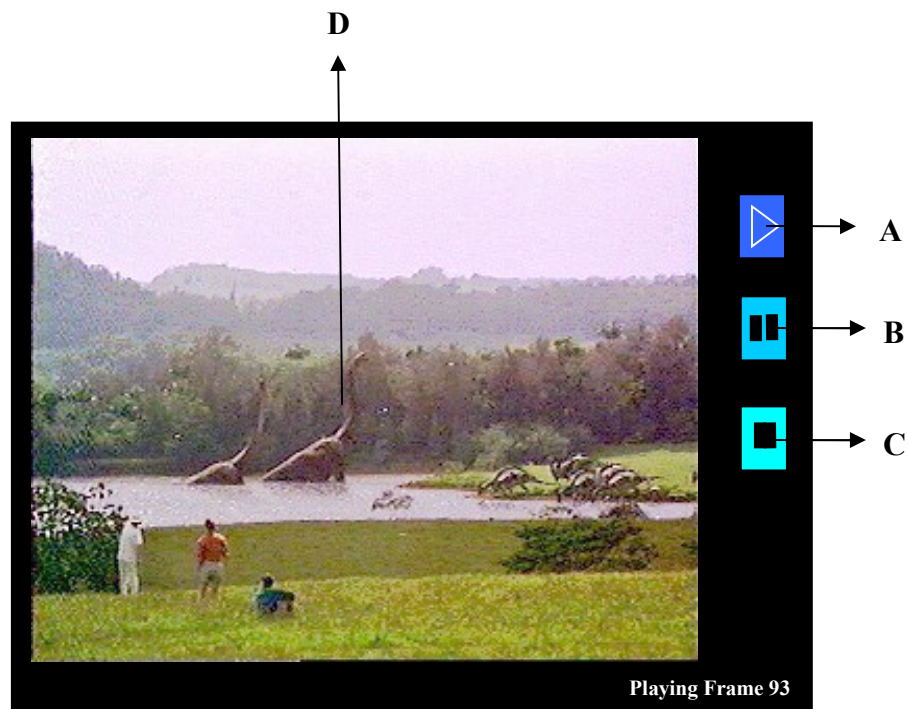
You also need to respect the hyperlinks that were defined in your setup session while creating hyperlinks. So for instance, if you clicked on D while the video is playing, you should stop the current video and load the corresponding video to play it from the frame defined during the setup phase.

Playing Frame 20

Implementation / Grading Guidelines:

- You are free use any programming environment, preferred languages and make use of external libraries of your choice.
- The project will be graded in the form of a presentation, where you will be asked to demonstrate setting up hyperlinked videos using your authoring tool and playback in your player.
- A survey form will be released to you to allow your group to choose a desirable time for the presentation.
- We also ask you to submit your source code on DEN before your presentation.