Motion Capture and Animation using Digital Image Processing

PRESENTED BY: ELIZA MAE SARET

abstract

We present a practical method for human posture recognition and animation through the use of digital image processing as an alternative for expensive means of motion capture. Given an input video of a moving subject wearing colored markers, the application identifies the position of the body parts and maps its movements into a cartoon character.

objectives

This study aims to create a computer program that can be used to facilitate motion capture and animation by fulfilling the following objectives:

01 To use digital image processing and knowledge in human body geometric constraints in detecting and identifying human body parts

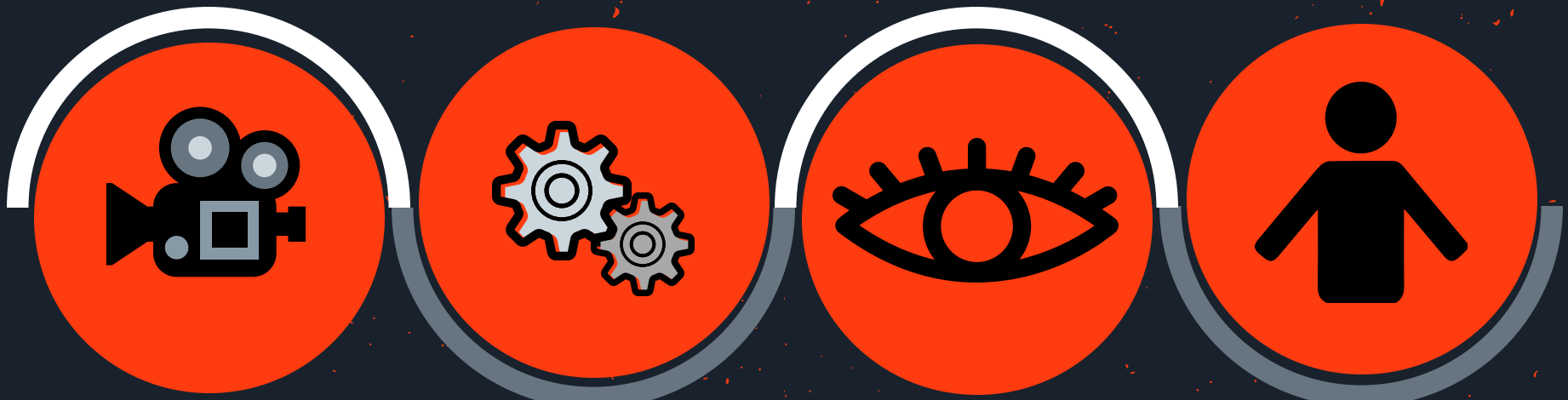
02 To use the detected human body parts in drawing a moving skeletal figure representing the motion executed

03 To map the motions of the moving skeletal figure in animating a character

date & place of study

This study was conducted from January to April, 2018 at the University of the Philippines Los Baños, Institute of Computer Science

materials & methods



video capture setup

preprocessing

body part identification

animation

materials & methods

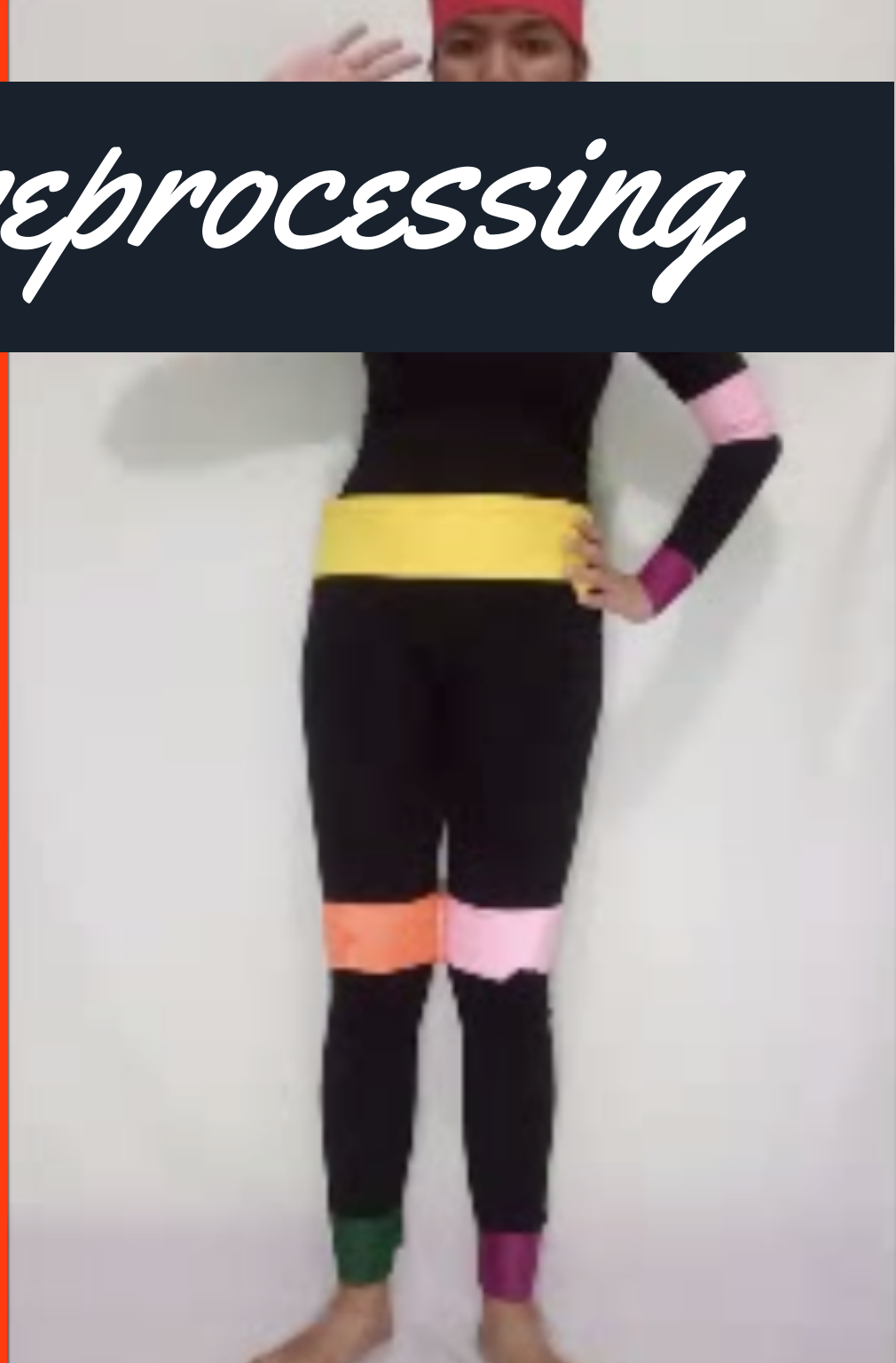
OpenCV 3.3.0 C++ and **Qt Creator 4.5.1** were used in creating the application. OpenCV C++ was used in preprocessing the input videos, identifying body parts and in creating the character animation. Meanwhile, Qt Creator was used to create the user interface for playing and configuring the animations.

setup

A **mini-studio** was setup in order to produce an input video with colored markers that can easily be recognized by the program. This studio consists of **two small led lights** , a **plain white background** , and a **tripod**. The input video was taken using a **cellphone camera**.

preprocessing

Once the video was loaded into the application, its **contrast, brightness** and **saturation** were adjusted to allow the application to detect the colored markers better. The frames were also converted **from BGR to HSV colorspace** which is more suitable for color based segmentation.

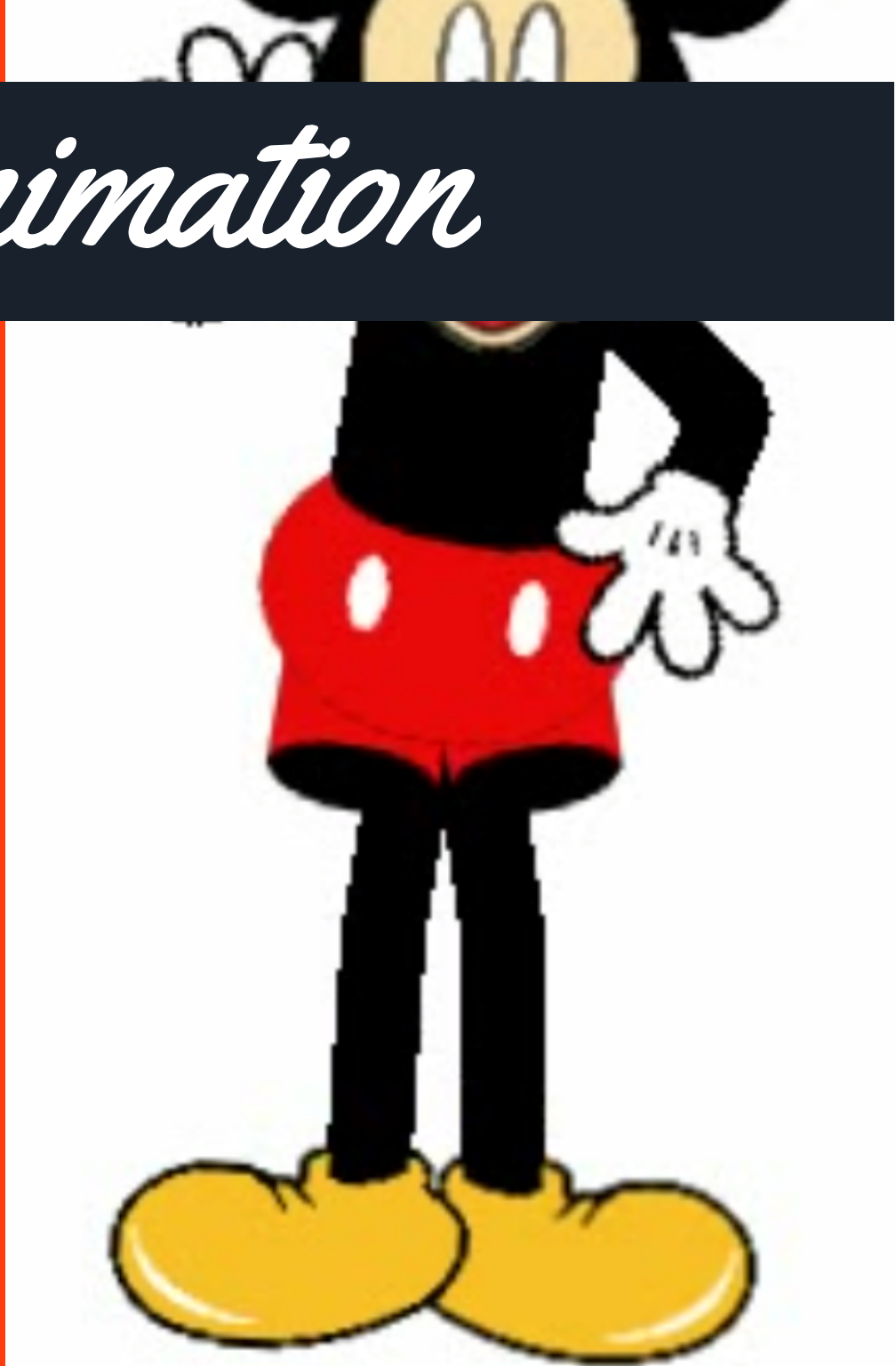


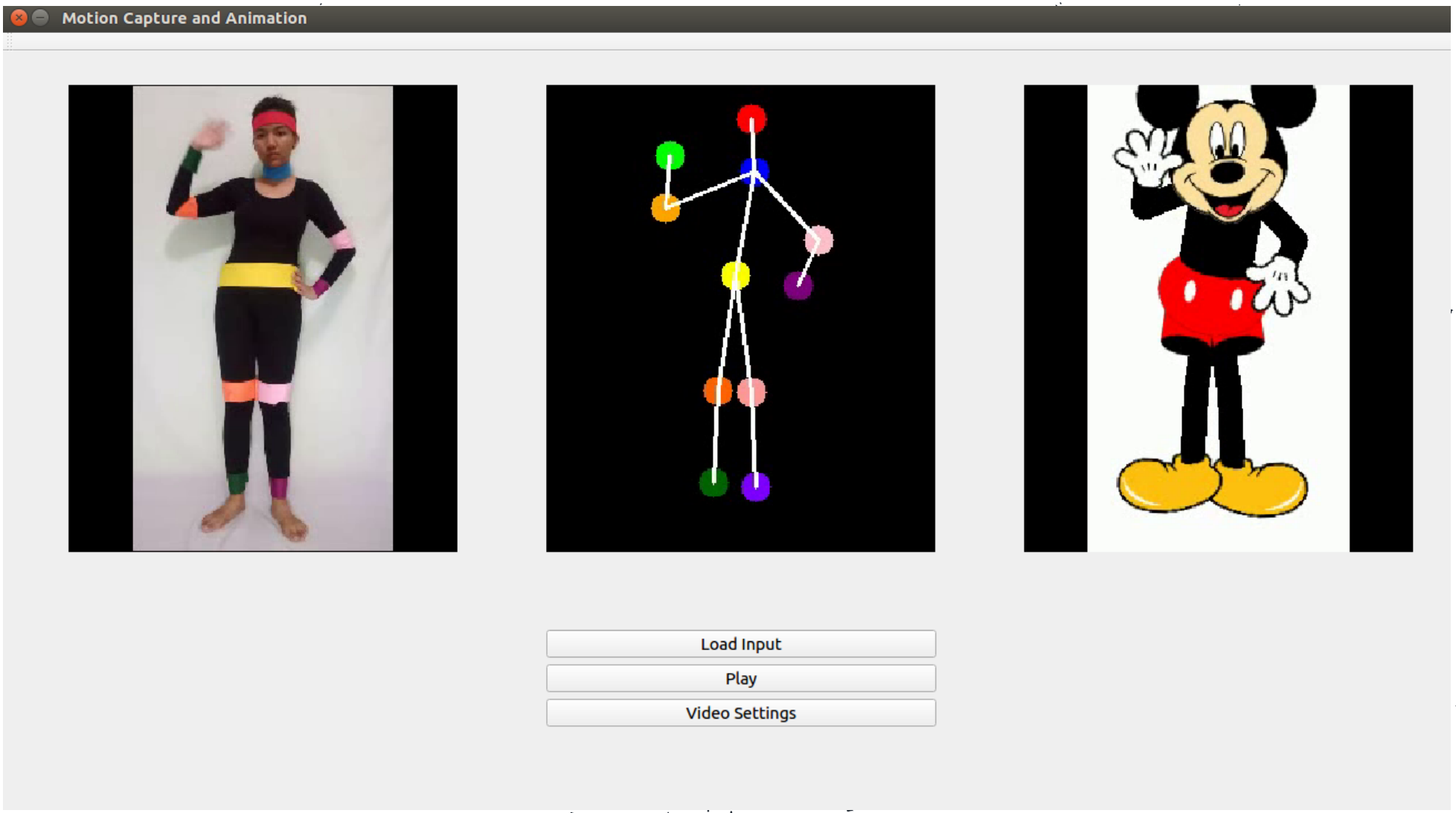
body part identificaation

The colors corresponding to the body parts were located in every frame. In order to identify body parts when a single color is used to represent them, it was assumed that the one found at the **upper part** of the frame is either the **hand or the elbow** and the one found at the **lower part** is the **leg or the foot**.

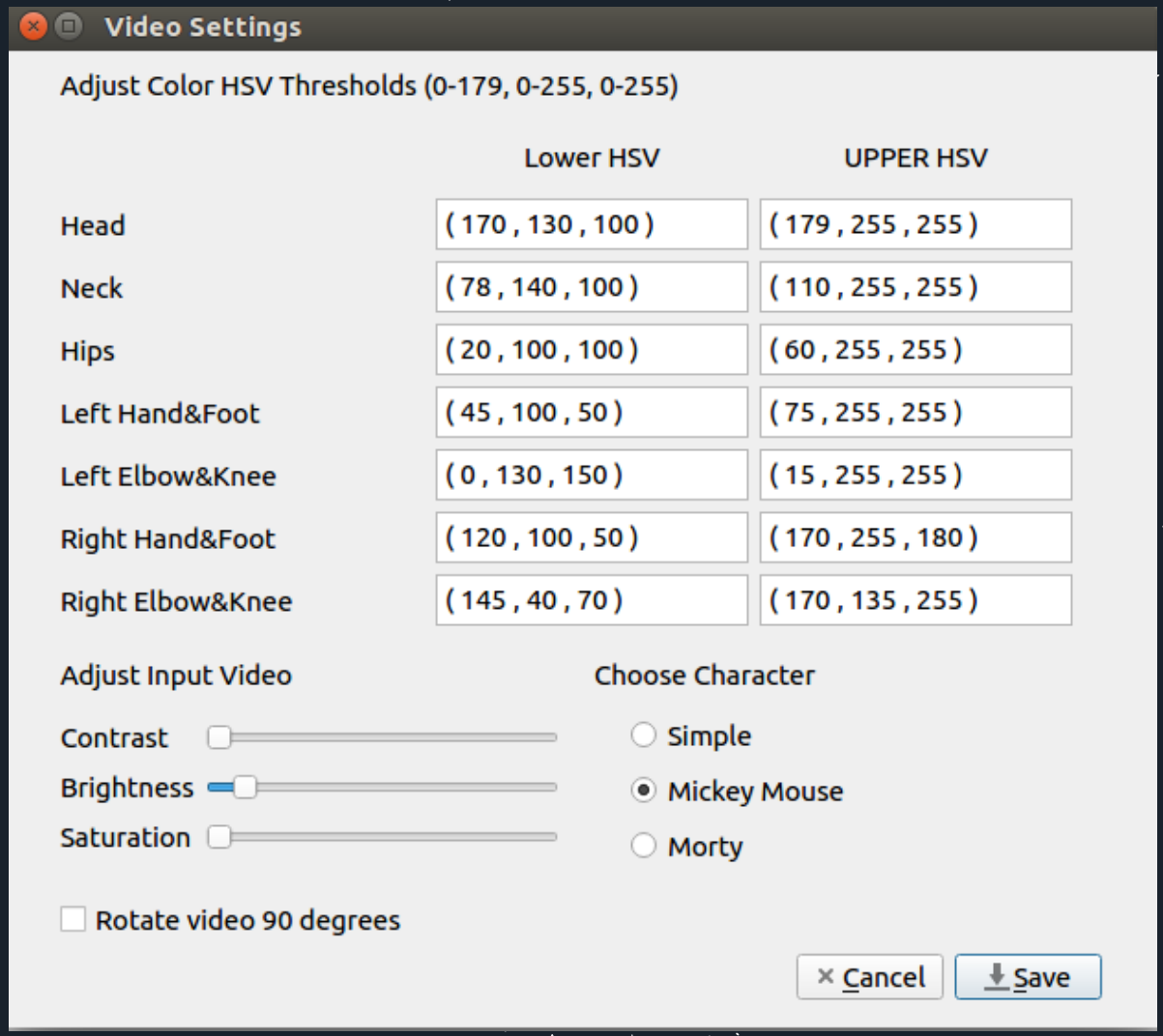
animation

The characters were drawn using a combination of built-iin **drawing functions** in opencv (mostly for the limbs) and **importing images** on detailed body parts. The angle between two endpoints were also taken in order to know how much an image is to be rotated before it is placed in the frame.





homepage displaying all outputs



video configuration options

results & discussions

Three sets of input videos were used to test the ability of the application to detect body movements and animate them.

- dark & inconsistent lighting + valid movements
- balanced light (mini-studio setup) + valid movements
- balanced light + invalid body movements

The set with the inconsistent lighting and the set with invalid movements had more mistakes in body part identification and gave more inaccurate animation as compared to the one taken with balanced lighting and valid movements.

It also took the application a few seconds to a minute to display the outputs depending on the video quality and the length of the input video.

conclusion & future work

- To detect body parts more accurately, it is important to:
  - Consistent amount of light throughout the whole frame
  - Relatively neutral background
  - All markers should be visible in all frames

The output of the demo videos proved that digital image processing can be used as an alternative for expensive means of motion capture based animation.

Other improvements to the application can be done such as:

- Fixing animation when not all markers are visible
- Better human body constraint definition

references

- Dent, S. (2016, July 14). What you need to know about 3D motion capture. Retrieved August 22, 2017, from https://www.engadget.com/2014/07/14/motion-capture-explainer/Speak loudly.
- Dent, S. (2016, July 14). How I turned my Xbox's Kinect into a wondrous motion-capture device. Retrieved August 22, 2017, from https://www.engadget.com/2015/03/08/using-the-kinect-for-motion-capture/?ncid=rss\truncated/
- Szykman, A. G., & Gois, J. P. (2014). Evaluating the Feasibility of Low Cost Motion Capture Systems. Retrieved September 19, 2017.Move around.
- Park, J., Oh, H., Chang, D., & Lee, E. (1999). . Storage and Retrieval for Media Databases 2000. doi:10.1117/12.373539. Retrieved September 24, 2017.
- Chowdary, R., Babu, N., Subbareddy, T., Reddy, B., & Elmaran, V. (2014). Image Processing Algorithms for Gesture Recognition using MATLAB. Retrieved September 19, 2017.
- Toshev, A., & Szegedy, C. (2014). DeepPose: Human Pose Estimation via Deep Neural Networks. 2014 IEEE Conference on Computer Vision and Pattern Recognition. doi:10.1109/cvpr.2014.214. Retrieved September 25, 2017.