Robotic Systems - II

Project 2: Tello

Aswayuja Koduri
ASU ID :1223390480

Lab1: Face Detection and autonomous tracking using Tello

The purpose of this lab:

To make Tello detect human faces in the capture footage in real time and autonomously track the face to keep capturing it in the center of the video frame.

The method of this lab:

For face detection, I used Media Pipe's Face Detection to identify human faces. This solution comes with 6 landmarks and multi-face support. For following faces, movement and speed of Tello are calculated by PID controller to make the drone keep capturing the faces in the center of the video frame.

The result of this lab:

The figures show that the drone could detect the face in the center of the video frame. In addition, when I move to the right, the drone also turns right to follow my face. I successfully achieved the purpose of this lab with the provided method.

Fig. Face Detection and Face Tracking

[Lab-1YouTube Link]

Lab2: Object tracking drone

The purpose of this lab:

To build the system in which Tello can detect various objects in the capture footage in real time based on the color of the object and track the object.

The method of this lab:

First, I convert the image into HSV plane then select only a particular region of HUE, VALUE AND SATURATION by using sliders. Second, I filter out the yellow color and create a mask frame to allow Tello detect any yellow objects. To find the contours for the objects, I use the OpenCV function findContours(). Finally, movement and speed of Tello are calculated by the PID controller to make the drone keep capturing the center of the mass of the yellow object in the video frame.

The result of this lab:

The figures show that the drone could detect and follow the center of the mass of the yellow object in the video frame. I successfully achieved the purpose of this lab with the provided method.

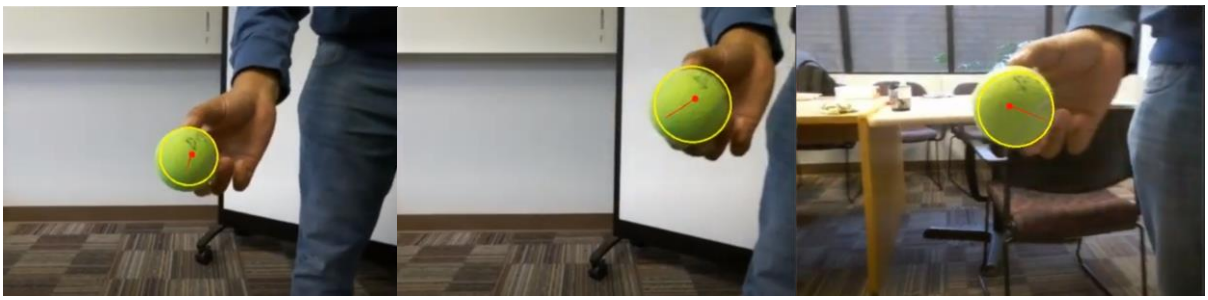


Fig. Object Detection and Object Tracking

[Lab-2 YouTube Link]

Lab3: Controlling Drone with Body Postures

The purpose of this lab:

To build the system in which Tello can detect various human body poses in the capture footage in real time and be controlled by using body postures.

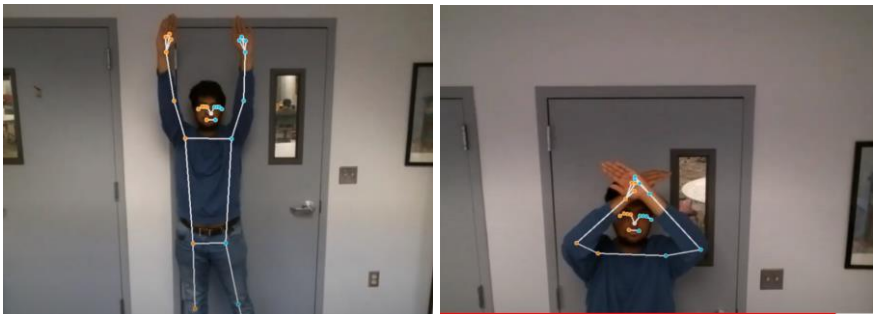
The method of this lab:

First, I use the pretrained model for body pose recognition. This dataset is created by using media pipes body key point detection model and save the videos. Then, after converting these videos to images, the body key points detection data save as CSV file. Second, I build a KNN classifier to identify the body poses and save as a pickle file.

The result of this lab:

The figures show that the drone could detect various human poses in the video frame. In addition, I successfully could control Tello with the body postures. Tello detected the poses and took action such as, move right, move left, move up, and move forward.

A Move Right B. Move Left



C Move Up D Move Forward

Fig. Body Posture Detection

[Lab-3 YouTube Link]

Lab4: Controlling Drone with Hand Gesture

The purpose of this lab:

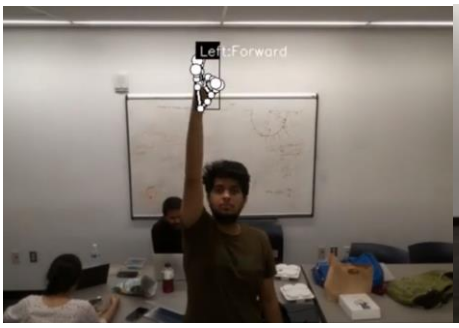
To build the system in which Tello can detect various hand gestures in the capture footage in real time and be controlled by using hand gestures.

The method of this lab:

First, I use the pretrained model for body pose recognition. This dataset is created by using media pipes hand key point detection models and saving the videos. Then, after converting these videos to images, the body key points detection data save as CSV file. Second, I build a KNN classifier to identify the body poses and save as a pickle file.

The result of this lab:

The figures show that the drone could detect various hand gestures in the video frame. In addition, I successfully could control Tello with the hand gestures. Tello detected the poses and took action such as, stop, move up, and move forward.



a) Forward

b) Stop

b) Upward.

[Lab-4 YouTube Link]

Lab5: YELLO (YOLO + TELLO)

The purpose of this lab:

To build the system in which Tello can identify various hand gestures in the capture footage in real time and then perform actions based on the detected object.

The method of this lab:

First, after downloading yolov4-tiny weights, I ran ttyoklov4 implementations. Second, I modified the code in detectornew.py (line 10-20) based on the weights version. Finally, I changed the code to perform spin when Tello detects humans.

The result of this lab:

The figures show that the drone could detect various objects in the video frame in real time. In addition, Tello could successfully take an action spin when Tello identifies humans in the video frame. I successfully achieved the purpose of this lab with the provided method.

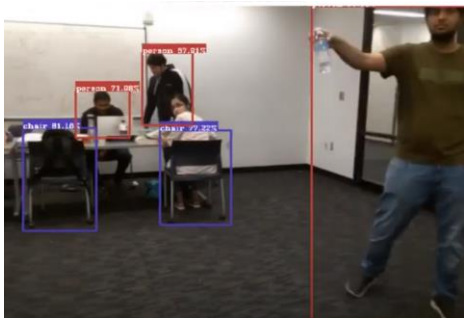


Fig. Detecting multiple objects

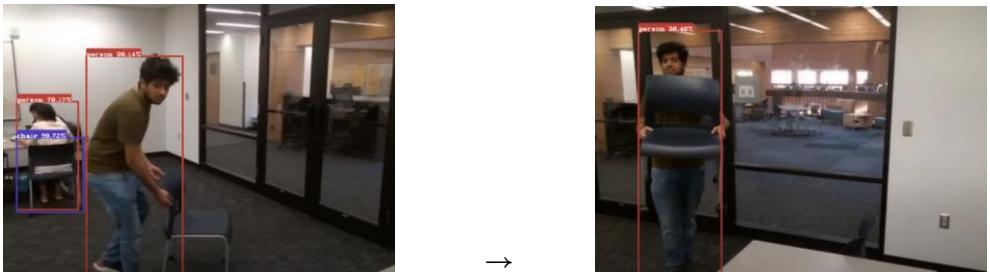


Fig. Turning right after detecting Humans

[Lab-5 YouTube Link]

Lab6: Collision Avoidance Drone

The purpose of this lab:

To build the system in which Tello can identify human faces in the capture footage in real time and then autonomously track the face. During following the face, Tello avoids getting too close to the object.

The method of this lab:

For face detection, I used Media Pipe's Face Detection to identify human faces. This solution comes with 6 landmarks and multi-face support. For following faces, movement and speed of Tello are calculated by PID controller to make the drone keep capturing the faces in the center of the video frame. To avoid going too close to the objects, Tello keeps detecting the area of the object. If its area is greater than the average area of that object, Tello raises an alert and moves backwards.

The result of this lab:

The figures show that the drone could detect the face in the center of the video frame. In addition, when Tello came too close to my face, Tello raised an alert and then moved backward. I successfully achieved the purpose of this lab with the provided method.

Fig. Face Detection

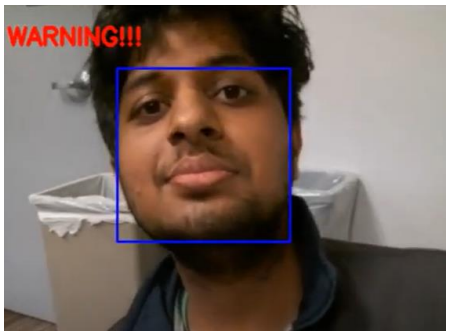


Fig. Collision Alert

[Lab-6 YouTube Link]