**Introduction:**

CCI Video Analysis Tool is a software application designed to assist users in annotating and analyzing traffic videos. It provides features for marking lanes, vehicles, and various events within the video, as well as managing and exporting the annotated data.

**System Requirements:**

* Operating System: Windows
* Python 3.x installed
* Required Python libraries: tkinter, PIL, numpy, cv2 (OpenCV), ttk, csv, filedialog

**Installation:**

1. Ensure Python 3.x is installed on your system.
2. Download the Video Annotation Tool source code.
3. Install the required Python libraries by running the following command in your terminal or command prompt:

pip install -r requirements.txt

or

python -m pip install -r requirements.txt

**Getting Started:**

1. Open a terminal or command prompt.
2. Navigate to the directory where you extracted the CCI Video Analysis Tool source code.
3. Run the following command to start the application:

python CCI Video Analysis Tool.py

1. The CCI Video Analysis Tool window should appear.

**Interface Overview:**

1. **Main Window:**
   * **Canvas for Video Playback and Annotation:** This section displays the video feed where you can draw traffic lanes and markings.
   * **Data Entry Table:** The table allows you to enter various data related to vehicles and traffic events.
   * **Playback Controls:** Control buttons for playing, pausing, and navigating through the video.
   * **Main Control Settings:** Options for loading video, drawing lanes and markings, managing annotations, and exporting data.
2. **Playback Window:**
   * **Canvas for Video Playback and Annotation:** This area shows the video feed with annotated traffic lanes and markings.
3. **Main Control Settings:**
   * **Load Video:** Load a video file for annotation.
   * **Draw Traffic Lanes:** Activate drawing mode to mark traffic lanes on the video.
   * **Draw Markings:** Activate drawing mode to mark specific points or lines on the video.
   * **Done With Lanes:** Complete the process of drawing traffic lanes.
   * **Done With Markings:** Complete the process of drawing markings.
   * **Undo:** Undo the last annotation action.
   * **Add Row:** Add a new row to the data entry table.
   * **Export Data:** Export the annotated data to a CSV file.
   * **Cancel:** Cancel the current annotation process.
   * **Help:** Access the tool's user manual for guidance.
4. **Playback Controls:**
   * **Play:** Start playing the video.
   * **Pause/Resume:** Pause or resume video playback.
   * **+1h:** Skip forward by 1 hour in the video.
   * **-1h:** Skip backward by 1 hour in the video.
   * **+10s:** Skip forward by 10 seconds in the video.
   * **-10s:** Skip backward by 10 seconds in the video.
   * **Frame Forward:** Move forward frame by frame in the video.
   * **Frame Backward:** Move backward frame by frame in the video.
   * **Right Side Line Entry:** It is used to increase the initial number of right side lines.
   * **Time Label:** Display the current timestamp of the video.
5. **Data Entry Table Columns and Usage:**
   * **VehID:** Vehicle identifier number, automatically assigned when a new row is added.
   * **Vehicle Type:** Select the type of vehicle (Car, Bus, Light-duty Truck, Truck).
   * **Entry Lane:** Select the first lane position of the vehicle. (1 is the rightmost lane)
   * **Exit Lane:** Select the lane that the vehicle exits the intersection. (1 is the rightmost lane)
   * **Type of Leading Vehicle:** Select the type of leading vehicle (None, Car, Bus, Light-duty Truck, Truck). If there is no leading vehicle, select None.
   * **Brake:** Record if the vehicle applied brakes. Use right-click to record.
   * **Onset of Yellow:** Record the time when the traffic light turns yellow. Use right-click to record.
   * **Onset of All-red:** Record the time when the traffic light turns all-red. Use right-click to record.
   * **Decision:** Select the decision made by the driver (Stop, Go).
   * **Observed Traffic Conflict:** Record observed traffic conflicts (e.g., Run red light, Abrupt stop). Observing traffic conflicts can be challenging, so it is not necessary to select one for every vehicle.
6. **Run red light:** A red light violation can occur when most of the vehicle is behind the stop line on the onset of red.
7. **Abrupt stop:** An abrupt stop occurs when a vehicle makes an unusually quick deceleration, particularly within 100 ft of the stop bar. This conflict can be recognized by a noticeable “dipping” of the front end and is an obvious last second decision.
8. **Swerve-to-avoid collision:** This conflict is an erratic maneuver of the driver to swerve out of their lane to avoid hitting the vehicle that had stopped for the light in front of them.
9. **Vehicle skidded:** This is a more severe case of abrupt halt. Vehicle skidding sound can be heard when wheels of the vehicle “lock-up” to stop during the yellow phase.
10. **Acceleration through yellow:**  This can be recognized by actually seeing or hearing a sudden acceleration.
11. **Brakes applied before passing through:** This indicates the indecision of the driver before finally deciding to pass through the red phase. This conflict should be carefully considered as in some cases drivers brake to slow down their vehicles due to downgrades or heavy traffic.
    * **Movement:** Select the movement direction of the vehicle (Thru, Left, Right).
    * **Additional Comments:** Add any additional comments related to the vehicle or event.

For columns requiring timestamps (e.g., "Onset of Yellow, Onset of Red, Brake"), click on the respective entry field to record the timestamp.

1. **ML Columns:**
   * **ML Columns:** These columns are used to record timestamps when vehicles pass specific marking lines in the video. Use right-click to record.
2. **Exporting Data:**
   * Click on the "Export Data" button in the Main Control Settings.
   * Choose a location and provide a name for the exported CSV file.
   * Click "Save" to export the annotated data to the selected location.

**Step-by-Step Guide to Using the CCI Video Analysis Tool:**

1. **Load the Video:**
   * Start by loading the video file you want to annotate. Click on the "Load Video" button in the Main Control Settings to select and load your video file.

A screenshot of a computer

Description automatically generated

* + After loading the video, click on the "Video Name" entry box to record the video name.

A screenshot of a road

Description automatically generated

1. **Draw Markings:**
   * Click on the "Draw Markings" button to enter marking mode.

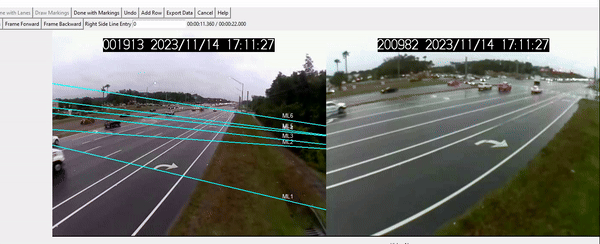
A screenshot of a video

Description automatically generated

* + To draw a line, click on the starting point, hold the click, and release it at the endpoint.
  + Begin by drawing all the lines on the left side of the video frame. Ensure that the last line on the left side is the stop bar.

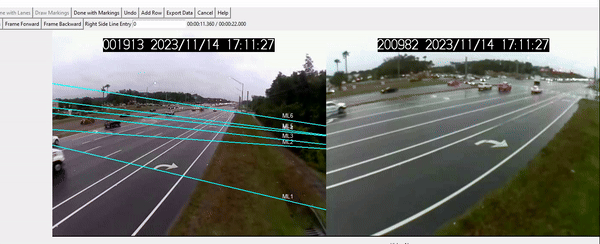


* + Next, draw the equivalent lines on the right side. If you need to adjust the numbering for the right side lines, enter the appropriate number in the "Right Side Line Entry" field. For instance, if you have drawn one line on the right side corresponding to ML6 on the left, set "Right Side Line Entry" to 5.

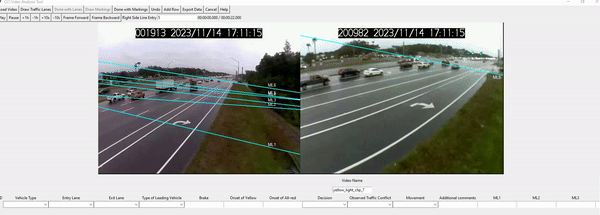


* + After completing all the markings, click on "Done with Markings" to save the lines.

1. **Highlight Lane Lines (Optional):**
   * If you want to highlight the traffic lane lines, click on "Draw Traffic Lanes" to enter lane drawing mode.
   * Draw all necessary lane lines on the video frame.
   * Once all lanes are drawn, click on "Done with Lanes" to finalize the lane annotations.
2. **Playback Controls:**
   * To review the video, you can click "Play" to start playback.
   * Since most videos are 20-25 seconds long, you might not need to play the entire video. You can use the playback controls to navigate through the video frames:
     + Use "Frame Forward" and "Frame Backward" to move frame by frame. Arrow buttons can be used for move frame by frame.
     + Use "+10s" and "-10s" to skip forward or backward by 10 seconds.
     + Use "+1h" and "-1h" to skip forward or backward by 1 hour (though this might be less useful for shorter videos).



1. **Record Vehicle Characteristics:**
   * Use the Data Entry Table to record detailed characteristics of each vehicle and traffic event.
   * Click on the "Add Row" button to add a new row to the table. The Vehicle ID will be automatically assigned.
   * Enter information for each column in the table:
     + **Vehicle Type:** Select the type of vehicle (e.g., Car, Bus, Light-duty Truck, Truck).
     + **Entry Lane:** Select the first lane position of the vehicle. (1 is the rightmost lane)
     + **Exit Lane:** Select the lane that the vehicle exits the intersection. (1 is the rightmost lane)
     + **Type of Leading Vehicle:** Indicate the type of leading vehicle (None, Car, Bus, Light-duty Truck, Truck). If there is no leading vehicle, select None.
     + **Brake:** Record if the vehicle applied brakes by right-clicking to note the timestamp.
     + **Onset of Yellow:** Record the time when the traffic light turns yellow by right-clicking to note the timestamp.
     + **Onset of All-red:** Record the time when the traffic light turns all-red by right-clicking to note the timestamp.
     + **Decision:** Select the driver's decision (Stop, Go).
     + **Observed Traffic Conflict:** Record any observed traffic conflicts (e.g., Run red light, Abrupt stop). Observing traffic conflicts can be challenging, so it is not necessary to select one for every vehicle.
     + **Movement:** Select the vehicle's movement direction (Thru, Left, Right).
     + **Additional Comments:** Add any relevant comments regarding the vehicle or event.
   * For columns requiring timestamps (Brake, Onset of Yellow, Onset of All-red), click on the respective entry field to automatically record the current timestamp.



1. **Export Data:**
   * After annotating the video, you can export the data for further analysis.
   * Click on the "Export Data" button in the Main Control Settings.
   * Choose a location on your computer where you want to save the exported CSV file.
   * Provide a name for the CSV file.
   * Click "Save" to export the annotated data to the selected location.