Semester Project

AI-Enhanced Analysis of Two-Wheeler Rides Using Dash Cam Footage and HMI Integration

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Goal

The primary goal of this project is to develop an AI-powered system that can analyze two-wheeler ride footage captured by a dashboard camera, and integrate it with a human-machine interface (HMI) to provide valuable insights and enhance the overall rider experience.

Objectives

Rider Speed

Utilize AI-powered analytics to identify and address sudden & irregular rise in speed.

Ride Stability

Utilize AI-powered analytics to identify and address sharp & improper turns during the ride.

Object detection & Classification

Leverage data from dash cam footage to analyze and identify objects appearing during the ride & classifying the motion of the object whether stationery or in motion.

Objectives

Relative motion of Objects.

If object is stationery, rider can get near the object (to an extent). Else, rider must maintain certain amount of distance for a safer ride.

Ride Highlights

Identifying and marking the committed infractions through the journey.

Grading the Performance

Grading the overall ride by distributing weightage based on threat level of the misendeavor. A lower score indicate that the ride was safe.

Initial Ideas

- Speed Detection :
  1. Optical Flow
  2. Data from GPS services
- Direction Detection :
  1. Image Segmentation & Optical Flow
- Object Detection :
  1. YOLO (You Only Look Once)
  2. Color & Feature based model
  3. Pixel Based
- Object Classification :
  1. YOLO
  2. Basic determination of object movement
- Relative Moments of Objects :
  1. Used GitHub repository

Initial Ideas

- Path Tracking :
  1. Via GPS
- Error Gradients :
  1. Irregular difference in acceleration
  2. Sharp turns

Chosen Ideas

- Speed Detection :
  Used data retrieval from GPS
  Reason : Optical Flow required intensive training.
- Direction Detection :
  Used Image Segmentation & Optical Flow
  Reason : This model used less resources & computation.
- Object Detection :
  Used Pixel based model
  Reason : Pixel Base model is fast & accurate
  Why not other models : YOLO model is rejected because it's too heavy & slow
  Color & Feature based model is rejected as accuracy is low here

Chosen Ideas

- Object Classification :
  Used Basic determination of Object movement model.
  Reason : This model is lightweight and provides all relevant information that is relevant to the goal.
  Why not other models : Pre-trained models like YOLO gives too much additional irrelevant information that is unnecessary for the project.
- Relative Moments of Objects :
  Used GitHub repository
  Reason : This GitHub repository which was intensive and accurate to detect how far the object is.
- Path Tracking :
  Used GPS
  Reason : GPS is already developed and provides all the required information.
- Error Gradient : The sharp turns made, the irregular acceleration & deacceleration was detected and was assigned score. This score determines the safety of the ride.

What we did

- Every chosen idea was attempted to be implemented.
- Speed determination was implemented via GPS.
- Object determination & classification was implemented using Pixel based model & Basic determination of Object movement model.
- Ride performance report was made at the end using the scores assigned to each committed infraction.

What we couldn't do

- Relative Moments of Objects :
  Used GitHub repository
  Reason : Repositories found were very heavy to compile and are not compatible with the rest of programs.
- Direction Detection :
  Used Image Segmentation & Optical Flow
  Reason : It is very heavy to compile and are not compatible with the rest of programs.