

Research Article

Helmet usage Analysis using Deep Learning

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Abstract

Head protector examination is utilized to recognize the utilization of caps. Street traffic wounds are a significant general medical issue and a main source of death and injury around the globe. In the proposed frameworks, edge location calculation is utilized to distinguish the edges of the bikes and moment object division calculation is utilized to isolate the objects of the equivalent. Protective caps are prepared utilizing the Convolutional Neural Networks (CNN) calculation. Lastly Single Shot Detection (SSD) calculation is utilized to recognize the head protectors and motorbike. Relu work is utilized to figure the exactness. The general proficiency got is 95.4%. This work is basic, powerful and cost-proficient that can spare numerous lives and decrease the stunning weight of street car accidents occurring in everyday life.

Keywords: Deep Learning; Convolutional Neural Networks; Single Shot Detection; Optical character recognition.

Introduction

In pretty much every nation, one among the chief or mainstream method of transportation are bikes because of their less costs and low activity and support cost as contrasted and another vehicles. Notwithstanding, there's a high hazard required because of less insurance and this expands the measure of motorbike mishaps inside the past couple of decade to downsize the included hazard, it's profoundly alluring for bicycle riders to utilize cap since it secures the motorcyclist head against mishaps. Governments have made it required by charging a culpable offense to ride a cruiser without protective cap. Be that as it may, the predominant video observation based techniques are inactive and need huge human help. By and large, such frameworks are infeasible gratitude to contribution of people, whose productivity diminishes over long length. Over the previous decades, some counterfeit clever procedures like computer vision and artificial intelligence with developing advancement has been broadly applied during this zone to recognize head protector.

Felix Wilhelm Sieberta et al. [1] used deep learning techniques to detect helmet usage and position of riders. They need used YOLO algorithm to detect the usage of helmets from video frames. Pradeep Maiya et al. [2] proposed

a system to detect helmets using initially the HOG algorithm then it uses background subtraction and object segmentation to detect helmets from the frame taken from the video. Wen et al. [3] suggested circle arc detection method supported Hough transform. This method is employed to analyse usage of helmet on the closed-circuit television of cash machine.

In Chiu et al. [4] it's used computer vision based system which aims to detect and segment motorcycles partly occluded by another vehicle. Chiverton et al. [5] proposed an automatic system for classification of motorcycles with helmet and without helmet. Support Vector Machine has been used which is trained of (HOG) Histogram of Oriented Gradients to detect the top region of the static images and individual image frame from video data Silva et al. [6] proposed a system for detection of helmet which first starts with moving object segmentation using descriptors then detection of helmet tracing the (ROI) Region of interest which is the head region then classifies between helmet and non-helmet. Dahiya et al. [7] proposed a system for detection of motorcycle riders without helmet using surveillance videos in real time it's used hand crafted features (HOG) Histogram of Oriented Gradients (SIFT) Scale invariant feature transform (LBP) Local binary pattern. Doughmala et al. [8] described half and full helmet wearing usage by Haar like

features like nose, ear, mouth, left eye, right eye and circular. Karwal et al. [9] proposed a system for detection of auto number plate in which it's used normalized cross correlation for template matching with an aim of addressing the matter of scaling and recognition of characters under different positions. Sulaiman et al. [10] process together of image processing and (OCR) Optical Character Recognition to detect vehicle number plate under different background. Lahiri et al [11] proposed a system during which it's used image processing techniques like edge enhancement, un-sharp masking for detecting correctly the edges during a picture and Optical character recognition (OCR) to detect the components in a picture.

Yun-Chung et al [12] proposed a system using Fuzzy system with (OCR) Optical character recognition. R. Silva et al. [13] proposed a way to work out whether bike-rider is employing a helmet or not using visual features and binary classifier. Initially background subtraction and object segmentation has been administered in video frames. R. Rodrigues Veloso e Silva et al. [14] proposed a way for the detection of helmet from images. For this they need used circular Hough Transform and therefore the histogram of oriented gradient descriptor to extract the pictures. During this method the image dataset taken as only about 255 images. Dalal et al. [15] proposed a system to detect whether the given image was an individual or not. This method uses the computation on performance, concluding that fine-scale gradients, fine orientation binning, relatively coarse spatial binning, and high-quality local contrast normalization in overlapping descriptor blocks are used.

In the current framework, they need started to build up a profound learning based way to deal with identify cruiser head protector use. an outsized number of video outlines were prepared inside the calculation to recognize dynamic cruisers, the sum and position of riders, likewise as their cap use. the usage of a commented on test informational index permitted them to guage the precision of our calculation personally . The calculation had high precision for the general location of bikes. Further, it had been able to do precisely recognizing the measure of riders and their situation on the bike. The calculation was less precise nonetheless, for cruisers with an

outsized number of riders or for bikes with an unprecedented rider arrangement. The calculation are frequently expected to get profoundly exact prompts nations, where just two riders are permitted on a motorbike and where riders adherence to the current law is high. Their execution of the calculation can run on buyer equipment with a speed of 14 edges for each second, which is over the casing pace of the recorded video information. In the proposed framework, profound learning approaches were utilized to identify the utilization of head protectors from the continuous reconnaissance recordings. First the video streams are taken from cctv camera film. Edge identification is applied to the video streams to recognize the edges of bikes and head protector while the rest different things, for example, different vehicles, streets, trees were not distinguished. In the wake of distinguishing the edges those identified video outlines experiences the procedure of moment object division. Moment object division is utilized to isolate the item inside a similar class and objects of various class. Presently the portioned video outlines experiences include extraction process. Highlight extraction is utilized to extricate high-lights from the video casings, for example, size, stature, width, edges and edges. Gigantic measure of Helmet picture dataset were taken and prepared utilizing CNN. Prepared dataset is presently given to the SSD which is utilized to distinguish the use of head protector structure the upper 25% of individuals who are riding the bikes.

As we all know the major fatalities in accidents are due to bicycle and motor cycle accidents, we would like to implement our project in real time to deal with this cause that could save millions of people from this threat that could even pay life of a person. There are also various steps taken by our government to avoid such accidents. Non-helmet wearers face serious injuries when compared to those wearing helmets and chances for survival is also high for those wearing helmet. The real motivation for our project is various day to day life incidents that we frequently go through. Not only the riders get affected but also the one who is travelling along with them and pass-ers-by also get serious injuries. When non-helmet wearers met with an accident they get serious injuries in head and brain due to force of collision. This could be prevented if non-helmet wearers are detected

before their arrival in huge traffic areas. We agree there are lot of pre-trained proposals in various do- mains such as Data mining, machine learning etc., but we have implemented in real time environment using Deep learning methodologies why because Deep learning ease and supports real time detection and implementation.

Methodology

A profound neural system prepared to recognize individuals from an outsized arrangement of pictures, will show assortment of highlights in its layers. From the essential layers such highlights become increasingly mind boggling and conceptual. In PC vision such a multifaceted nature goes from pixels, masses, eyes, noses, faces, until garments and full scenes. Obviously explicit neurons will actuate for every one of these theoretical ideas. Amazing that another classifier – state of creatures, blossoms, or vehicles – will use the equivalent implanting particularly in the primary layers. All things considered, masses of pixels, portions and other low level high- lights are generally moderated across areas.

Edge detection

Watchful edge identification can be utilized to separate helpful basic data from various vision objects and drastically diminish the measure of information to be handled. It has been broadly applied in PC vision frame- works. Watchful has discovered that the needs for the apparatus of edge identification on differing vision frameworks are generally comparative. In this manner, a dependable balance recognition answer for manage these necessities are regularly actualized during a wide determination of circumstances. The general models for edge discovery include:

Detection of edge with low mistake rate, which pro- poses that the identification ought to precisely get how- ever many edges appeared inside the picture as could be allowed

The sting point recognized from the administrator ought to precisely limit on the center of the sting.

A surrendered edge the picture should just be checked once, and where conceivable, picture commotion shouldn't make bogus edges. To fulfill the above prerequisites Canny edge identification can be utilized to ascertain the

variety – how which finds the capacity which improves a given useful. The ideal capacity in Canny's locator is depicted by the whole of 4 exponential terms, however it are frequently approximated by the essential subsidiary of a Gaussian. Shrewd edge identification calculation is one of the preeminent carefully characterized strategies that gives great and dependable discovery. Because of its optimality to fulfil with the three models for edge recognition and along these lines the straightforwardness of procedure for execution, it got one of the preeminent mainstream calculations for edge location. The Canny calculation is versatile to different conditions. Its boundaries permit it to be custom fitted to acknowledgment of edges of contrasting qualities depending on the genuine necessities of a given usage.

Instant object segmentation

Occurrence division treats numerous objects of a com- parable class as unmistakable individual articles (or cases). Regularly, occasion division is more earnestly than semantic division. Case division utilizes methods from both semantic division additionally as article discovery. Given an image we might want to foresee the circumstance and personality of articles in that picture (like item identification), notwithstanding, rather than anticipating bouncing box for those articles we need to foresee entire division cover for those articles i.e which pixel inside the info picture compares to which article occasion. In this we get independent division cover for everything about sheep inside the picture rather than semantic division where all the sheep got a proportional division veil.

Convolution neural network

Convolutional Neural Networks perform picture characterization by searching for low level highlights, for example, edges and bends, at that point develop to increasingly digest ideas through a progression of convolutional layer. This layer has a channel which contains cluster of numbers (the numbers speak to either weight or boundaries). The profundity of the channel ought to be equivalent to the profundity of the info. Each extraordinary area on the info volume produces assortment. In the wake of sliding the channel over all the areas, there will be $28 \times 28 \times 1$ exhibit of numbers, which we call an

enactment guide or highlight map. At the point when the channel is at the upper left corner of the info volume, it is registering augmentations between the channel and pixel esteems at that district. At the point when we experience next convolution layer, the yield of the principal convolution layer turns into the contribution of the subsequent convolution layer. In the main layer, the info was only the first picture. In the second convolution layer, the info is the enactment map that outcome from the main layer. So each layer of the info is basically portraying the areas in the first picture where certain low level highlights show up. Presently when a lot of channels are applied on head of that (go it through the second convolution layer), the yield will be initiations that speak to more elevated level highlights.

These elevated level highlights are appended to a completely associated layer to the furthest limit of the system. This layer fundamentally takes an info volume and yields a N dimensional vector where N is that the quantity of classes that the program must pick between. Being given a picture and a mark is that the preparation procedure that convolutional neural networks experience. Back engineering can be isolated into 4 particular areas, the airborne, the misfortune work, the retrogressive pass, and along these lines the weight update. During the forward pass, we take a preparation picture which is a variety of numbers and pass it through the entire system. For instance on first preparing model, since the entirety of the loads or channel esteems were arbitrarily instated, the yield will most likely be something like [.1 .1 .1], essentially a yield that doesn't offer inclination to any number particularly. The ebb and flow loads with its system, isn't prepared to scan for those low level highlights or in this way isn't prepared to make any sensible decision about what the order may be. This goes to the misfortune work some portion of back proliferation. A misfortune work are regularly characterized from various perspectives however a standard one is mean squared blunder, which is $\frac{1}{2}$ times (real - anticipated) squared. At last, to see whether our convolutional neural network works, we have an alternate arrangement of pictures and marks and pass the pictures through the convolutional neural network. We contrast the yields with the base truth and check whether our system works.

In Single Shot Detector calculation, just little items can be recognized in higher goals layers. In any case, those layers contains low-level highlights, similar to edges or shading patches, that are less enlightening for order. Precision increments with the measure of default limit boxes at the estimation of speed. Multi-scale include maps assumes a significant job to recognize the articles at various scale. Configuration better default limit boxes will support exactness. COCO dataset has littler items. Utilize littler default boxes to improve the exactness rate. SSD has lower restriction mistake contrasting and R-CNN yet more arrangement blunder taking care of comparable classes. The higher grouping blunders are likely in light of the fact that we utilize an identical limit box to frame different class expectations. SSD512 has better precision (2.5%) than SSD300 however run at 22 FPS instead of 59. SSD can be prepared start to finish for better exactness. SSD makes more expectations and highlights a superior inclusion on the spot, scale and perspective proportions. SSD can bring down the information picture goals to 300×300 with a relative exactness execution with the above enhancements. The model can run at continuous speed, by expelling the designated locale proposition and furthermore by utilizing lower goals pictures,. The SSD object identification makes out of 2 sections, for example, extricate include maps, and apply convolution channels to identify objects. The SSD approach is predicated on a feed-forward convolutional arrange that creates a fixed-size assortment of jumping boxes and scores for the nearness of article class occasions in those cases, trailed by a non-greatest concealment venture to gracefully a definitive discoveries.

Architecture diagram

The architecture of this work is shown in figure 1.

Results and discussion

These results help to detect the usage of helmets from real time surveillance video taken from CCTV camera footage (Figure 2 and 3). The accuracy obtained is 93.4% on an average calculated using precision method. CNN is used to train the helmet dataset and SSD is used to detect the usage of helmet (Figure 4). The threshold is set to 0.5. The range above 0.5 is

detected as the rider wearing helmet and the range below 0.5 is detected as the rider not wearing helmet. Our future work is to perceive tag which needs a picture with better quality to perceive the characters. The pre-owned descriptors return a ton of highlights and this can troublesome the grouping. Along these lines, the characteristic choice is another future work. As, it is essential to expand the achievement rates, an expert for this sort of calculation is required. Another future work is that the identification of motorbike traveler. A bike can convey the motorcyclist and a traveler, yet the proposed frameworks don't distinguish more than one protective cap in a picture. Since a traveler without head protector might be a petty criminal offense.

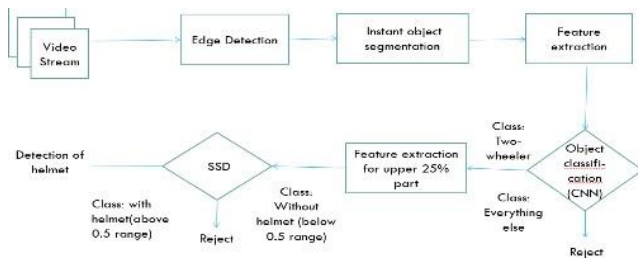


Figure 1. Architecture Diagram



Figure 2. Edge detection

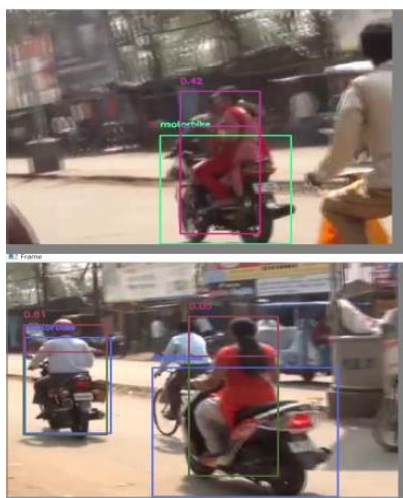


Figure 3. Single shot detector

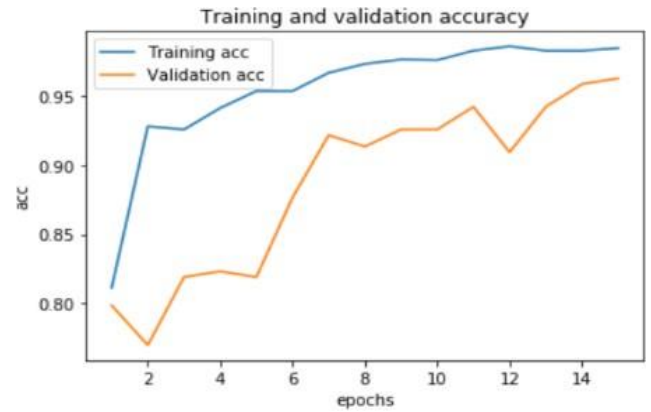


Figure 4. Accuracy graph

Conflict of interest

Authors declare there are no conflicts of interest.

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