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EC601 A2

Project One

My project topic is NFL Health & Safety - Helmet Assignment, segment and label helmets in video footage. The link to this topic is

https://www.kaggle.com/c/nfl-health-and-safety-helmet-assignment. The topic is mainly about inventing an algorithm to assign detected helmet impacts to correct players without a field map to determine player locations. The importance of this topic is that a successful algorithm would help NFL no longer have to manually label every exposure and thus dramatically enhance the speed and scale of researches related to helmet impact. Such support contributes to improvements to medical protocols and game rules. As the result, NFL could make football a safer game. It is not hard to imagine that this algorithm helps NFL analyze historic exposure trends and answer complex questions related to helmet impact. Thus, in the future, NFL perfects the game rule and engineers invent better protection.

Object tracking within the video interests me since it could be applied in various fields. For example, in China, electronic surveillance covers every corner of the city for the sake of public security management. Specifically, when many people enter a building at the same time, the camera can identify each one of them and measure their body temperature for preventing the spread of COVID-19. In addition, autopilot AI implements object tracking to identity signs on the road. Object tracking provides machines with eyeballs that could focus on items. This is a critical step since machines can respond to what they see, which makes the machine more

human. What machines could do better than human is that they could predict the future base on the data. For instance, object tracking could be used in kindergarten or school for predicting dangerous movements among kids.

After doing the literature review, I found that DeepSort could be very helpful. In the article, DeepSORT: Deep Learning to Track Custom Objects in a Video, the author firstly introduces that the difference between object detection and object tracking is that, object detection processes every frame independently and identifies multiple objects in one frame, whereas object tracker needs to use Spatio-temporal features to seamlessly track different objects through the entire video. Admittedly, when using traditional methods, such as meanshift and optical flow, there are many challenges, such as the occlusion of objects, variations in view points, non-stationary cameras, and annotation training data. However, Deep SORT provides high improvements to tracking challenges. The Kalman filter plays an important role in deep SORT since it helps us factor in the noise in detection and uses prior state in predicting a good fit for bounding boxes. It also has a parameter to track and delete tracks that had their last successful detection long back, as those objects would have left the scene. The minimum number of detections threshold for the first few frames is used to delete duplicate tracks. DeepSORT uses the squared Mahalanobis distance to incorporate the uncertainties from the Kalman filter and uses the standard Hungarian algorithm to associate the data. To conquer the challenges mentioned above, deep SORT introduced a distance metric that can describe all features of a given image by building a classifier base on the dataset, training it till achieving good accuracy and then strip the final classification layer.

The open-source project I found useful to duplicate results is a repository that contains code for

Simple Online and Realtime Tracking with a Deep Association Metric (Deep SORT). The link is

https://github.com/nwojke/deep_sort.

Work Cited

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