VirtualEye - Life Guard For Swimming Pools To Detect Active Drowning

(Category: Artifcial Intelligence)

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ABSTRACT

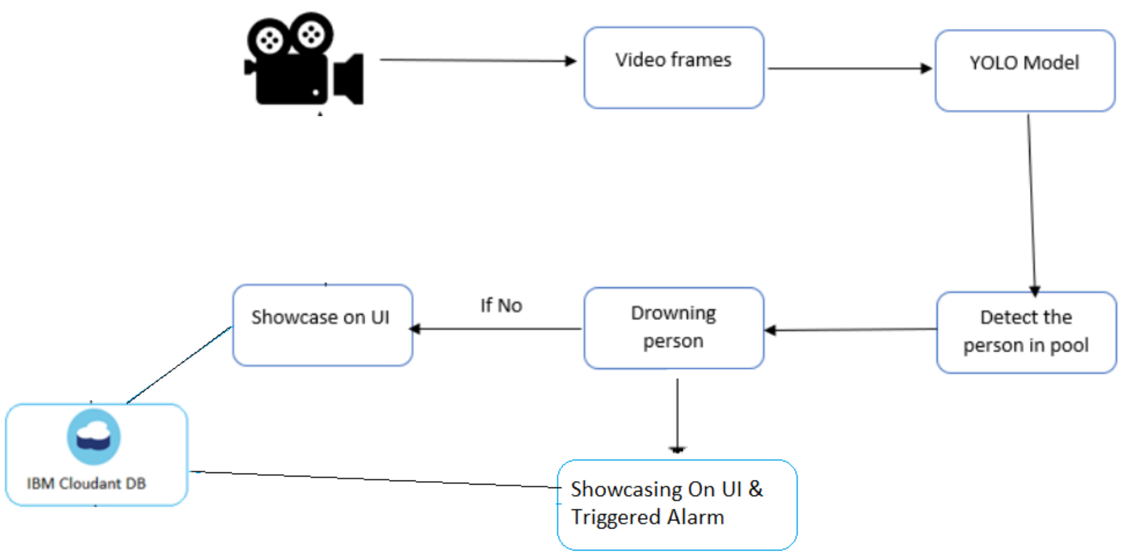
In this project, we'll build a drowning detector program. We are using YOLO object detection and can detect whether a person is drowning or it's a normal person. Similarly, a Raspberry Pi Camera should be used for this project, and can then be put into underwater with a suitable case.

Let's understand how this project is used to detect a drowning person. So, the initial step is to identify the person first and draw a blue rectangle box around them. After drawing the rectangular box, this project store the center position of the person from the created rectangular box. And, the program runs till 10 seconds to compare the position of the person which means to compare a person's position is more or a person's position is less or a person's position is falling. If the program detects the drowning person then the blue rectangular box will now turn to red and the word 'DROWN' will appear on the top of the person. Similarly, if the program detects the center position of the person is above water, then the term 'DROWN' would be omitted by the program as a person are only standing in the pond.

INTRODUCTION

With the constant improvement of public swimming pool facilities, people in large numbers flock to the swimming
pool. But drowning has become a concern when people enjoy the pleasure that comes with swimming . The reason for drowning is that beginners cannot breathe freely in the water, and it is difficult to maintain body balance. Swimmers who have mastered swimming skills will also drown when they suffer from sudden cramps and stress . At present, for the safety of natatoriums and outdoor swimming venues, some of the venues use conventional human supervision mode. Each swimming pool relies on 2–4 lifeguards to keep a close eye on the water surface to prevent and rescue drowning swimmers. However, this kind of super-vision model is not very reliable for the ability of lifeguards
to deal with emergencies is weak, and the rescue speed of drowned swimmers is also very slow. It is difficult to effectively guarantee public safety in the venues. Coupled with the limitations of human physiological conditions, it is hard for lifeguards to maintain a high concentration of attention
for a long time. Looking at the swimming pool water surface for a long time will also make the lifeguard feel dizzy. Some venues use cameras to monitor the interior and underwater of the swimming pool, but most of them are manual operation, not only consuming manpower, but the monitoring effect will be affected by factors such as people's emotions and fatigue. It is prone to miss inspections and prevent drowning.

ARCHITECTURAL DESIGN



PROPOSED METHOD

YOLO is an abbreviation for the term ‘You Only Look Once’. This is an algorithm that detects and recognizes various objects in a picture (in real-time).

Object detection in YOLO is done as a regression problem and provides the class probabilities of the detected images.

YOLO is an algorithm that uses neural networks to provide real-time object detection. This algorithm is popular because of its speed and accuracy.

YOLO algorithm employs convolutional neural networks (CNN) to detect objects in real-time. As the name suggests, the algorithm requires only a single forward propagation through a neural network to detect objects.

This means that prediction in the entire image is done in a single algorithm run. The CNN is used to predict various class probabilities and bounding boxes simultaneously.

Why the YOLO algorithm is important

YOLO algorithm is important because of the following reasons:

- **Speed:** This algorithm improves the speed of detection because it can predict objects in real-time.
- **High accuracy:** YOLO is a predictive technique that provides accurate results with minimal background errors.
- **Learning capabilities:** The algorithm has excellent learning capabilities that enable it to learn the representations of objects and apply them in object detection.

How the YOLO algorithm works

YOLO algorithm works using the following three techniques:

- Residual blocks
- Bounding box regression
- Intersection Over Union (IOU)

Residual blocks

First, the image is divided into various grids. Each grid has a dimension of S x S. The following image shows how an input image is divided into grids

In the image above, there are many grid cells of equal dimension. Every grid cell will detect objects that appear within them. For example, if an object center appears within a certain grid cell, then this cell will be responsible for detecting it.

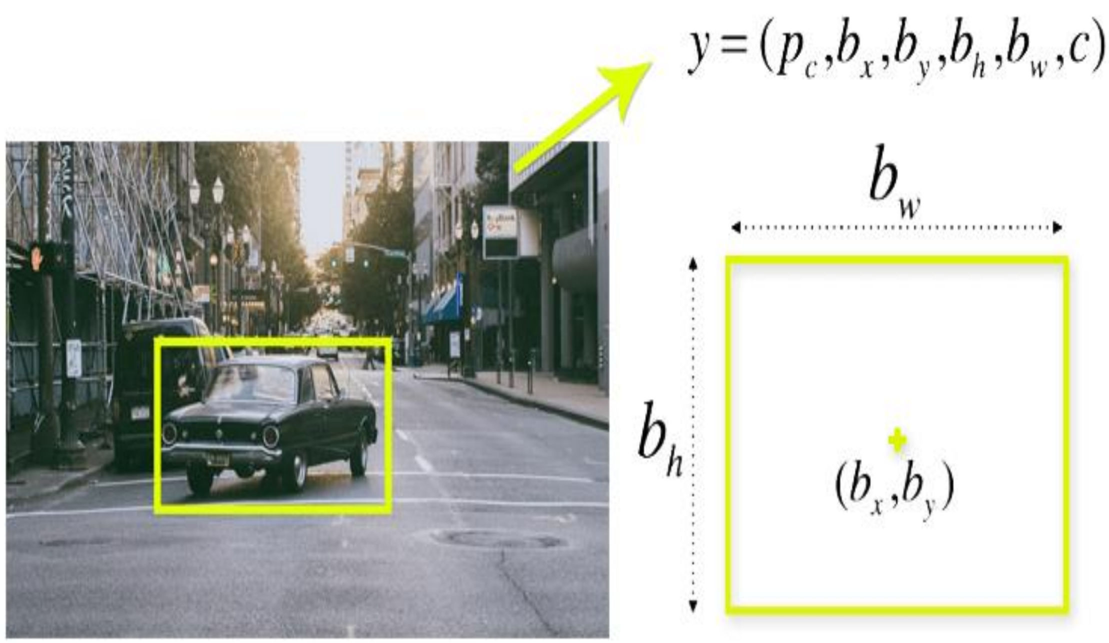
Bounding box regression

A bounding box is an outline that highlights an object in an image.

Every bounding box in the image consists of the following attributes:

- Width (bw)
- Height (bh)
- Class (for example, person, car, traffic light, etc.)- This is represented by the letter c.
- Bounding box center (bx,by)

The following image shows an example of a bounding box. The bounding box has been represented by a yellow outline.

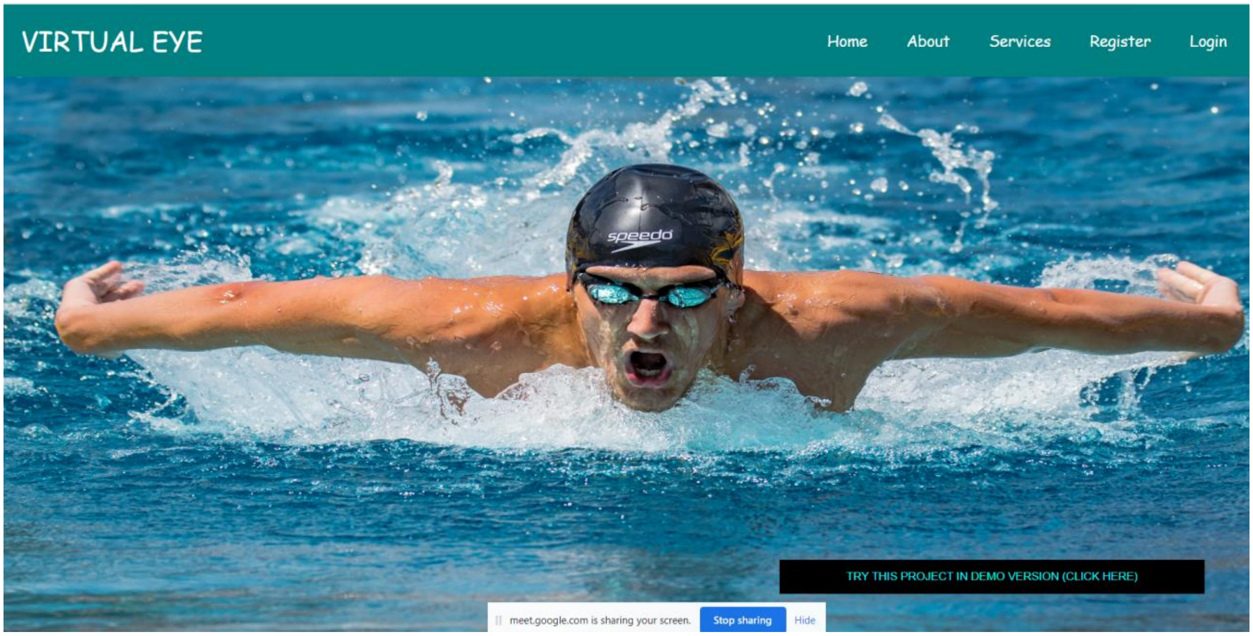


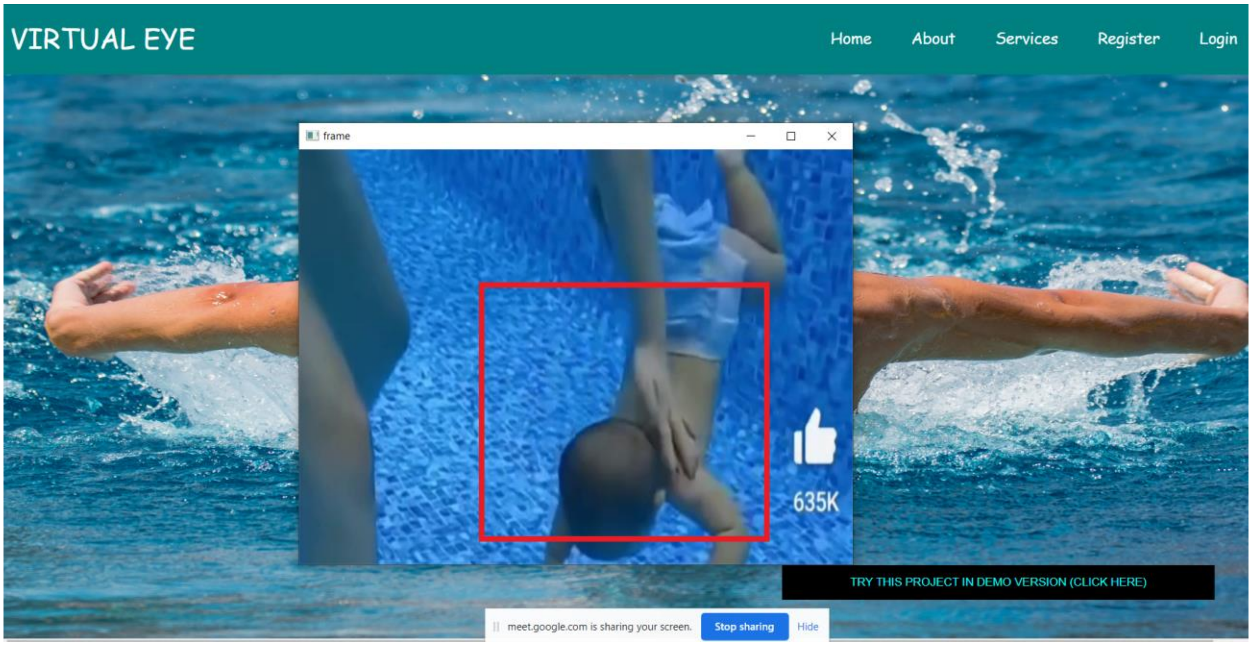
YOLO uses a single bounding box regression to predict the height, width, center, and class of objects. In the image above, represents the probability of an object appearing in the bounding box.

CONCLUSION

In this paper, we provided a method to robust human tracking and semantic event detection within the context of video surveillance system capable of automatically detecting drowning incidents in a swimming pool. In the current work, an effective background detection that incorporates prior knowledge using YOLO enables swimmers to be reliably detected and tracked despite the significant presence of water ripples. The system has been tested on several instances of simulated water conditions such as water reflection, lightening condition and false alarms. Our algorithm was able to detect all the drowning conditions along with the exact position of the drowning person in the swimming pool and had an average detection delay of 1.53 seconds, which is relatively low compared to the needed rescue time for a lifeguard operation. Our results show that the proposed method can be used as a reliable multimedia video-based surveillance system

OUTPUT

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