Table 1. The object detection salient comparison

Reference Paper	Year	Result	Methods	Characteristic	Future work
[25]	2017	A new deep complete convolution network model	A new r-dropout (Regularized-dropout) is introduced to promote probability training and reasoning; the hybrid up-sampling method detects the precise boundary	It can contain more uncertainty and face the need for more accurate object boundary reasoning	-
[31]	2018	A new neural network: attention salience network (ASNET)	Using fixed prediction, the fixed graph is used as the derivation of the upper network layer, and the outstanding target detection is segmented by significance, and then it is gradually optimized from top to bottom under the guidance of the fixed graph	Using the importance of a fixed graph to strengthen the relationship between significant target detection and fixed detection	This paper discusses the basic principle of SOD from the perspective of fixed prediction and looks for a better loss function to improve the performance of the SOD model based on deep learning

As Table 1 shows the Salient Object Detection (SOD). ASNet and R-dropout are the methods that can be used for the SOD. The table shows that both ASNet and R-dropout are successful methods used for object detection.

Table 2. The 3D object detection comparison

Reference Paper	Year	Result	Methods	Characteristic	Future work
[23]	2017	A 3D full convolution network based on FCN can be applied to 3D vehicle detection of the autonomous driving system	Detect and locate the target as a 3D box in the point cloud	Compared with the previous point cloud-based detection method, the performance of this method is improved by 20%	-
[24]	2017	3D object detection and pose estimation from a single image	Using the depth convolution neural network to get the 3D object attributes, combined with a 2D object bounding box to get a new 3D bounding box	It is better than L2 consumption, and the variance of 3D object dimension is relatively small	Effective use of time information to explore 3D box estimation in video and predict object position and speed
[32]	2018	Achieve a high recall rate of RGB-d data 3D target detection in indoor and outdoor scenes	The original point cloud is operated by RGB-d scanning, and the object location is realized by combining the mature 2D object detector and 3D depth learning	Can adapt to strong occlusion or sparse point cloud	Improve recognition accuracy and realize the recognition of multiple objects

Table 2 shows 3D object detection, a modern-day technology. RGB-D, Depth Convolution Network, and FCN are used for 3D object detection. FCN has good detection accuracy and faster recognition than other neural networks.

Table 3. Shows End-to-End Approach comparison

Reference Paper	Year	Result	Methods	Characteristic	Future work
[27]	2017	The trained network can distinguish and detect UAVs from birds	The end-to-end object detection model based on CNN	the trained network has good generalization , high accuracy and recall value	Future work can take the time domain into account to further improve performance
[28]	2018	the average accuracy of faster r-CNN is about 16% higher than that of Yolo v2.0	Faster R-CNN and YOLOv2	--	to make the data analysis of camera trap image automatic based on this data set and help humans understand the population dynamics of the earth's ecosystem
[29]	2018	A new in-depth learning method (afforcenet) is proposed to detect multiple objects and their afforcements from RGB images simultaneously. Very suitable for real-time robot applications	Three components: a sequence of deconvolutional layers, a robust resizing strategy, and a new loss function	Its end-to-end architecture is 150 milliseconds per image	
[30]	2018	A new end-to-end trainable depth architecture (voxelnet) based on point cloud 3D detection is superior to the most advanced lidar 3D detection method	Capture 3D shape directly from sparse 3D points and connect to RPN to generate detection	Eliminate the need for a 3D point cloud for artificial feature engineering. It combines feature extraction and bounding box prediction into a single, end-to-end trainable depth network	Expand voxelnet to combine lidar and image-based end-to-end 3D detection with improving detection and positioning accuracy further

Table 3 discuss the end-to-end approach to object detection. CNN, Fast R-CNN and YOLOv2 deep learning methods are used for this approach. Among them, Fast R-CNN achieved higher accuracy and faster recognition results compared to CNN and YOLOv2. Figure 1 shows the deep learning working domain in various subjects.

The figure shows the object detection applications and methods used in those applications. Some object detection applications are; Robotics, Image detection and training, 3d object detection, Salient object detection and end-to-end approach. The object detection task almost uses CNN in most applications based on accuracy and has fast recognition speed in Deep Learning (DL) techniques and other neural networks.

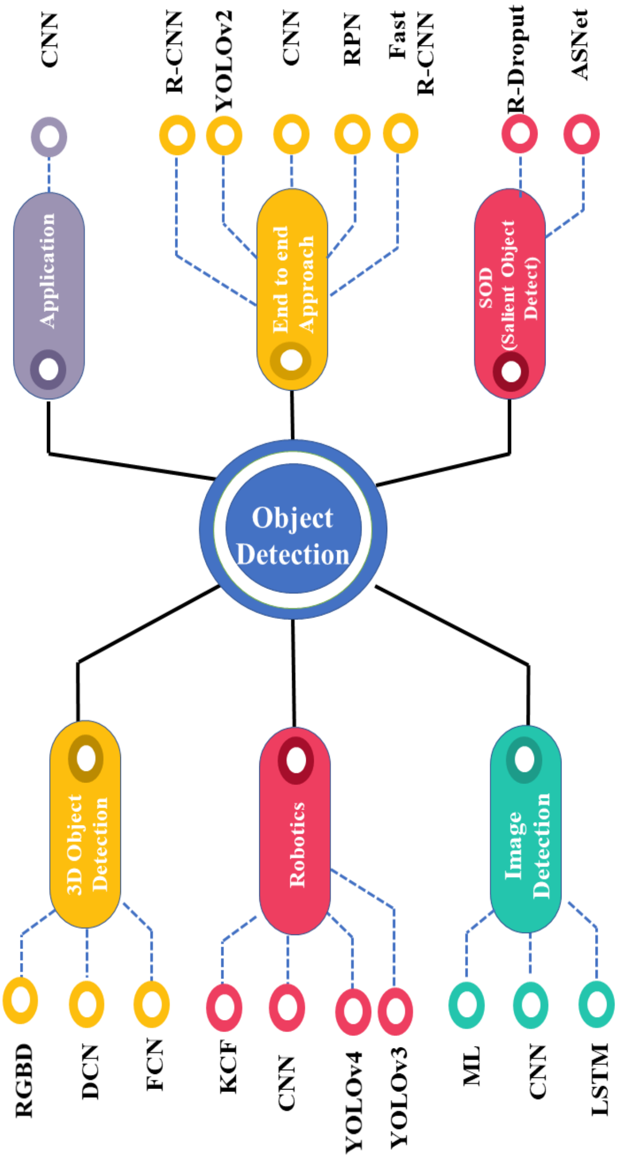

Figure 1. Object detection application Vs method

Section V: CONCLUSION

Object detection can help many security agencies, especially law enforcement security agencies, to avoid violations and problems. The main aim of this review was to find which deep learning method can be used for object detection and how it can be helpful to the human world. Some years ago, finding and classifying objects in a picture was hard and almost impossible. But today, with the help of computer vision and deep learning technology, it is quite easy to do these tasks and recognize any image. For object detection, many computer vision-based techniques and algorithms are used. CNN, R-CNN, Faster R-CNN, Mask R-CNN, YOLO (with different versions; V2, V3, V4 and R), MobileNet and SqueezeDet. These algorithms have a very high accuracy of recognition and detection, Especially the CNN, Faster R-CNN and YOLOv2. These Deep Learning methods and algorithms [51] make it easier for computer vision applications to recognize and detect any object, especially for detecting vehicle license plates.

Computer Vision plays a very key role and thus helps a lot of big industries these days. With the help of identifying objects in images or videos, they can improve many problems and difficulties they face. Smart systems equipped with computer vision face several difficulties, paying attention to which it only makes the system more accurate.

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