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Detection of a user-defined object in an image using feature extraction-Training based

Arun Sai S

Department of Computer Science and Engineering, Manipal Institute of Technology, Karnataka, India

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Abstract - *Object detection in computer vision plays a critical role in understanding a scene amid a cluttered background. Object detection is a subfield of computer vision and image processing that identifies objects in images and videos. Even after numerous advances in object detection, it is still difficult to effectively determine and identify an object from a background of similarly shaped objects. In this study, I suggested a method for detecting objects against such a chaotic background by combining contour detection, edge detection, K-means clustering, color identification, and image segmentation. The suggested method uses an original object in an image as the source object and then trains the system using a feature set to reliably recognize and identify the specified target object.*

Key Words: Contour Detection (CD), Structural Similarity Index Measure (SSIM), Computer vision, Masking, You Only Look Once (YOLO), SSD, K-Means.

1. INTRODUCTION

One of the most significant industrial applications for reducing user stress and saving time is detecting and comparing objects in digital images. These technologies were developed many years ago, but need to be further improved to achieve the desired goals more efficiently and accurately. There is a growing demand for improvements in image processing technology to achieve high performance. In image analysis, image segmentation is a prominent image processing technique. As we move towards a more complete understanding of images, more accurate and detailed object recognition becomes increasingly important. It is critical in this context to consider not only classifying images but also precisely estimating the class and distinguishing the objects, as well as the co-ordinates and location of an object that present in image, an issue known as object detection. Detecting objects in images or image sequences is an area of computer vision called object recognition. In the real world, humans can effortlessly recognize all objects, even if they differ in some way, such as scale, size, orientation, rotation. Machines, on the other hand, do not possess the ability to detect and recognize on their own. Extremely complex detection algorithms are implemented on machines that can detect objects in images and videos but each algorithm has its own set of drawbacks. As a result, it is necessary to design and enhance algorithms for this purpose.

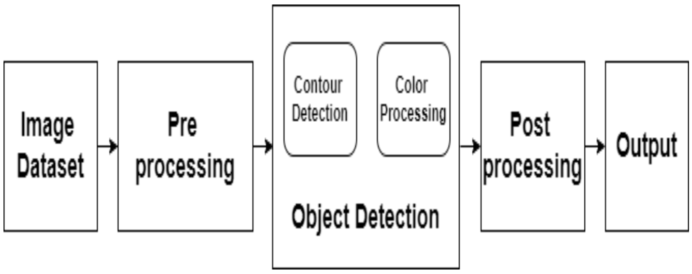

Fig.2.1 Block Diagram of Proposed System

2. LITERATURE REVIEW

Object detection systems developed to date can be classified into three broad categories. Model-based systems fall into the first category, in which a model is defined for the interest point and the system attempts to match this model to various parts of the image in order to find a fit. Image invariance is another kind of matching approach, and it is built on a collection of image pattern connections (such as brightness levels) that identify the items being looked for. Example-based learning algorithms distinguish the final group of object detection systems. [2]

Over the years, many methodologies for object detection and identification have been proposed. Some of them are as follows:

A) Single Shot Detector (SSD):

A real-time object detection system is SSD (single Shot Detector for object Detection using Multi field).

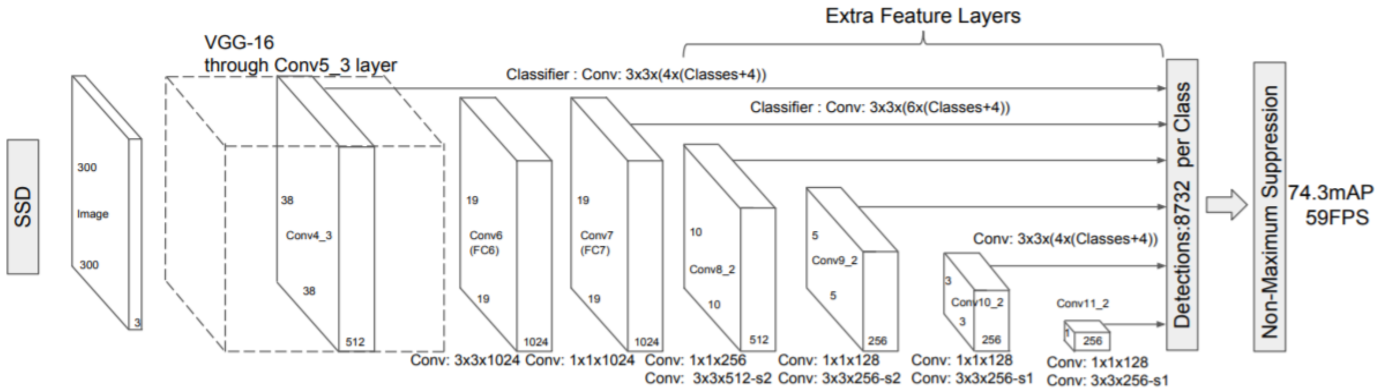

Fig 2: Single Shot Detector (SSD) Architecture [6]

It has the capability to locate ninety precise objects. R-CNN is quicker as it employs a vicinity concept network to assemble boundary boxes, which it then uses to categorize objects. Even though it is considered state-of-the-art in terms of accuracy, the whole technique runs at a rate of seven frames in keeping with 2d. A lot below the necessities of actual-time processing. SSD hurries up the procedure by means of removing the requirement for the area proposal network. To compensate for the loss of precision, SSD provides a few enhancements such as multi-scale features and default boxes.

Fig 3: Object Detection using SSD Algorithm [3]

These SSD advancements allow it to match the accuracy of the Faster R-CNN using lower resolution images while increasing the speed.

B) YOLO (You only look once):

"You Only Look Once," or YOLO, is an abbreviation that stands for "You Only Look Once." It's a method of detecting items using an algorithm. It's one of the most well-known and extensively used object detection methods. It is run as a regression problem, and objects from the detected class are returned. The YOLO Algorithm uses a Convolutional Neural Network to recognize and identify objects in real time (CNN). This algorithm, as the name implies, requires a single forward progression through a neural network. In a single algorithm run, this feature algorithm can detect the objects present in an image or video. Simultaneously, it can detect multiple class possibilities and draw a bounding box around the discovered object using CNN. The YOLO algorithm was released in several versions. Among the popular variants, Tiny YOLO and YOLOv3 are the two algorithms.

C) Appearance based approach:

Diverse picture processing techniques and methodologies had been utilized in appearance-primarily based object detection to stumble on the objects. strategies which includes edge matching, gradient matching, grayscale matching, histogram matching, and so on.

D) Color based Approach:

Most of the people of existing object detection algorithms rely on intensity-primarily based features and typically avoid item color information. This shade elimination is caused by excessive assessment in coloration, which occurs due to modifications in illumination, shadows, compression, and so forth. As the lighting situation modifications, the color detection-based totally technique turns into extra complicated, and as a end result, the accuracy decreases.

3. METHODOLOGY

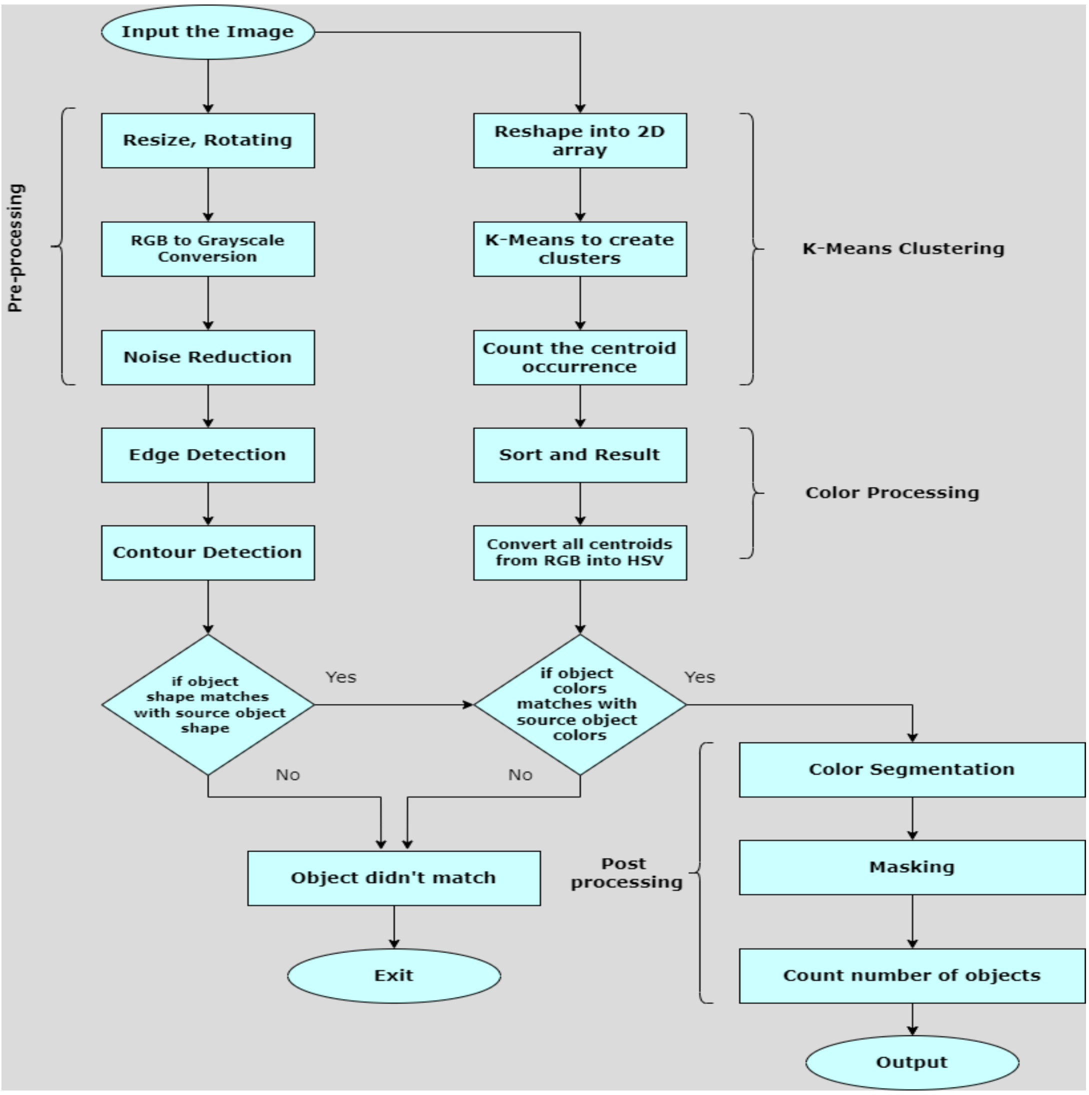

Fig 4: Flow chart of proposed system

A) Prerequisite to Input:

The input image that is fed into the object detection system in order for it to predict the object must be in a specific format. If the input image does not conform to the system's specifications, the accuracy of the result will be reduced. It entails resizing the target image in relation to the source image, rotating, flipping, translation, shifting, cropping and image transformation.

B) Pre-Processing of an Image:

1) RGB to Grayscale conversion:

Colors in a grayscale image are only shades of gray. The reason for converting RGB to grayscale is that less information is required for each pixel. In reality, a 'grey' color is one in which the intensity of the red, green, and blue components in RGB space is equal. As a result, each pixel requires only one intensity value to be specified. Grayscale images are stored as an 8-bit integer with 256 different shades of grey ranging from black to white. Grayscale images are frequently used, which is due in part to the fact that most modern display and image capture hardware can only support 8-bit images. Furthermore, grayscale images are completely adequate for many tasks, so there is no need to use more complicated and difficult-to-process color images.

2) Noise Reduction:

Noise may manifest itself in a number of ways in digital images. Image noise is created by picture acquisition problems that do not precisely reflect the true values of the real scene. A filtering method used to decrease or remove noise in an image is known as noise reduction. By smoothing the whole image and leaving sections near contrast limits, noise reduction methods reduce or eliminate the appearance of noise.

C) Image Processing:

1) Contour Detection:

A contour is a closed curve that connects all continuous points with some color or intensity to form the shape of an object detected in an image. The contour detection technique will be extremely useful in shape detection and analysis, as well as object identification and segmentation. Contours, on the other hand, are nothing more than a collection of continuous points that correspond to the shapes of the object. These contours can be used in our object detection system to categorize the shapes of objects, crop objects from images, segment images, count the number of similar objects in an image, and much more.

To come across the contours of an object in an image, we use the subsequent approach:

• Transforming an image into a binary image (which should be a result of threshold image).

• The contours are located the use of the OpenCV feature findContours().

• Draw and connect these contours, then display the image.

2)Edge Detection:

The technique of determining which pixels are the threshold pixels is referred to as edge detection. most of the people of an image's form data is contained inside its edges. So, first, we locate those edges in a photo, after which, with the aid of using those filters and enhancing those areas of the photo that contain objects, the sharpness of the image will increase and the picture becomes clearer.

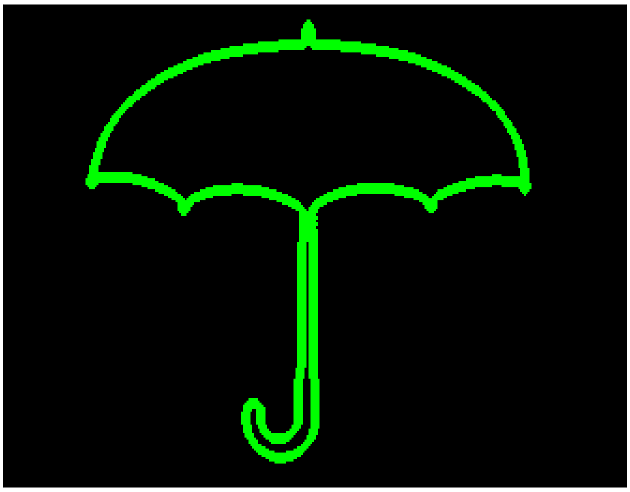

Fig 5: Contour Detection [4]

D) K-Means Clustering:

K means clustering is a method used to segregate the data points into clusters. It's a learning algorithm that classifies the datasets into distinct clusters. The value k denotes the wide variety of clusters to be produced. In our proposed approach, K defines the number of different color shades which need to be find in an image. If K is equal to 2, there will be two colors, three colors for K=3, and so on.

It allows us to divide data into separate groups and gives a straightforward method for determining group categories in an unlabeled dataset without any training. It's a centroid-based method, meaning that each cluster has its own centroid. The main goal of this strategy is to reduce the total distance between data points and the groups to which they correspond.

The k-means clustering technique primarily accomplishes two goals:

• Uses an iterative technique to get the optimal value for K center points or centroids.

• Each data point is assigned to the k-center that is nearest to it. Data points that are closer to a given k-center create a cluster.

As a result, each cluster contains datapoints with certain commonality and is isolated from the others.

The K-means Clustering Algorithm is depicted in the following diagram:

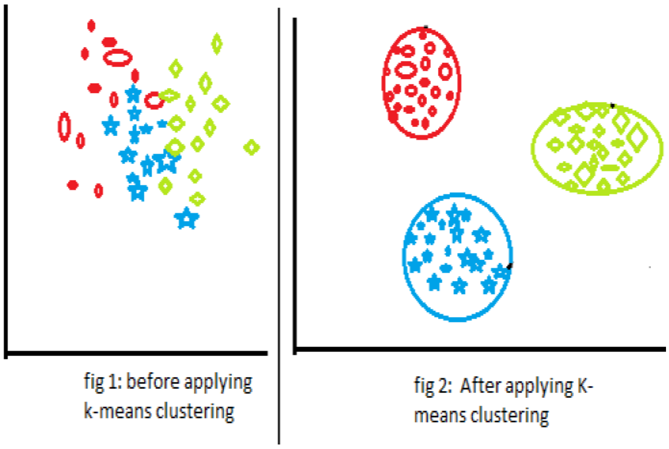

Fig 6: K-means Clustering [11]

The following steps will describe how the K-Means algorithm works:

Step 1: Choose the number K to determine the number of clusters.

Step 2: At random, select K locations or centroids.

Step 3: Form the preset K clusters by assigning each data point to the centroid that is closest to it.

Step 4: Determine the variance and move the centroid of each cluster.

Step 5: Repeat the third steps, reassigning each datapoint to its new cluster centroid.

Step-6: If there is a reassignment, go to step-4; otherwise, move to FINISH.

Step 7: The model is now complete.[12]

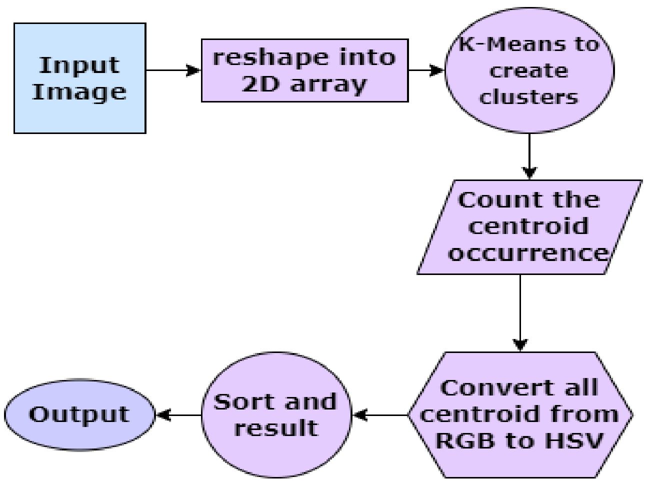

Fig 7: K-means Clustering flowchart for identification of colors present in an image

3. Color Processing: Through use of color in an image makes it easier to isolate and identify items. A color picture's brightness, hue, and saturation are the features that distinguish it. Color processing due to fluctuations in light is eliminated by the current object identification approach. When form and color-based techniques are coupled, the results are dramatically improved.

4. RESULTS

Fig 8: User defined Source Image Input

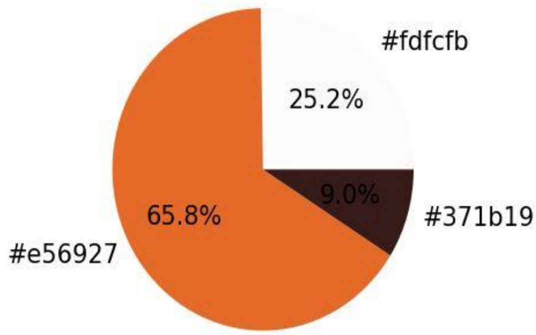

Fig 9: Color Analysis of Source Image Object

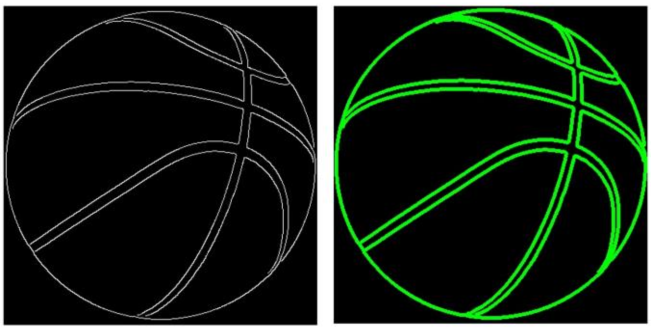

Fig 10: Edges and Contours of source image object

Fig 11: Target Image

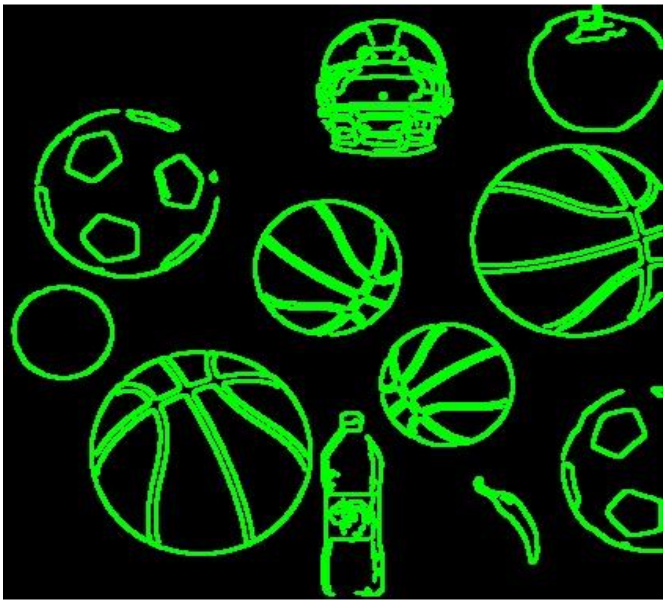

Fig 12: Contours of Target Image

Fig 13: Detection of similar source object shapes

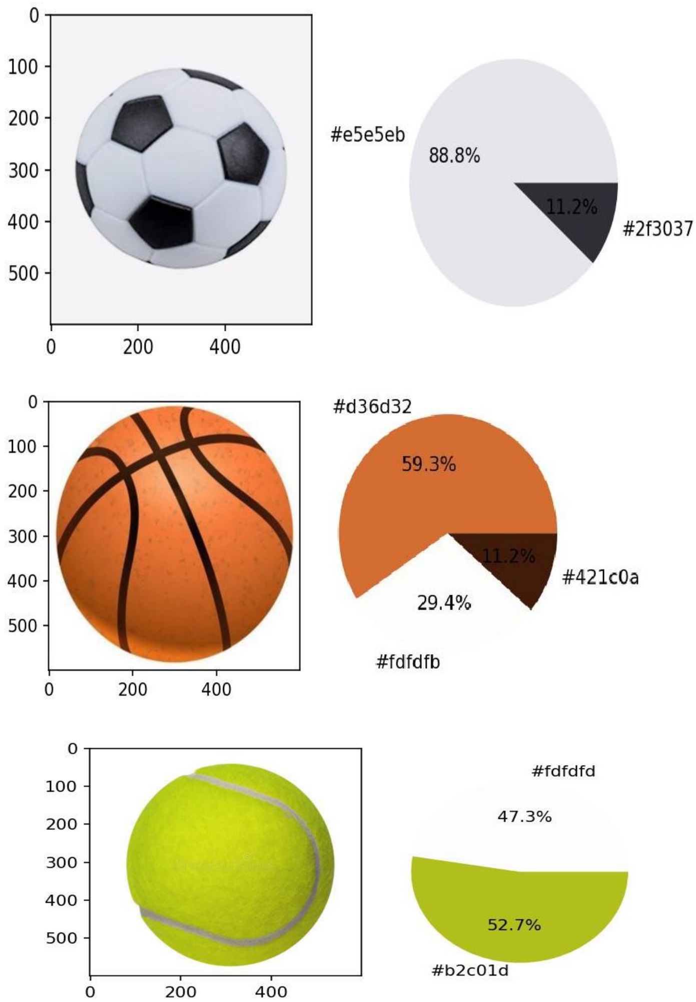

Fig 14: Color analysis of similar shape objects

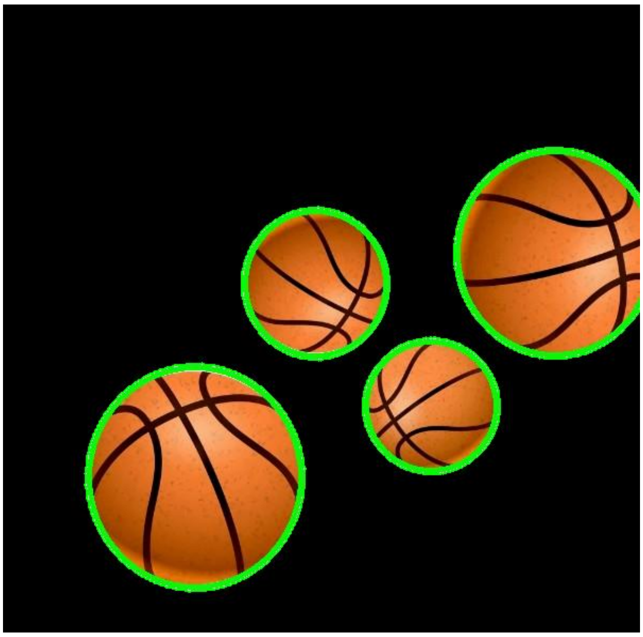

Fig 15: Final Output (Objects Identified)

5. CONCLUSION

As a result of this method, the proposed methodology will be extremely useful since the current object detection system can only detect objects of a class but cannot clearly distinguish between objects that belongs to the same class. The proposed research attempts to address some of the drawbacks of current object detection algorithms, as well as to improve efficiency and accuracy by training the model in which users can select the desired object type and compare it to the reference object in the target image.

REFERENCES

[1] Szegedy, Christian, Alexander Toshev, and Dumitru Erhan. "Deep neural networks for object detection." (2013).

[2] A. Mohan, C. Papageorgiou and T. Poggio, "Example-based object detection in images by components," in IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 23, no. 4, pp. 349-361, April 2001, doi: 10.1109/34.917571.

[3] Laptop near plant. [image] Available at: <https://www.pexels.com/photo/photo-of-laptop-near-plant-1006293/> [Accessed 16 January 2022].

[4] Umbrella. [image] Available at: <https://www.123rf.com/stock-photo/umbrella.html?sti=o51o50xe54lpu2gpds|> [Accessed 17 January 2022].

[5] Structure similarity index measure. [Blog] Available at: <https://www.imatest.com/docs/ssim/#:~:text=The%20Structural%20Similarity%20Index%20(SSIM,image%20and%20a%20processed%20image.> [Accessed 17 January 2022].

[6] SSD Architecture. [image] Available at: <https://towardsdatascience.com/understanding-ssd-multibox-real-time-object-detection-in-deep-learning-495ef744fab> [Accessed 17 January 2022].

[7] J. Farooq, "Object detection and identification using SURF and BoW model," 2016 International Conference on Computing, Electronic and Electrical Engineering (ICE Cube), 2016, pp. 318-323, doi: 10.1109/ICECUBE.2016.7495245.

[8] Papageorgiou, Constantine, and Tomaso Poggio. "A trainable system for object detection." International journal of computer vision 38.1 (2000): 15-33.

[9] J. U. Kim and Y. Man Ro, "Attentive Layer Separation for Object Classification and Object Localization in Object Detection," *2019 IEEE International Conference on Image Processing (ICIP)*, 2019.

[10] Q. Shuai and X. Wu, "Object detection system based on SSD algorithm," *2020 International Conference on Culture-oriented Science & Technology (ICCST)*, 2020

[11] K-Means clustering. [image] Available at: <https://www.analyticsvidhya.com/blog/2020/10/a-simple-explanation-of-k-means-clustering/> [Accessed 6 March 2022].

[12] www.javatpoint.com. 2022. K-Means Clustering Algorithm - Javatpoint. [online] Available at: <https://www.javatpoint.com/k-means-clustering-algorithm-in-machine-learning> [Accessed 6 March 2022].

[13] Schwartz, B. and Schwartz, B., 2022. Google Image Search by Image feature. [online] Search Engine Land. Available at: <https://searchengineland.com/google-image-search-removes-view-image-button-search-image-feature-292183> [Accessed 6 March 2022].