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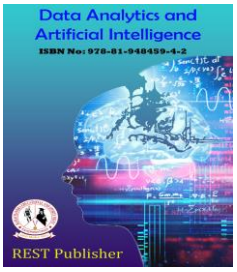

Garbage Detection On the Water Surface Based On Deep Learning

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Abstract: *Based on the software used in water surface cleaning robots, this paper applies deep learning to the garbage on the water surface. The garbage image is uploaded by the user and the image is preprocessed and the features are extracted using deep learning algorithm. The object detection in real time is done using YOLO V3 algorithm and the feature extraction is done using CNN algorithm. The Image preprocessing further have three stages: Canny operator extraction, Image segmentation and Histogram averaging enhancement. The results will show the garbage detected along with properties like its type and decomposition time.*

Keywords: *Garbage detection, CNN, Image Preprocessing, Deep Learning*

1. INTRODUCTION

With the raising population there has been many imbalances in the nature. The major problem of all is water pollution and the treatment to water pollution is on large demand. The garbage in the rivers, canals, lakes have eventually affected them surroundings therefore we need a method to clean the garbage on the water surface. Manual method of cleaning is both difficult and time consuming so an intelligent robot is used to clean the garbage. This robot automates according to the software which is built using a deep learning model. In order to detect the image, we use CNN which is a deep learning based model. For image prediction research says CNN are very effective. The model is trained using a large dataset. Canny operator, image segmentation, histogram averaging is used in this work for image preprocessing. The YOLOV3 algorithm and CNN algorithm are used for real time object detection and feature extraction respectively.

2. RELATED WORK

LeCun, Y., Koray K., and Clment F. [1] Proposed a model where Conv Nets have been successfully deployed in many commercial applications from OCR to video surveillance, they require large amounts of labeled training samples. They describe new unsupervised learning algorithms, and new non-linear stages that allow Conv Nets to be trained with very few labeled samples. Applications to visual object recognition and vision navigation for off-road mobile robots are described. Oquab, M., Bottou, L., Laptev, I., and Sivic, J.[2] proposed a model called Learning and Transferring Mid-level Image Representations Using Convolutional Neural Networks. In this paper we use a method to reuse layers trained on the ImageNet dataset to compute mid-level image representation for images in the PASCAL VOC dataset. This property currently prevents application of CNNs to problems with limited training data. Wang G, Li W, Zuluaga M A, et al. [3] proposed a model called Interactive Medical Image Segmentation Using Deep Learning with Image-specific Fine Tuning Proposed an image-specific fine-tuning to make a CNN model adaptive to a specific test image, which can be either unsupervised (without additional user interactions) or supervised (with additional scribbles). It also propose a weighted loss function considering network and interaction-based uncertainty for the fine-tuning.

3. EXISTING SYSTEM

The existing framework uses Convolutional Neural Network (CNN). This section presents the proposed garbage recognition method based on Alex Net algorithm. This algorithm is used for the classification of the images. The disadvantages in the existing system are: Some error in the accuracy and Performance rate is low.

4. PROPOSED SYSTEM

The main aim of the project is to build a model which is used for detecting and classifying the garbage on the water surface. Here the user can capture the images of different garbage's on the water surface then the image will be sent to the trained model. It is deep learning based system based on YOLOV3 algorithm. Hence, we proposed model to detect, classify and further provide with some properties of the garbage like decomposition time and type of garbage. The advantages in the proposed system are: Accurate identification of the garbage, Awareness of the properties of the garbage and Performance rate is high.

5. MATERIAL AND METHODS

Deep learning: Deep learning is a method for learning features from large amount of training datasets automatically. Trend of deep learning in computer vision applications is increasing as modern deep learning methods are more accurate than manual methods. The characteristics of convolutional neural networks different from other neural networks. Generally, there are three characteristics all aiming at dimensionality reduction. The first characteristic is sparse connectivity, which means that there are only local connections between neurons of adjacent layers. The second characteristic is shared weights. Every input has a weight to determine the output. As show in, each neuron in one layer shares the same weights and bias. All neurons in the same layer form a feature map. It reduces the number of parameters for the network. The last characteristic is pooling, which is a form of down sampling. Pooling means aggregate features in a rectangle neighborhood into one feature, as show in. Pooling is used to avoid overfitting.

YOLOV3 Algorithm*:* YOLO is a Convolutional Neural Network (CNN) for performing object detection in real-time. CNNs are classifier-based systems that can process input images as structured arrays of data and recognize patterns between them (view image below). YOLO has the advantage of being much faster than other networks and still maintains accuracy. It allows the model to look at the whole image at test time as shown in figure 4., so its predictions are informed by the global context in the image. YOLO and other convolutional neural network algorithms "score" regions based on their similarities to predefined classes.

6. METHODOLOGY

Input acquisition module: the photo will be uploaded and the multiple frames can be converted into a single frame image and sent to the next block for further processing as shown in [Fig 1]

FIGURE 1. Input Image

FIGURE 2. Image preprocessing and segmentation

The open water surface environment is complex and diverse. If there is no preprocessing during image recognition, the final garbage recognition rate will be reduced due to too many images interference factors. Therefore, the preprocessing of the collected image includes three stages: contour extraction, image segmentation and image enhancement.as depicted in [Fig 2].

Feature extraction module: CNN is one of the most popular algorithms for image and video depth learning. Like other neural networks, CNN consists of an input layer, an output layer and multiple hidden layers in the middle. The purpose of convolution operation is to extract different input features. The first convolution layer may only extract some low-level features, such as edges, lines and angles. Networks with more layers can iteratively extract more complex features from low-level features.

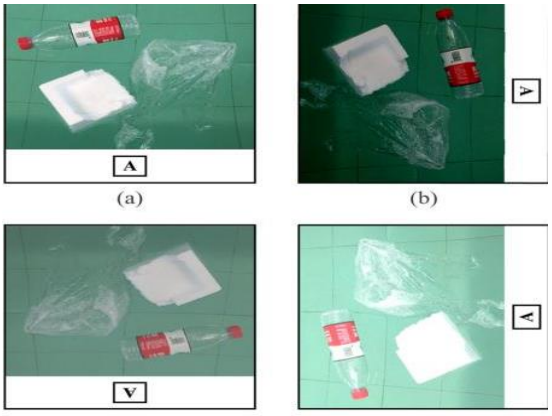

FIGURE 3. Feature extracted from image

Dataset training module: Augmentation methods like rotation and vertical and horizontal flipping are applied to increase the size of the dataset. The spiral images are rotated 360 degrees and wave images are rotated in 5 degrees on either side. The images are also flipped vertically and horizontally to further increase the dataset size. These images are pre-processed before using them to train the model. In fig.7 it shows how an input is classified using a neural network.

Properties estimation: The deep learning model predicts the object and further the predicted garbage is classified and information's like decomposition time, how much harmful the garbage is will be displayedd.

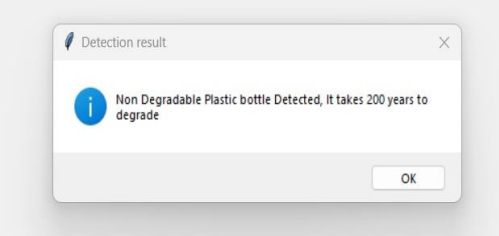

FIGURE 4. Properties estimation

7. RESULT AND DISCUSSION

The results of image preprocessing results show that after image preprocessing, some fuzzy features in the image will be directly ignored, and the adjacent features will be integrated into one feature. When processing an image with too many features, the image with the largest number of 9 pixels is set during image segmentation to ensure the processing speed. If too many images are retained, the subsequent processing speed will be too slow, and then the image processing speed will not keep up with the garbage collection speed. The final recognition rate of water surface garbage is between 80% and 98%. And, the results show the effectiveness of the CNN implemented the image classification YOLOv3 algorithm. processing speed. If too many images are retained, the subsequent processing speed will be too slow, and then the image processing speed will not keep up with the garbage collection speed. The final recognition rate of water surface garbage is between 80% and 98%. And, the results show the effectiveness of the CNN implemented the image classification YOLOv3 algorithm. The following graph plots testing values on the x-axis and the predicted values on the y-axis the graph forms an almost diagonal line which shows the accuracy of the model. The accuracy of the model is well around ninety percent which is goodcompared to other existing systems.

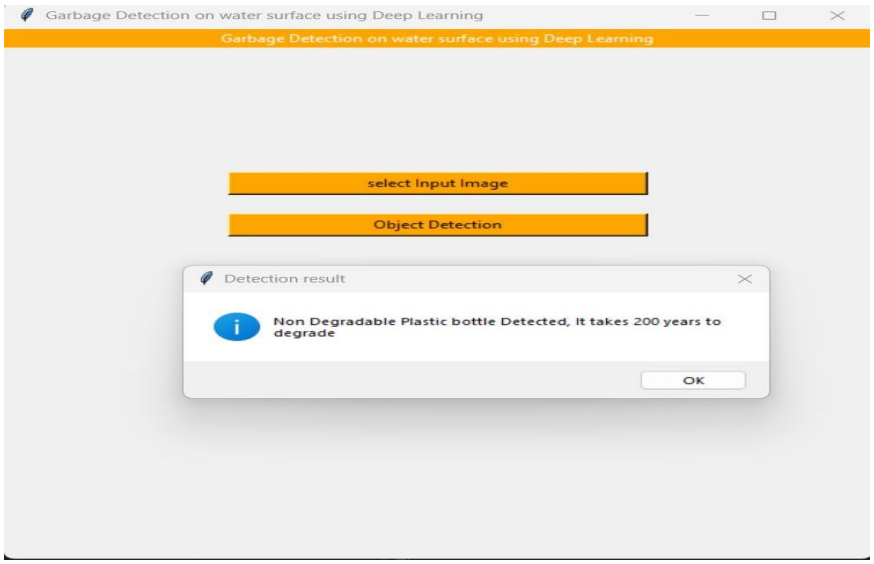

FIGURE 5. output

Advantages of Proposed System: Hence, we proposed model to detect, classify and further provide with some properties of the garbage like decomposition time and type of garbage. The advantages in the proposed system are: Accurate identification of the garbage, Awareness of the properties of the garbage and Performance rate is high.

Future Scope: Further it can be used in the underwater vehicle which is an intelligent robot to clean the garbage.

8. CONCLUSION

In this paper, the target detection algorithm is based on CNNs algorithm. Three stages are used in image preprocessing, Canny operator edge extraction, image segmentation and histogram averaging image enhancement. The neural network model of deep learning is established by convolution neural.

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