International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 10 Issue 7 ǁ July 2022 ǁ PP. 446-449

Crowd Management System Using Deep Learning

AnjaliGupta R[1], Manya H N[2], Prof. Gagana B R[3]
Department of ISE, Vidya Vikas Institute of Engineering and Technology, Karnataka, India

Abstract –*Cities are growing at dizzying pace and this is due to exponential growth in the world's population and this is resulting in urbanization. Crowd management is an important factor and plays a vital role in these cities. Managing these crowds requires some improved and advanced methods. In such scenarios, it is essential to analyse the behaviour of the crowdin order to have better management, safety, and security. Crowd management stands for the decisions and actions that are taken to supervise and control these densely populated areas. This involves multiple challenges ranging from recognition and assessment that are tailored to the current situation.*

Date of Submission: 02-07-2022 Date of acceptance: 14-07-2022

I. INTRODUCTION

The rapid urbanization of cities has created a need for better ways to manage the multitude of people living in these areas. Therefore, it is important that the proper methods are used to analyse and monitor the behaviour of the crowd. Since the COVID-19 pandemic has affected many nations, it is now more important than ever that the proper management of the crowd is carried out. Due to the increasing number of applications of crowd analysis, it has attracted the attention of researchers. A crowd is a group of people who have gathered together in a certain area. It can be defined in various ways depending on the situation. For instance, if more than a hundred people have gathered in India, it can be considered a crowd. Due to the varying nature of the crowd, it can be difficult to define it properly. People can gather in various places such as markets, temples, subways, religious festivals, processions, football games, and other public events. It is also important to monitor and analyse the crowd for acts of violence or disorder in public areas. Crowd analysis is a process that involves analysing various factors such as objects, events, and behaviour. It can be carried out in three steps: pre-processing, object tracking, and behaviour recognition.

Deep learning is a type of machine learning that uses a neural network composed of multiple layers. These networks attempt to mimic the behaviour of the human brain in order to learn from large amounts of data. Although a single layer can still per-form well in predicting future events, additional layers can help improve accuracy.

Developers of artificial intelligence (AI) systems rely on deep learning to improve the efficiency of their applications, such as analysing and performing physical tasks without the need for human intervention. Some of the services and products that are currently using deep learning include voice-enabled TV remotes and digital assistants.

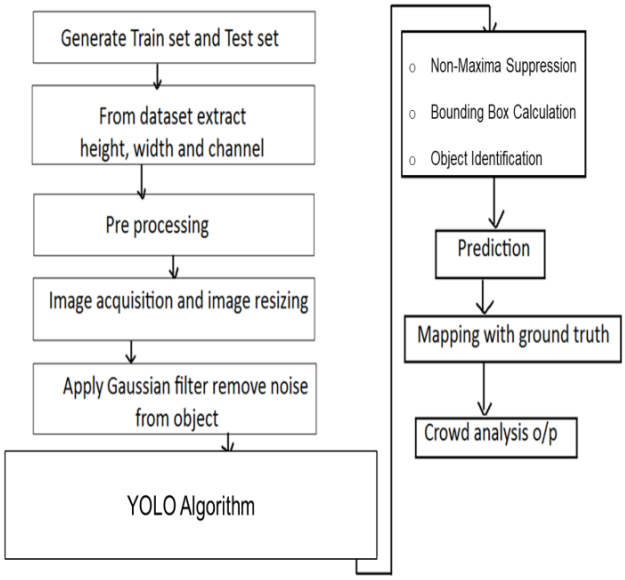

Fig 1: System design of CMS

II. RELATED WORK

Khan. A, ShahJ's "Crowd Monitoring and Localization using DNN", 2020 June
The main problem faced in the real time crowd management system is with the aspect ratio. The image captured for image processing may be expanded or overlapped developing problems for analysis. During image capturing, since it is not a live video, if image is captured when two or more objects come closer to each other, it becomes hard to recognize each object. This causes inaccuracy [3].

MdRoman Bhuiyan, Junaidi Abdullah's "Hajj Pilgrimage Case Study", June 2017
It is observed that analysis of crowd condition using surveillance camera with image processing is a difficult task due to excessive occlusions, inconsistencies in some perceptions and multiple distributions of crowds. In normal crowded scenes, human detection and monitoring is difficult [2].

Khalil Khan, Relan Ulal Khan, Waleed Albattah, Durre Nayab, Ali Mustafa Qamar, Shabana Habib, Muhammad Islam's "Crowd Counting Using End-To-End Semantic Image Segmentation", May 2021
In this paper, the researchers have concluded that the optimal resolution was 300x450 pixels. The experiments were conducted on google Collab using tesla K80 GPU while employing the Shangai Tech Dataset which is not usually affordable by common citizens [8].

Haroon Idrees; Imran Saleemi; Cody Seibert; Mubarak Shah "Multi Source, Multi Scale Counting In Extremely Dense Areas", June 2016 IEEE conference
In certain scenarios, obtaining the people count is of direct importance but obtaining people count in situations such as marathons, public rally's is a difficult task but is performed nonetheless by experienced personnel when needed [9].

III. WORKING

The working of CMS is as bellow:

1. Feeding a video as the input to the system.
2. Obtaining image frames from the inputted video.
3. Resize the image into required dimensions using a function in DNN called "blobfromimages".
4. After resizing the image, YOLO algorithm is applied to the resized image. This algorithm is used to detect objects in the image and locate them by dividing the entire image into grids of equal size. Later, the objects are located based on the centroid of each grid. This is depicted in Fig 2.
5. The object is then counted only the grid that contains the centroid.
6. The YOLO algorithm finds multiple bounding boxes for a single object which is resolved using Non-Maximum Suppression (NMS).
7. The NMS chooses the best bounding box using IoU values of those boxes.
8. It gives us the count of the person and categorize them into different classes.
9. The class "Abnormal Violation" indicates that a person is almost near to violate safe distance limit.

10. The class "Serious Violation" indicates that 2 or more people are close to each other and have violated the safe distance limit.
11. If the serious violation count exceeds the threshold limit, the system will display an alert message.

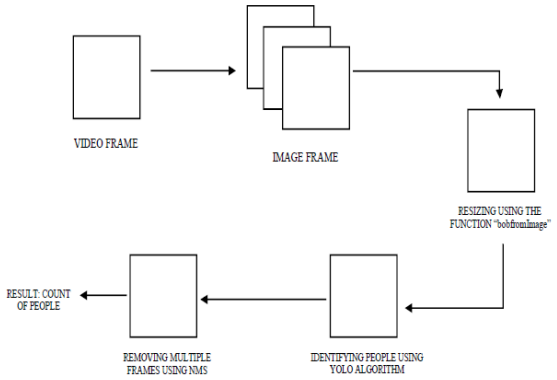

Fig 2: System process of YOLO & NMS algorithm

IV. APPLICATIONS

A deep neural network is an artificial intelligence (ANN) that can detect humans in the moving frame. It has multiple layers that are hidden from the main input and output layers. Compared to shallow ANNs, deep neural networks can perform complex calculations.

A neural network is designed to receive and perform complex calculations on a set of inputs. It then produces outputs to solve real-world problems. We only feed forward neural networks.

Developers can implement deep neural network algorithms on various hardware, such as general-purpose machines and specialized video processing units.

Developers can use deep neural network algorithms to analyse video to detect and analyse spatial and temporal events in real time. This technology can be used in various areas such as video retrieval, video browsing, andsecurity. Its capabilities are commonly used inareas such as automotive, retail, and home automation.

YOLO, "You Only Look Once" is an algorithm which detects and recognizes objects that belongs to different categories in a captured picture. YOLO can detect around 20 different classes of objects including humans, animal, so on. These classes are known as COCO NAMES which can readily be imported into our projects. The CNN is used to determine various bounding boxes around an image. Object detection can be done as a regression problem and gives us probabilities of detected images. YOLO algorithm uses CNN to detect objects.This algorithm needs only single forward propagation to detect objects in an image.

The applications of Crowd Management system are as follows:

1. Use of video analysis for crowd detection.
2. At festive gathering, to measure crowd density at different shows, which food & concessions stands are attracting the most traffic.
3. Used at tourist hotspots, pilgrims, occasions such as dassara, etc. to manage the crowd.
4. Helps the manufacturers to estimate the total customers attracted to their product to increase sales.
5. Since COVID, people can have clear picture of the crowded place to avoid them.

V. CONCLUSION

This system introduces the concept of video analysis and how it can be used to analyse crowd. First, we talk about the traditional approach to crowd analysis, and then we introduce the CNN-based models. We then show how these models can be used to manage the crowd in various sectors. Due to the complexity of crowd management, it is very difficult to predict the outcome of a particular event using the existing approach.

Since covid break out, it is difficult to manage crowd in various sectors which include human interaction. With CMS, it has become easier for security system in those places to manage crowd as the system will count, calculate and alerts if the count increases and in verge of pestilence.

This system is easy to implement. It can be used for detecting any kind of crowd and to track people activities to avoid illegal leakage. This system will have low cost, low space consumption and high accuracy.

Crowd management plays a vital role in business as it helps in predicting the products / shops that attract more customers.

REFERENCES

[1]. Vishwanath Sindagi & Vishal M Patel's "A Survey of Recent Advances in CNN-based Single Image Crowd Counting and Density Estimation.", July 2017

[2]. MdRoman Bhuiyan, Junaidi Abdullah's "Hajj Pilgrimage Case Study", June 2017

[3]. Khan.A, ShahJ's "Crowd Monitoring and Localization" using DNN, 2020 June

[4]. A Privacy-Aware Crowd Management System for Smart Cities and Smart Buildings Published by IEEE on 20 July 2020.

[5]. A Survey of Recent Advances in CNN-based Single Image Crowd Counting and Density Estimation published by Vishwanath Sindagi and Vishal M Patel in July 2017.

[6]. Zhang, Y.; Zhou, D.; Chen, S.; Gao, S.; Ma, Y. Single-image crowd counting via multi-column convolutional neural network. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, Las Vegas, NV, USA, 27–30 June 2016.

[7]. Khan, A.; Shah, J.; Kadir, K.; Albattah, W.; Khan, F. Crowd Monitoring and Localization Using Deep Convolutional Neural Network: A Review. Appl. Sci. 2020, 10, 4781.

[8]. Khalil Khan, Relan Ulal Khan, Waleed Albattah, Durre Nayab, Ali Mustafa Qamar, Shabana Habib, Muhammad Islam's "Crowd Counting Using End-To-End Semantic Image Segmentation", May 2021

[9]. Haroon Idrees; Imran Saleemi; Cody Seibert; Mubarak Shah "Multi Source, Multi Scale Counting In Extremely Dense Areas", June 2016 IEEE conference.