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EFFECTS OF SEGMENTATION AND SCALING ON ANOMALY DETECTION USING CONVOLUTIONAL NEURAL NETWORKS

Yash Nimish Padhye

yash.padhye.aids.2020@vpkbiet.org

Department Of Artificial Intelligence and Data Science

Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

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Abstract - Anomaly detection have been a successful technique in real world applications and mostly in industrial applications where precision is to be valued the most. Images are a day-to-day part of our lives, so here I have tried to present an approach for solving the issue of anomaly detection using Convolutional Neural Networks. The Neural network has been trained on diverse images of both anomalous images and Good (Normal) image. Neural Networks have been an integral and also emerged as a effective Deep Learning approach for tasks like image classification, anomaly detection and many such classification tasks. In recent years convolutional neural networks have been emerged as favorites for image classification tasks because of its various functionalities. The implications of this research are to present the effects of Scaling and Edge Preservation, Segmentation on images gives us different results of similar Neural network and to choose best of them. Thus, experimenting the Convolutional Neural Networks on different parameters yields us various results.

***Key Words*:** Convolutional Neural Networks, Image Segmentation, Edge Preservation

1. INTRODUCTION

Anomaly Detection have always been a continuously evolving task in computer vision field having numerous applications in day to day lives. CNN's have always shown remarkable results in image classification tasks, outplaying the traditional machine learning techniques. The more the number of data points the more effectively CNN's have been performing. CNN have numerous applications on images like image classification, outlier detections, Anomaly detections. This was one of the reasons to choose Convolutional Neural networks for performing operations, and gaining various insights by comparing Convolutional Neural Network Algorithms.

2. LITERATURE REVIEW

Krishna et.al [1] in 2010 proposed a paper on different techniques for image segmentation and suggested the applications of segmentation algorithms which considers and maintains the properties of images. Jonathan et.al [2] in 2019 demonstrated the classification results on different datasets on Convolutional Neural Networks and demonstrated their accuracies. Farhana et.al [3] in 2018 discussed about various Convolutional Neural network architectures like ResNet, AlexNet, VGGNet and their performances on different image parameters. Weiming et.al [4] in 2009 prosed a technique for image resizing using an image distance function which also preserves the important regions. This technique can also be used for enlarging the images. Shervin et. Al [5] in 2021 surveyed the different image segmentation models and compare their model performances on different datasets.

3. AIMS AND OBJECTIVES

1. The main aim of this project is to construct a Convolutional neural network architecture for detecting anomalous images more correctly.
2. Determine the effects of edge detection and image segmentation on neural networks does they perform well on segmented images or normal images.

4. PROPOSED SYSTEM

Collecting of Good and anomalous images and giving labels. Image Preprocessing like Image Segmentation and Edge Preservation techniques. Construct the suitable CNN model having suitable number of convolutional layers and also performing all the operations like Pooling, Flattening and Dense operations. Perform Early Stopping which will give us the best trained model using which we can predict the class of image. Pass the images from testing data to the model to predict the class of the image whether it is an anomalous image or good image. Measure Accuracy and loss of the CNN model for every parameter like segmented images and scaled images. Derive the conclusion that is which parameter gives us the best result for size of image.

Fig.1 Original Good Identified Image

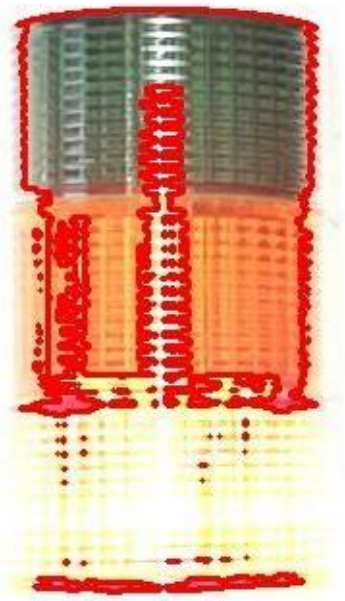

Fig. 2 Anomalous Segmentation Image

5.SYSTEM ARCHITECTURE

Anomaly detection in images using convolutional neural network is renowned method for detecting anomalies within the image. Spectacular capabilities of the Convolutional Neural Networks which are highly effective in capturing and learning patterns and features from visual data. Image Preprocessing is the basic first task to be carried out like Scaling images, Gray-scaling Images, Image Segmentation are the basic operations that are to be carried out. The core part of the system lies in CNN architecture, having convolutional layers, Pooling Layers, Dense Layers and Flattening Layer. Having appropriate number of layers and feature selection based on size of the image is important factor on training the CNN model. Number of Layers to be increased for large size of image and vice versa for effective working of CNN model.

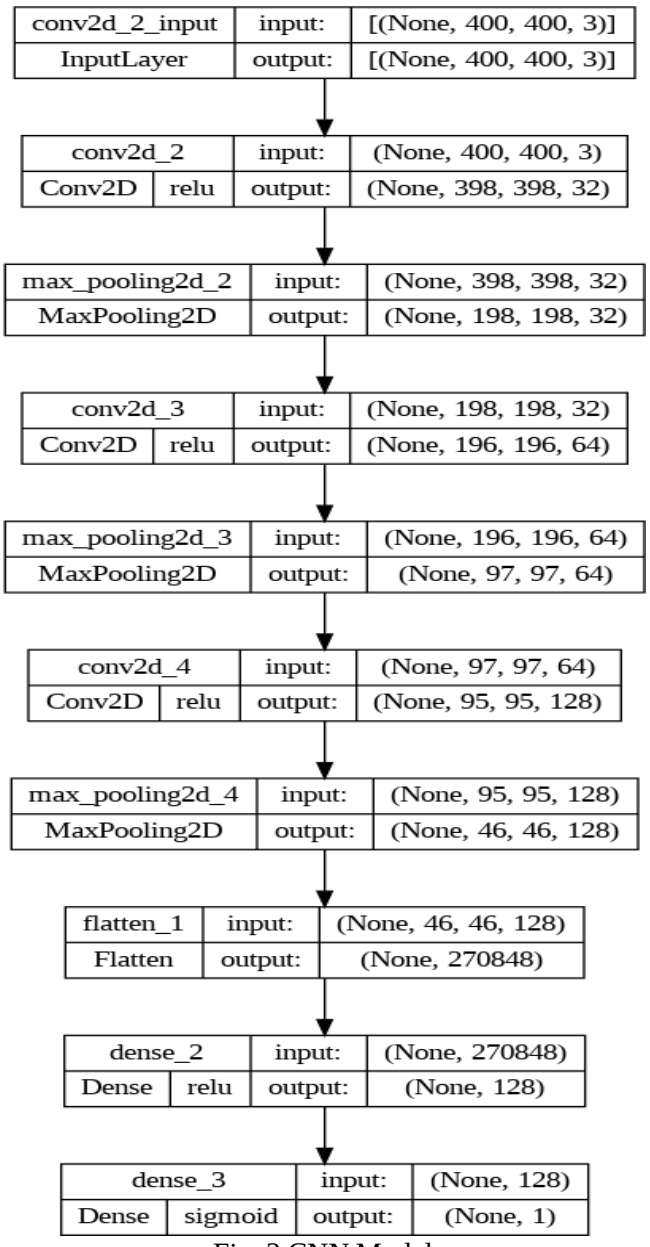

Fig. 3 CNN Model

5. RESULTS AND ANALYSIS

The results obtained for detecting the anomalous images using CNN on various images of different dimensions and segmented images too. Model demonstrated good accuracy with minimal loss in identifies the anomalies within the images.

ORIGINAL IMAGES		
SIZE	LOSS	ACCURACY
400,400	0.37	0.806
300,300	0.372	0.75
200,200	0.379	0.80

Table 1 Performance of CNN on original images

SEGMENTED IMAGES		
SIZE	LOSS	ACCURACY
400,400	0.315	0.818
300,300	0.35	0.812
200,200	0.345	0.831

Table 2 Performance of CNN on images after performing Image Segmentation

6. CONCLUSION

The aim of this project is to identify the best suitable combination of Scaling and segmentation data for anomaly detection using Convolutional Neural Network. The images which undergo segmentation and thus we can get the decision boundaries which defines the actual edges withing the image helps the model to predict more efficiently as the edges helped to learn the model more effectively. Thus, we can see the capability of handing segmented images with size of **(200,200)** was the best suited with an accuracy of **83%.**

7. ACKNOWLEDGEMENT

I would like to thank ADFI [6] for providing datasets which can be used for research purposes. They have provided proper documentation with for their datasets. All the images in the dataset are of high quality and same resolution. ADFI datasets are pre labelled and divided into two categories Good and Anomaly. Datasets are further divided into training and testing which helps a lot while working on them.

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