CROWD COUNTING AND ANOMALY DETECTION
FROM CCTV FOOTAGES USING DEEP LEARNING
AUGMENTED WITH CELLULAR AUTOMATA

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ABSTRACT

Automatic Video surveillance is the need of the hour and interesting research problem to be addressed. We have understood the need of automatic monitoring of the CCTV footages, security is main concern for any country. In the novel work, we have identified people in the footages, counted the number of people in the video and identified the people with abnormal behavior. We have used CNN convolution neural network augmented with cellular automata for identifying people with abnormal actions etc. The developed classifier has achieved 97.6% identifying the people, 91.3% in counting the number of people in a given instance and 78.9% in predicting the people with abnormal actions. The datasets are collected from the Vishnu Society as we have implemented the same in this society.

Keywords: Deep Learning, Cellular Automata, Video surveillance, Crowd Counting

1. INTRODUCTION

The integration of CNN with CA, a first of its kind, is described in this work in order to create a superior classifier that can handle significant issues with video automatic surveillance. The Artificial Immune System suggested classifier aims to predict the count and abnormal actions. In order to readily utilise this classifier to tackle highly significant challenges in bioinformatics, a solid theoretical foundation is offered. The modified clonal algorithm, an CNN technique, is then used to create the suggested classifier. The search space can be minimized with effective clonal selection algorithm implementation. The boolean Multiple Attractor Cellular Automata, which employs fuzzy logic to analyses patterns made up of real values, are the natural progression of this proposed classifier. It therefore applies fuzzy logic.

In a geographically expanded grid, a cellular automaton conducts reckonings in a distributed manner. It differs from the traditional method of parallel processing, which divides a task into independent subtasks and assigns each to a different processor to complete[8]. The ultimate result is produced by combining the results of the subtasks[9]. The spatially expanded grid's interactions, which are locally defined, are what give CA its complexity. A programmer can define neighborhoods rules for interaction and research how the rules' effects on fitness[10]. In CA, it can be difficult to choose the rules that can be used to address a particular issue.

We have done an extensive literature survey on all these three areas. As this is one of the novel work, we have found few good papers. Sreenu, G., and Saleem Durai[1] has used deep learning to analyze the crowd. Nawaratne, Rashmika, et al. [2] worked on anomaly detection in videos using deep learning. Wang, Qi, et al[3] has worked on localization of the crowd using various classifiers. Some of the authors [4], [5] used various context aware methods to predict the abnormal actions. We have surveyed various papers on how the cellular automata can be used to be augmented with deep learning for having a better classifier [6],[7].

2. DESIGN OF THE CLASSIFIER

Cellular automata is an array of linearly ordered cells makes up cellular fuzzy logic, which evolves
over time. This array's cells all take on reasonable values between zero and one. Each of these cells modifies its state in accordance with the local evaluation function, which.

![Fig 1: Natural Design of CA using Hybrid Rule](image1)

We have collected 68,954 images from VISHNU society for validating our project. Each imaged stored and compared later, whenever it is required. The Video is taken in the form of set of frames, which will be passed through a set of convolution layers, then poling layers till it reaches the connected layers. We have used nonlinear and hybrid CA rule to get a versatile classifier.

![Fig 2: Natural Design of CA using Non Linear Rule](image2)

3. RESULTS & DISCUSSION

depends on both its left and right neighbors including its own state
We have compared our work with standard various machine learning techniques, neural network mechanisms and data mining approaches. ML approach has reported an accuracy of 93.6%, whereas neural network method reports an accuracy of 90.3%, data mining technique has reported an accuracy of 91.6% and the deep learning augmented with CA reports 97.6 which is the better among the cited literature for identifying the people in the society.

ML approach has reported an accuracy of 90.5%, whereas neural network method reports an accuracy of 90.2%, data mining technique has reported an accuracy of 91.2% and the deep learning augmented with CA reports 91.3% which is the better among the cited literature for predicting the count of people in the video.

ML approach has reported an accuracy of 56.9%, whereas neural network method reports an accuracy of 71.3%, data mining technique has reported an accuracy of 69.3% and the deep learning augmented with CA reports 78.9% which is the better among the cited literature for identifying the people with abnormal behaviors.

4. CONCLUSION

We have successfully developed a novel mechanism for automatically monitoring the CCTV footages. The proposed method employed a deep learning method augmented with hybrid & nonlinear cellular automata for developing a versatile classifier which can process large datasets with considerable accuracies. The developed classifier is tested on VISHNU society data set which reported an accuracy of 97.6%, 91.3%, 78.9% respectively for identification, count computation and abnormal action detection.

REFERENCES


Prediction with Convolution Neural Network (CNN) Augmented With Cellular Automata."


