Journal of Theoretical and Applied Information Technology
15th July 2023. Vol.101. No 13

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

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

DR. POKKULURI KIRAN SREE [1] DR. G. SRINIVASA RAO[2] DR. P. SRINIVASA RAJU[3]

[1]Head & Professor, Dept Of C.S.E, Shri Vishnu Engineering College For Women(A), Bhimavaram,
[2]Principal, Shri Vishnu Engineering College for Women(A), Bhimavaram,
[3]Vice Principal, Shri Vishnu Engineering College for Women(A), Bhimavaram,
hodcse@svecw.edu.in, principal@svecw.edu.in, viceprincipal@svecw.edu.in

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

Journal of Theoretical and Applied Information Technology
15th July 2023. Vol.101. No 13

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

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.

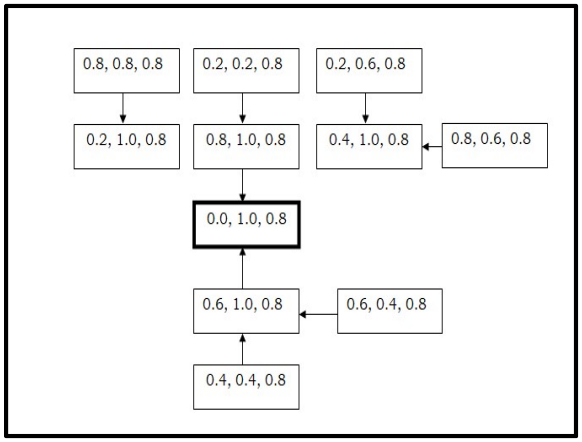

Fig 1: Natural Design of CA using Hybrid Rule

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.

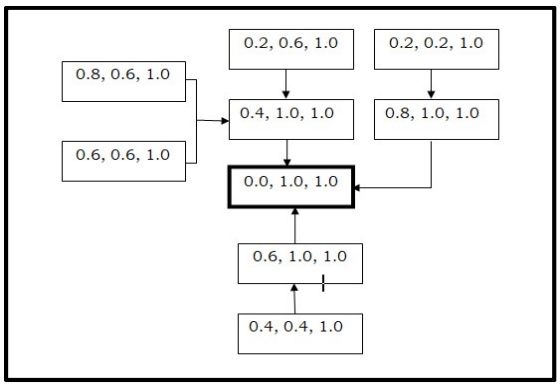

Fig 2: Natural Design of CA using Non Linear Rule

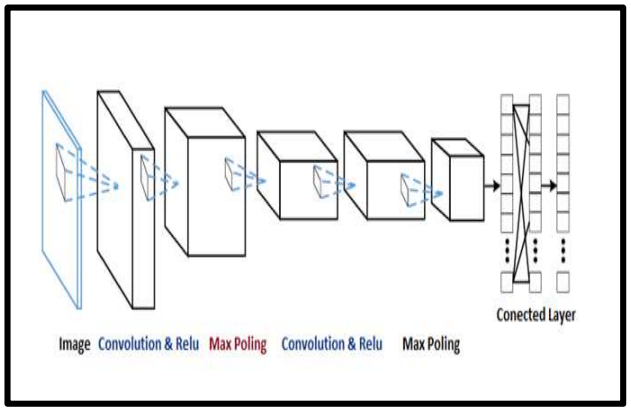

Fig 3: Design of DLCA

depends on both its left and right neighbors including its own state

3. RESULTS & DISCUSSION

Fig 4. Running in the Corridor | Fig 5. Valid Entrance

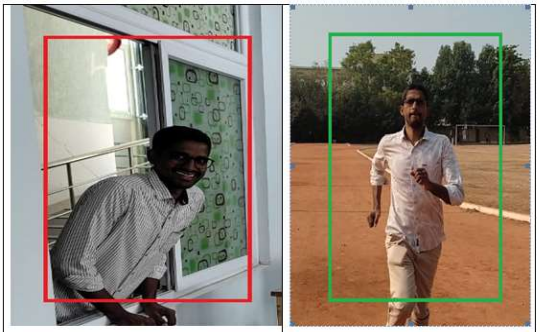

Fig 6.Illegal entry | Fig 7.Running in the Play Ground(Legal Action)


Fig 8. Crowd Counting System1


Fig 9. Crowd Counting System2

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.

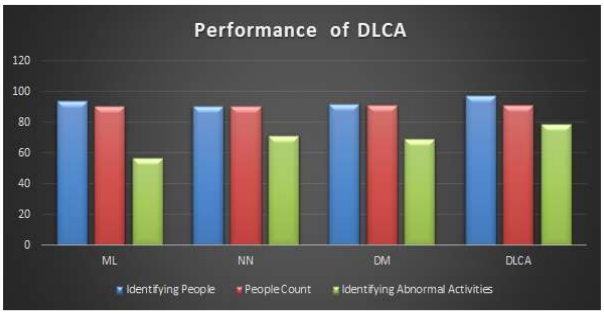

Fig 10: Performance comparison of DLCA

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

[1] Sreenu, G., and Saleem Durai. "Intelligent video surveillance: a review through deep learning techniques for crowd analysis." Journal of Big Data 6.1 (2019): 1-27.

[2] Nawaratne, Rashmika, et al. "Spatiotemporal anomaly detection using deep learning for real-time video surveillance." IEEE Transactions on Industrial Informatics 16.1 (2019): 393-402.

[3] Wang, Qi, et al. "NWPU-crowd: A large-scale benchmark for crowd counting and localization." IEEE transactions on pattern analysis and machine intelligence 43.6 (2020): 2141-2149.

[4] Liu, Weizhe, Mathieu Salzmann, and Pascal Fua. "Context-aware crowd counting." Proceedings of the IEEE/CVF conference on computer vision and pattern recognition. 2019.

[5] Yan, Zhaoyi, et al. "Perspective-guided convolution networks for crowd counting." Proceedings of the IEEE/CVF international conference on computer vision. 2019.

[6] Pokkuluri, Kiran Sree, SSSN Usha Devi Nedunuri, and Usha Devi. "Crop Disease

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Prediction with Convolution Neural Network (CNN) Augmented With Cellular Automata." INTERNATIONAL ARAB JOURNAL OF INFORMATION TECHNOLOGY 19.5 (2022): 765-773.

[7] Pokkuluri, Kiran Sree, and Devi Nedunuri Usha. "A secure cellular automata integrated deep learning mechanism for health informatics." Int. Arab J. Inf. Technol. 18.6 (2021): 782-788.

[8] Pokkuluri, Kiran Sree, and SSSN Usha Devi Nedunuri. "A Novel Cellular Automata Classifier for COVID-19 Prediction." Journal of Health Sciences 10.1 (2020): 34-38.

[9] Sree, P. K. Deep Learning Mechanism Augmented with 16-Hybrid Cellular Automata For Secondary Structure Prediction. PP: 490-493 , Volume-9 Issue-2, December 2019, International Journal of Innovative Technology and Exploring Engineering (IJITEE).

[10] Sree, Pokkuluri Kiran. "RTWPCAMARM: A dynamic real time weather prediction system with 8 neighborhood hybrid cellular automata and modified association rule mining." 2015 International Conference on Advances in Computing, Communications and Informatics (ICACCI). IEEE, 2015.