ACADEMIC YEAR 2020-2021

SAI SPURTHI INSTITUTE OF TECHNOLOGY

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Number of books and chapters in edited volumes/books published and papers published in national/ international conference proceedings per teacher during the year.

Total number of books and chapters in edited volumes/books published and papers in national/ international conference proceedings during the year.

List of the Conferences during Academic Year 2020-21

S.NO	Title of the book/chapters published/ Conference	Name of the teacher	National / International
1.	An Optimal Steering vector Generation using chaotic Binary Crow search Algorithm for MIMO System	Dr.P. Sekharbabu	International
2.	Machine Learning-Based Intelligent Video Analytics Design Using Depth Intra Coding	Mr.T.Veeranna	International
3.	Driving Sustainable Development Through Higher Education In Wake of Covid-19	Mrs.Ch.Leelavathi	National
4.	Driving Sustainable Development Through Higher Education In Wake of Covid-19	Mrs.K . Vasavi	National

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in the 3rd International Conference on Recent Trends in Advanced Computing – Artificial Intelligence and Technology (ICRTAC-AIT, 2020) held during 17th and 18th December 2020 organized by School of Computer Science and Engineering, VIT Chennai, Tamilnadu, India.

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1. Please check whether the edits made in the sentence 'The performance degradation ... training data [11]' convey the intended meaning.

The MIMO system

2. Please check whether the edits made in the sentence 'The weights are linked to ... nodes of ANN' convey the intended meaning.

The Neural Network weights

3. References [7, 16, 17] are given in the list but not cited in the text. Please cite them in text or delete them from the list.

References [7,16,17] are cited in introduction

An Optimal Steering Vector Generation Using Chaotic Binary Crow Search Algorithm for MIMO System

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Abstract

The abstract is published online only. If you did not include a short abstract for the online version when you submitted the manuscript, the first paragraph or the first 10 lines of the chapter will be displayed here. If possible, please provide us with an informative abstract.

Beam forming is a signal processing technique used for directional signal transmission or reception, and it requires the antenna array to change the directionality during transmission. The beam forming improves the throughput for a great extent by matching the parameters of transistors to the time-invariant channels. The multiple-input multiple-output (MIMO) systems are well known in providing gains for spectral efficiency and reliability during beam forming. The MIMO is set up based on the knowledge of transmitter and receiver to obtain steering vectors and the weight of the channels. The formation of channel setup is important for improving the quality of signal transmission. However, the existing models failed to determine the accurate channel due to time-variant distortions that resulted optimization problem. This research overcomes such problems by proposing chaotic binary crow search algorithm (CBCSA) which is an efficient algorithm for handling both time-variant distortions and optimization problems. In this research work, artificial neural network (ANN) is tested and trained for the generation of steering vectors to select the particular channel for beam forming. The proposed CBCSA effectively predicts various channels for beam forming. The proposed CBCSA achieves better values of steering vectors, and these vectors are trained into ANN to achieve better signal-to-noise ratio (SNR) compared to other existing methods.

Keywords

Artificial neural network

Beam forming

Chaotic binary crow search algorithm

Multiple-input multiple-output

Steering vectors

Time variant

1. Introduction

Beam forming is a radio frequency management technique in which an access point makes use of various antennas to transmit the same signal. Beam forming is considered a subset of smart antennas or advanced antenna systems. In general, beam forming uses multiple antennas to control the direction of a wave front by appropriately weighting the magnitude and phase of individual antenna signals in an array of multiple antennas. The applications of beam forming are found in numerous fields such as radar, seismology, sonar, and wireless communications [1,2]. The MIMO radar performs multiple transmissions and has receiving antennas that has received enduring attention from researchers due to its capacity of providing diversity to enhance system performance [3]. One of the most important types of radar is the MIMO radar that has influenced many researchers to choose this topic for research in recent years [4,5]. The collocated MIMO radar recognizes number of targets which is having a flexible number of transmit antennas for transmitting beam patterns in both uniform and directional beam patterns [6]. The omnidirectional beam pattern is transmitted for independent orthogonal waveforms, while the generated beam patterns are depending on the transmit wave feature [8, 9]. Consequently, the data rate of the signal decreases due to the side information of the receiver antenna, and the transmitted signals cannot be correctly reconstructed if the transmitted side information is corrupted [10]. Some of the well-known methods for channel detection in MIMO beam forming are estimated by using covariance matrix and steering vector, joint beam forming, space–time block codes (STBCs) with the pilot symbols tracked radar target. The **AQ1** performance degradation is obtained because of the finite number of training iterations, and the signal steering vector was mismatched with the desired signal by corrupting the training data [11]. However, the beam forming technique in MIMO is a challenging process as it creates difficulty during non-convex optimization due to the non-convex constraints imposed by the phase shifters. In addition to this, the design of such beam formers for frequency selective channels is very difficult [12].

The present research overcomes time-variant distortions by developing an efficient algorithm called as CBCSA. In this work, artificial neural network (ANN) is tested and trained for the generation of steering vectors. The dimension of the virtual steering vector of the MIMO radar is relatively large, and thus, the autocorrelated matrix is estimated by using a low-complexity method which improved the computational efficiency of the adaptive beam forming algorithm[7]. The generated steering vectors are evaluated for determining the particular channels for beam forming. The proposed chaotic binary crow search algorithms (CBCSA) effectively predict the various channels for beam forming, and also it resolves the optimization problems[16,17].

This research paper is organized as follows. In Sect. 2, numerous research papers on channel estimation in MIMO radars using beam forming techniques are discussed. The detailed explanation about the proposed system is given in Sect. 3. In addition, Sect. 4 illustrates the quantitative analysis and comparative analysis of the proposed system. The conclusion is made in Sect. 5.

2. Literature Review

The existing models that were involved in channel estimation using the beam forming in the MIMO radars are given as follows.

Qian [13] developed a robust adaptive beam former design for multiple-input multiple-output (MIMO) radar systems. The beam former system was designed with the help of beam forming weight vector. The desired signal was analyzed with the help of steering vectors, and the shrinkage estimator computed the interference due to plus noise covariance matrix. This model estimated the covariance matrix using rank-constrained minimization method for better performance. However, an average run time consumed by the developed method was more when compared to the existing methods.

Li [14] developed a joint optimization of hybrid beam forming in two stages for multiuser massive MIMO system in frequency division duplexing (FDD) mode. The weighted conditional average mean square error minimization (WAMMSE) algorithm was developed under the kronecker channel. The kronecker channel model showed the strongest eigenbeams of the receive correlation matrix. The optimal analog combiner maximized the intra-group interface to intergroup interface with addition to noise ratio. The advantage of the developed scheme was it showed the best performance even at the lower frequencies. However, the base station does not know the instantaneous information of the intergroup interference.

Zhou [15] developed a colocated MIMO radar waveform optimization with receive beam forming. An optimization process was performed for the receiver end of MIMO radar to analyze the beam forming operation. The receiver end of the system showed optimization criteria during beam forming operation. The models showed that correlation side lobes at the receiver end were suppressed for lower side lobe level. The Doppler problem was not examined for the system even when the generalization of the criterion case was not much difficult. However, the waveform optimization algorithm could be integrated with the hybrid algorithm for a better performance output.

3. Proposed Method

The aforementioned problems in the existing methods are overcome by proposing an efficient CBCSA optimization algorithm in this research. The wireless channels are predicted accurately on the basis of statistical fading past value and linear filter that predicts the channels for evaluation. In this section, the ANN is used for optimization with the chaotic binary crow search algorithm (CBCSA) to determine the accuracy of the channel and overcomes the optimization problem present in the process [18].

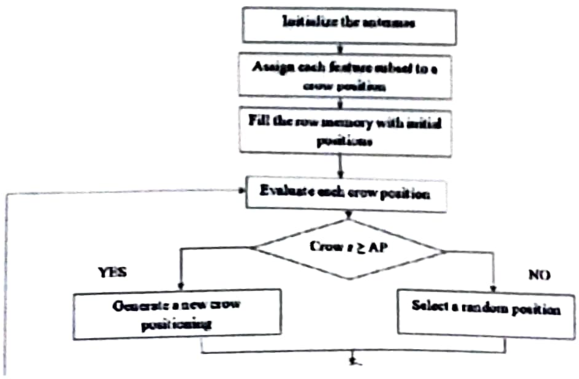
3.1. Feature Selection Using Chaotic Binary Crow Search Algorithm

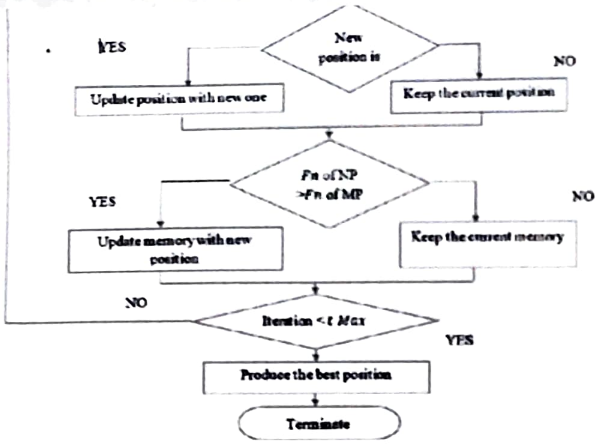
Crow search algorithm is the most important existing optimization algorithm that suffers from low convergence rate and entrapment in the local optima. The research work considered a novel metaheuristic optimizer, namely CBCSA to overcome the optimization problem. The steering vectors from the downlink and uplink channels are adjusted to obtain maximum signal-to-noise ratio (SNR).

The output is achieved by minimizing the entire interference at the output array by eliminating the entire unwanted array and thereby it continually maintains a constant signal of interest. The flowchart of the proposed chaotic binary crow search algorithm is shown in Fig. 1. In Fig. 1, NP is known as the new position, MP is known as memory position, and AP is the awareness probability.

Fig. 1

Flowchart of the proposed chaotic binary CSA





In this section, the randomly generated variables are used for updating the crow position and are substituted by chaotic variables. The optimal solution is influenced by variables substitution that updates the crow position. The convergence rate, chaotic sequence, and chaotic maps are used for generating optimal solution and a combination of such chaos is used for CBCSA. The research uses 10 different chaotic maps for performing optimization process such as Chebyshev, sinusoidal, circle, sine, tent, gauss, piecewise, singer, logistic, and iterative. The different chaotic maps used are improved significantly for the convergence rate, and performance of CSA is explained in the following section. The chaotic sequences are combined with the CSA approach as described in Eq. 1.

$$y^{j,i+1} = \left\{ \begin{array}{ll} y^{j,t} + C_j \times fl^{j,t} \times \left(N^{z,t} - y^{j,t}\right), & C_z \geq \mathrm{AP}^{j,t} \\ \text{Choose a rand position,} & \text{otherwise} \end{array} \right\} \quad (1)$$

Here, C_j is the chaotic map value at *j*th iteration.

C_z is the chaotic map value obtained at *z*th iteration.

AP is the awareness probability.

The proposed CBCSA optimization algorithm is a feature selection algorithm that optimizes the generated steering vectors. In CBCSA, binary form is obtained as the solution pool where the results obtained are in the form of {0, 1}. The agents are transferred continuously to the binary space by using the equations as shown in (2) and (3)

$$y^{j,t+1} = \left\{ \begin{array}{ll} 1 & \text{if} \left(s\left(y^{j,t+1}\right)\right) \geq \mathrm{rand}() \\ 0 & \text{otherwise} \end{array} \right\} \quad (2)$$

where

$$s\left(y^{j,t+1}\right) = \frac{1}{1 + e^{10\left(y^{j,t+1} - 0.5\right)}} \quad (3)$$

Here,

$\mathrm{rand}()$ is the randomly generated number from uniform distribution [0,1] and $y^{j,t+1}$ is the binary position updated at the *t* iteration for *s* steering vector. The proposed CBCS algorithm is designed based on wrapper method and implemented as a feature selection algorithm. The chaotic sequence is embedded in the iterations generated during binary searching. The dataset is described by using the optimal feature using CBCSA. The feature selection is used for improving the classification performance, reduction in the computation cost, and length of the feature subset. The detailed description is as follows.

3.2. Parameter Initialization

The proposed CBCSA is used to obtain optimal parameters which are given in Table 1. The CBCSA starts at the beginning and adjusts the parameters and initializes the crow positions randomly in the search space. Each position of the feature subset consists of different number of features having distinct length. The CBCSA is initialized by setting the parameter in Table 1.

Table 1

Parameter settings for CBCSA

Parameter	Value
Number of crows (*M*)	30
Awareness probability (AP)	0.1
Flight length (*fl*)	2
Lower bound	0
Upper bound	1
Maximum number of iterations (*t*Max)	50
Random number (R_j)	[0, 1]
Total number of dimension (*D*)	= Total number of features

Fitness function

The crow positions at each iteration are computed using the fitness function F_{n_i}. The data are randomly divided into two different parts such as testing and training. The proposed CBCSA sets M to 10 that ensures the stability of the obtained results. The proposed model aims for two main objectives, namely evaluating classification accuracy and the selecting number of features. The adopted fitness function combined two objectives into one weight factor as shown in Eq. 4.

The classification accuracy calculates the number of correctly classified sequences to the total number of instances. The KNN classifier is used for the proposed model, wherein $k = 3$ having mean absolute distance.

Where L_f is the selected feature subset length.

L_t—denotes the number of features used totally.

w_f—weighted factor having [0,1] value that controls the number of selected features and classification accuracy.

The main aim of the research is to increase the accuracy, so it generally sets the weight factor value to 1. But in the proposed method, the weight factor is set to 0.8. The best solution for the proposed method is obtained by maximizing the accuracy and by minimizing the number of selected features.

$$F_{n_i} = \text{maximize}\left(\text{Accuracy} + w_f \times \left(1 - \frac{L_f}{L_t}\right)\right) \tag{4}$$

The crow position is updated using proposed CBCSA, and termination criteria are performed. The optimization process terminates when the iterations are reached to the maximum number which leads to the best solution.

3.3. Training and Testing the Data Using Artificial Neural Network

The ANN uses one continuous function for its description that is obtained as the small error using the training process. ANN values are updated for performing reduction in errors by obtaining possible values. The error result is obtained by analyzing the difference between the target attributes and the ANN output value.

The ANN has many distinct nodes set parallel for processing simple units that are structured and is used in network topology. The ANN has three different layers such as input, hidden, and output layers, where each layer consists of nodes linked with weights. The AQ2 weights are linked to the next-later nodes and likewise form stacked network for all the nodes of ANN. The bias nodes consist of single output node which is connected to that of remaining leftover nodes. The nodes are having connections with the bias nodes which are obtained from leftover nodes and are known as bias weights.

The generated weights are connected to each node x and are summed to indicate the activation function for input value of the node such as sigmoid function, sign function, and step function. The sigmoid function is most commonly used activation function which is shown in Eq. 5.

$$f(x) = \frac{1}{1+e^{-x}} \tag{5}$$

Here, the error is computed by using Eq. 2 which measures the differences for obtaining actual output (*O*) and desired output (*T*) and gives rise to a feedforward which is shown in Eq. 6.

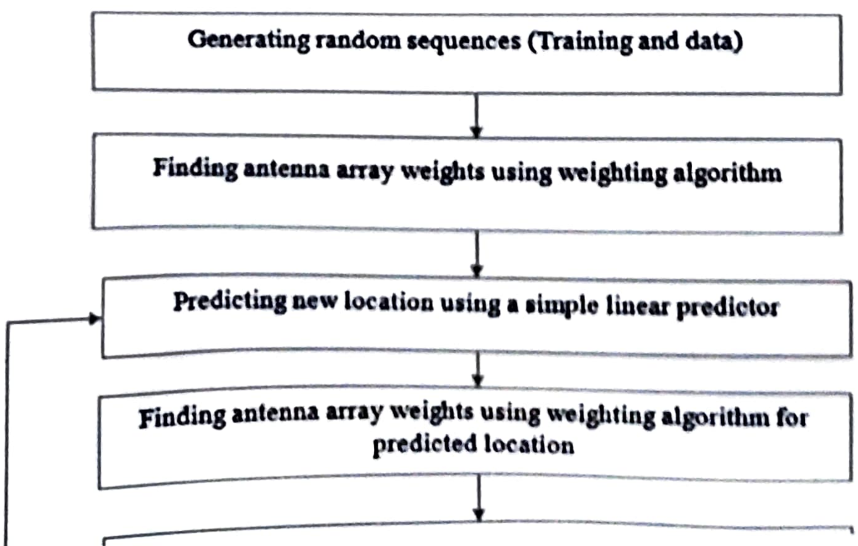
$$\text{Error} = \frac{1}{2}\Sigma\Sigma(T - O)^2 \tag{6}$$

Figure 2 shows the block diagram of the beam forming. The outputs generated from the CBCSA feature selection algorithm are the steering vectors, and the generated array output is shown in Eq. 7. The average total output power *P* for *i*th array is expressed in Eq. 7.

$$P_i E\left[|y_i(n)|^2\right] = E\left[w_{i,k}^H(n)\, x(n)\, x^H(n)\, w_{i,k}(n)\right] \tag{7}$$

Fig. 2

Block diagram of the beam forming



Forming the antenna pattern according to the weights for predicted location

↓

Doing the Beam forming algorithm at new sampling point and finding the exact location of source

↓

Output

where the $w_{i,k}^{H}$ indicates the weights of steering vector for the ith user index and H is the Hermitian conjugate transpose.

$y_i(n)$ is an output array output signal and E is the mean operator defined in Eq. 8.

$$R = E\left[x(n)\, x(n)^{H}\right] \tag{8}$$

The autocorrelation matrix (R) which corresponds to an input signal receives an output power averagely for an array as shown in Eq. 9

$$P_i = w_{i,k}^{H} R_{w_{i,k}}(n) \tag{9}$$

The final steering weight of the vector maximizes SNR of the output array and minimizes the problem as per Eq. 10

$$w_{i,1} \ldots w_{i,k}, P_{1,} \ldots P_{k,} \left(\sum_{i=1}^{K} P_i\right) \quad \text{Subject to SNR} \geq \delta_i \tag{10}$$

where δ_i is the SNR value having lower dB, P_i is the transmission power for the ith user, and $w_{i,k,}$ is the optimum weight value of beam forming vector for ith user. This proposed research aims to obtain steering vectors with minimum power during entire transmission and maintains the SNR above the threshold. Thus, beam forming is obtained from antenna arrays, and optimum weights are computed by using adaptive beam forming algorithms. The better performance and capacity are provided based on MIMO beam forming. From the setup of the proposed method, beam forming adjusts steering vectors for obtaining a maximum SNR.

4. Result and Discussion

This section detailed about the experimental result and discussion of the proposed algorithm. In this research, MATLAB (version 2019) was utilized for experimental simulations with 8 GB RAM, 3.0 GHz Intel i5 processor, and one TB hard disk. In this section, CBCSA algorithm is evaluated for various parameters such as bit error rate (BER), standard deviation (SD), symbol error rate (SER), and signal-to-noise ratio (SNR).

4.1. Performance Measures

- **Bit Error Rate:**

Bit error rate (BER) is a measure of the number of the bit errors occur in a given number of bit transmissions. The expression for BER is shown in Eq. 11.

$$\text{BER} = \frac{\text{Total number of error bits}}{\text{Total number of bits transmitted}} \tag{11}$$

- **Standard deviation:**

The standard deviation is a measure of the amount of variation or dispersion of a set of values. The expression for the standard deviation is expressed in Eq. 12

$$\sigma = \sqrt{\frac{\sum (x_i - \mu)^2}{N}} \tag{12}$$

σ is population standard deviation, N is the size of the population, x_i is each value from the population, and μ is the population mean.

- **Symbol Error Rate:**

Symbol error rate (SER) is defined as the number of changes in symbols, waveform, or signaling events across the transmission medium per time unit using a digitally modulated signal or a line code. The SER is expressed as shown in Eq. 13.

$$\text{SER} = \frac{\text{Number of symbols in error}}{\text{Total number of Transmitted symbols}} \tag{13}$$

- **Signal-to-Noise Ratio:**

Signal-to-noise ratio is defined as the ratio of the signal power to the noise power such as background noise or unwanted input. The SNR is expressed as shown in Eq. 14.

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4.2. Quantitative Analysis

The performance measures SNR, SER, and BER are calculated for the proposed CBCSA.

The proposed CBCSA optimization algorithm performs the optimization process and thus generates the steering vectors for the determining the significant channel for beam forming. The symbol error rate across all channels is calculated across SNR, and bit error rate is also calculated across all the channels. Table 2 shows the performance measures BER and SNR obtained for the proposed CBCSA, and the performance measures SER and SNR obtained for the proposed CBCSA are tabulated in Table 1. Tables 2 and 3 show an improved SNR of 23.96 dB when the BER is 10^{-4} and the SNR of 34.95 when the SER is 10^{-10}.

Table 2

Performance measures BER and SNR obtained for the proposed CBCSA

SER	10^{-2}	10^{-3}	10^{-5}	10^{-8}	10^{-9}	10^{-10}
SNR (dB)	−10	−5	−1.09	9.89	20	34.95

Table 3

Performance measures SER and SNR obtained for the proposed CBCSA

BER	10^{0}	10^{-1}	10^{-2}	10^{-3}	10^{-4}
SNR (dB)	0	11.45	14.07	18.76	23.26

The tabulation of amplitude values obtained for the proposed CBCSA method is shown in Table 4, and Fig. 3 shows the graph obtained for maximum errors for the proposed method.

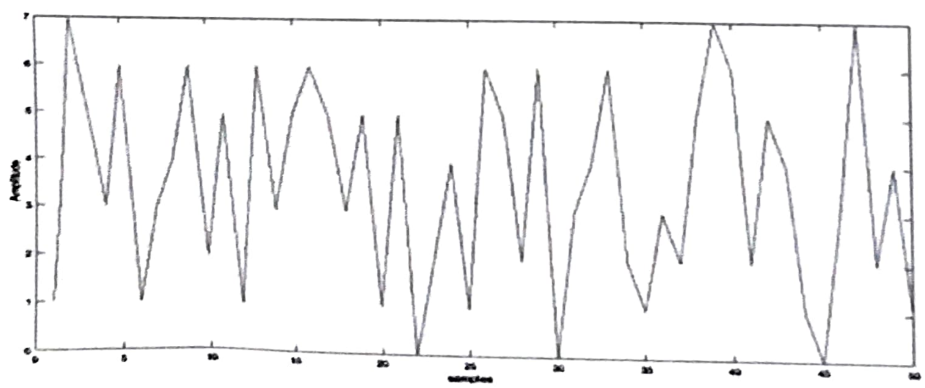
Table 4

Tabulation of amplitude values obtained for the proposed CBCSA method

Samples	5	10	15	20	25	30	35	40	45	50
Amplitude	1	2	6	1	1	0	1	7	0	4

Fig. 3

Maximum errors obtained for the proposed CBCSA method

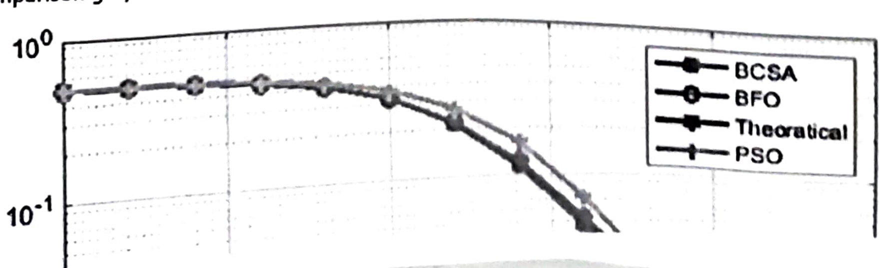


4.3. Comparative Analysis

In this section, the proposed CBCSA and the existing particle swarm optimization and bacterial foraging optimization (PSO-BFO) algorithm are evaluated for various parameters. The steering vectors obtained from the proposed CBCSA algorithm showed better performance than BFO techniques obtained for same computational load. The comparison graph for existing PSO-BFO and the proposed CBCSA against SER is shown in Fig. 4. From the results, it is observed that the SNR has received higher dB of noise and is plotted against BER.

Fig. 4

Comparison graph for SNR against BER



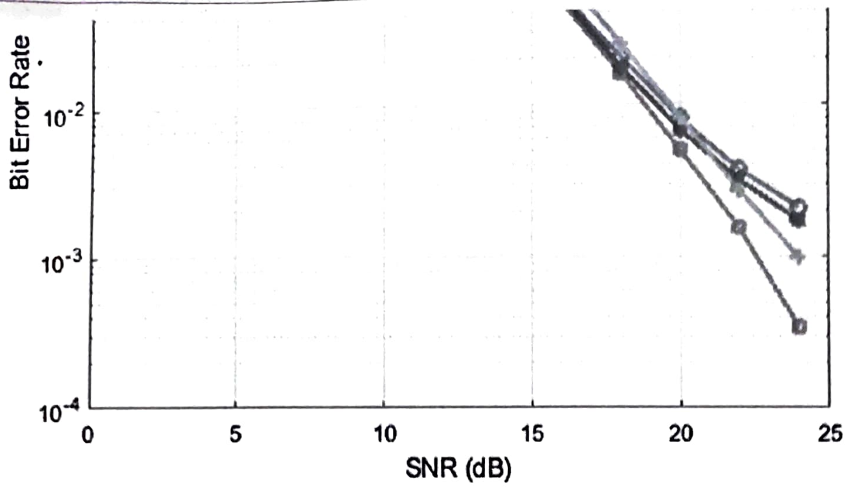


Figure 5 shows the graph of the maximum errors obtained in the proposed method. The tabulation of maximum errors obtained for the proposed and existing method is shown in Table 5.

Fig. 5

Graph obtained for the maximum errors in the proposed and the existing methods

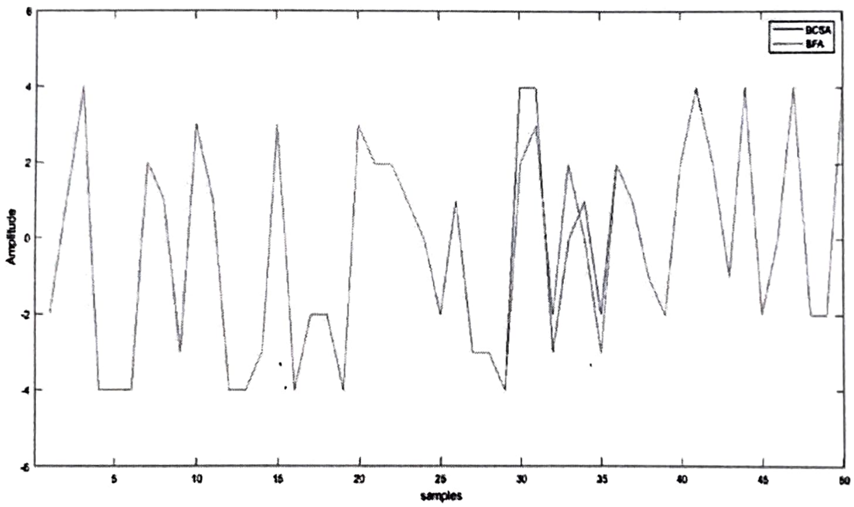


Table 5

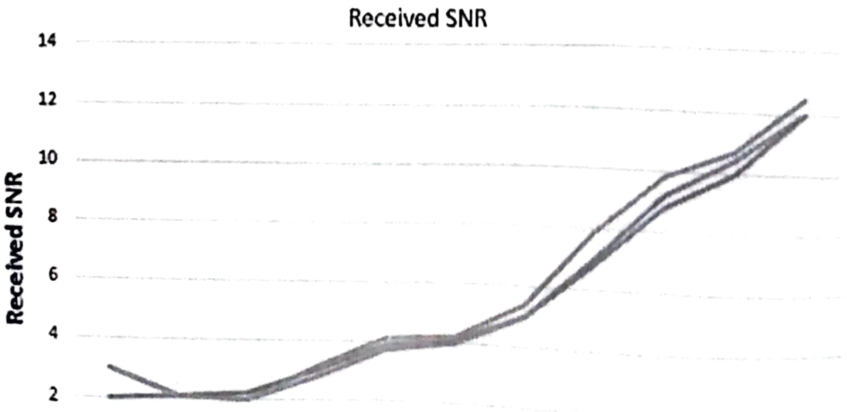
Maximum errors obtained for the proposed and existing method

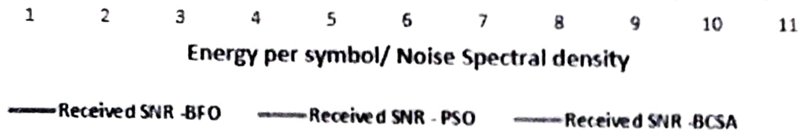
Samples	5	10	15	20	25	30	35	40	45	50
Amplitude (BFA)	−4	3	1.56	3.58	−3	2.48	−3	−2	−1.5	4
Amplitude (CBCSA)	−5	2	1.3	3.06	−4	4	−2	−1	−1.3	5

The amount of SNR obtained at the receiver end for the modulated signals shows the quality of the received output. The SNR performance obtained higher values at the receiver when the proposed model is developed. The proposed CBCSA showed better SNR values when compared with the existing models. The graph for the existing and the proposed model is shown in Fig. 6

Fig. 6

Graph obtained for the received SNR performance measure for the proposed and the existing methods

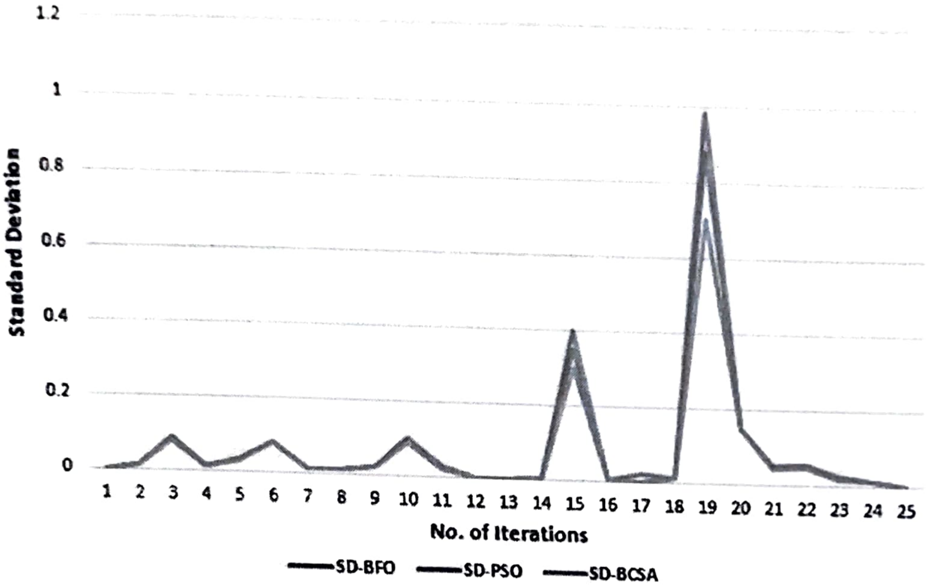




The standard deviation obtained from the existing and the proposed model is shown in Fig. 7. The standard deviation performance obtained higher values at the receiver when the proposed model is developed. The proposed CBCSA showed better standard deviation values when compared with the existing models.

Fig. 7

Graph obtained for the standard deviation for the proposed and the existing methods



The comparison graph for the existing PSO-BFO and the proposed CBCSA is plotted against SNR. From the results, it was observed that the actual SNR received is 2% higher when compared to SER. Figure 8 shows the comparison for SNR against SER. The comparison analysis for the SNR against SER for the proposed and the existing methods is shown in Table 6. The SNR values are plotted against the SER values ranging from 10^{0} to 10^{-10}. As the value of SER decreases, the SNR will increase.

Fig. 8

Comparison graph for SNR against SER

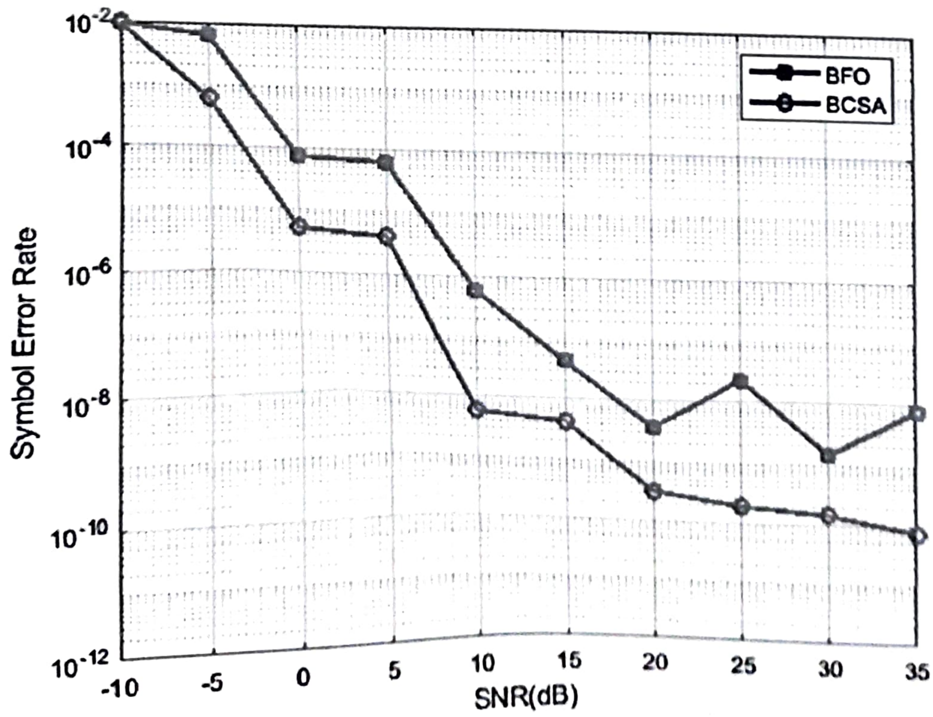


Table 6

Comparison of SNR against SER for the proposed and the existing model

						10^{-8}	10^{-10}
Existing BFO (SNR dB) [5]	−4.8	0	5.6	10.54	23.75	35.46	36.53
Proposed CBCSA (SNR dB)	−14.75	−10	−4.56	−1.09	7.78	9.89	34.59

From the results obtained from the proposed system, it shows that the proposed system has better SNR when compared to the existing BFO-, PSO-based system. The importance of the proposed CBCSA was that it achieved better values of steering vectors and also these vectors were trained into ANN to achieve better SNR values. The proposed CBCSA research handles both time-variant distortion and also overcomes the optimization problems to reduce the complexity of the system. As the SER decreases, the SNR was increasing in dB which gives improvement in the convergence speed and decreases the time consumption.

5. Conclusion

The main objective of the beam forming is to obtain steering and weight vectors that maximize the SNR rate. The beam forming for the MIMO system provided better results for the determination of suitable channel during signal transmission. The proposed CBCSA algorithm is mainly focused on channel selection of the MIMO wireless transmission system, and it is important to train the CBCSA with ANN parameters to effectively producing channels for beam forming. The limitation of optimization problem during time-variant distortions in existing model BFO-PSO is overcome by CBCSA algorithm that obtained steering vectors as features and those trained into ANN for channel determination. The optimization is performed using a proposed CBCSA algorithm that improved the convergence speed, and the accuracy of the neural network was obtained by training the steering vectors during the feature selection process. The obtained results show that the proposed CBCSA achieved better SNR ratio when compared to the existing PSO and BFO algorithm. The future work can be extended by implementing hybrid PSO and CSA algorithm for overcoming optimization problem.

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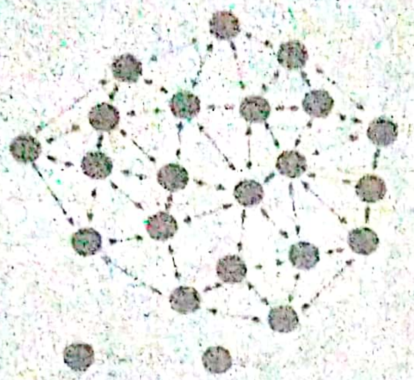

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Machine Learning-Based Intelligent Video Analytics Design Using Depth Intra Coding

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Abstract

Machine learning-based intelligent video analytics design using depth intra coding is implemented. There is a requirement for an intelligent and smart system that can solve this deficiency by automating the process. When unsecure objects in the frame are detected, then this should give an alert to the security person. This approach restores depth component for conventional intra-picture coding. Preanalysis of coding unit is done for giving input. After preanalysis, the features are selected from the obtained data. The fast depth intra coding mode and 2N × 2N intra mode will perform the operation. If the depth or size is not equal, then it will again perform its operation from the preanalysis. If the partition is equal, then it will depend on the increment of depth and if it is not equal then content decision will process the screen content. If screen content is not equal, then it will perform the N × N intra mode and if it is equal then it performs Depth Intra Coding and PLT mode. Finally, best Coding Unit depth intra mode is chosen. If the depth, size is not

equal then it will again perform its operation from the pre analysis. Hence, from the results it can observe that it gives effective results.

Keywords: Depth Intra Coding (DIC), Coding Unit (CU), Depth Size, Machine Learning, Feature Collection, Bjonteggard Delta Bit Rate (BDBR), Signal to Noise Ratio, Complexity, Accuracy.

6.1 Introduction

Picture or video coding is a rule which suggests to the processing innovation that packs picture or video into double code (e.g., bits) to work with capacity and transmission. The pressure could possibly guarantee ideal reproduction of picture/video from the pieces, which is named lossless and lossy coding individually. For common picture or video, the pressure proficiency of lossless coding is typically underneath necessity, so the majority of endeavors are dedicated to lossy coding [1]. Lossy picture or video coding arrangements are assessed at two perspectives: first is the pressure proficiency, usually estimated by the quantity of pieces (coding rate), minimizing would be ideal; second is brought about errors, generally estimated by the nature of the remade picture/video contrasted and the first picture or video. Picture or video coding is a basic and empowering innovation for PC picture preparing, PC vision, and visual correspondence.

The creative work of picture/video coding can be followed right back which exactly on schedule as present day imaging, picture dealing with, and visual correspondence systems. For example, Picture Coding, a grand overall get-together offered expressly to types of progress in picture or video coding [2, 3]. In this, different undertakings from both insightful world and industry have been given to this field.

Metropolitan zones or current urban areas are for the most part presented to tremendous group and traffic. Such zones needed to be under consistent re-consistence for security purposes. Past techniques like manual perception by security individual 24 × 7 is anything but a successful or practical strategy for re-consistence. However, if any individual conveys a blade or an arm in a jam-packed spot, it may not be identified because of the lack of ability of the security individual to discover such items in the group by the unaided eye. Subsequently, we require a long-lasting framework which will tackle this issue, a framework which is unequipped for including the quantity of individuals in the casing and separate among safe and unstable articles. 3D Video innovation has appeared as of late alongside expanded exploration at all phases of the preparing chain from 3D video catch to the presentation innovation. This will gradually incorporate new and progressed 3D video coding techniques for powerful pressure and transmission and furthermore most recent applications that blend 3D PC designs components and 3D recordings.

Here, the Multi View Video (MVV) portrayal design is used, giving similar scenes from at least two separate points of view. We notice tremendous group and traffic in metropolitan territories. These zones need constant reconnaissance for security reasons. A standard technique that utilizes manual perception by a security individual 24 × 7 is certainly not a successful or reasonable path for reconnaissance. Envision if any individual conveys a blade or weapon in a stuffed spot, it may not be recognized in light of the insufficiency of the security faculty to notice such items in the group by the unaided eye [4].

Along these lines, there is essential of a system which would incorporate the amount of individuals and separated among protected articles. Hence, this might diminish the load on the security work power and cooperation the perception more useful and suitable. The possibility of uniqueness is utilized to see conditions which are effectively used with MVC. This provides tremendous coding when diverged from simulcast coding. This idea is further appropriate to the HEVC standard for introducing a straightforward sound system and multi view video coding expansion [5]. The better coding effectiveness of HEVC contrasted with H.264/AVC is acquired. Compelling pressure and transmission of MVD information is the significant angle for the accomplishment of the model. The significance of intra coding strategy with another bearing and expecting mixing of 3D video and 3D PC plans [6]. The consistent and convincing coding plan is the key achievement for 3D video applications that either used assertion guides or polygon organizations, with further developed design blocks for a high assertion coding practicality in thought of least trinkets in outfitted points of view with an immaterial number of triangles of cross area extraction for a referred to bits rate [7, 8].

The new creations are the lattice extraction calculation that coordinates effectively in decoder for uncommonly planned arrangement of displaying capacities and applicable expecting modes for the improvement of the unaltered idea for totally dependent coding of the statement related intra encoder and decoder at all the stages. The primary point is the sign of a profundity block approach by mathematical sources planning capacities that permit introduction of scene surface with a least number of triangles.

6.1.1 Object Detection

Object detection is utilized for recognizing objective items. It is a strategy of PC vision which is organized in recordings or pictures. Item recognition calculations are shown in outcome when a client is introduced as a picture or video and is approached to discover an article. Hence at that point the client is fit for playing out that task promptly. The article recognition's primary design is to recover this shrewdly using a PC by Object identification is a fundamental innovation behind cutting edge driver help frameworks where the vehicle driving paths are distinguished or used to perform walker location to upgrade street wellbeing. These days Object identification is generally utilized in video reconnaissance or picture recovery frameworks fields.

6.1.2 Deep Learning

Artificial insight comprises of deep learning capacity that mimics the human cerebrum and information preparing and creating designs for dynamic and deep learning is a subset procedure of AI in man-made Artificial Intelligence (AI) that has learning unaided organizations ability of information that isn't orchestrated or marked. Profound learning helps a progressive degree of fake neural organizations to complete the methodology of AI. The fake neural organizations are constructed like human cerebrums associated together like a web portraying neuron hubs. The varieties among customary projects and profound learning is that customary projects investigating the liner information while chipping away at profound learning frameworks measure information with a computational methodology utilizing its different leveled capacities.

6.1.3 Geometric Depth Modeling

The two methodologies are obtained from the mathematical planning capacities where both the frameworks are adjusted to a specific profundity signal component that is changed from the estimation. Geometrics has same demonstrating capacities have been applied in before works, for instance wedgelet and plane models or form model.

6.1.3.1 Plane fitting

The essential guideline of this profundity signal demonstrating approach is approximating the sign of a rectangular square by a direct model that depicts a plane. This sort of model focuses on a nearby estimation of profundity blocks with a planar sign trademark-normally introducing level scene territories or articles. With the example esteems dM(u, v) of the plane model of a profundity block is characterized by a straight capacity as follows:

$$d_M(u, v) = d_o + m_u \cdot u + m_v \cdot v \tag{6.1}$$

As do is utilized for characterizing the counterbalance at position (0, 0) and m_(u/v) the incline of the plane in both synchronized ways as given in a profundity block with native common qualities d(u, v), bringing about best estimate by a plane model for recognizing the plane with boundaries do that utilizes the couple of bending grouped with the native sign which is an overall methodology for finishing of less contortion of direct model for introductory arrangement of test esteems is called as straight relapse. The many times it utilizes the mutilation metric for this is Mean Squared Error (MSE), so the least squares direct relapse technique infers the straight model with the least MSE. For test esteems appointed with more than one facilitate, the technique is reached out to different straight relapse. If there should arise an occurrence of two directions, similar to the (u, v) of our profundity block, this is additionally alluded to as least-squares relapse plane or plane fitting.

6.1.4 Depth Coding Based on Geometric Primitives

The compelling profundity pressure utilizes calculation based profundity displaying approach which comes first of its quality to intently address prescient coding of the sign of a profundity block. In like manner, the data or boundaries disclosing the model needed to be available at the decoder remaking. On a basic level the vital information either gathered from accessible wellsprings of recently decoded pictures and squares (forecast) or assurance at the encoder and changed in the piece stream (expected)-typically joined such that the variety among expected and assessed data is communicated at the encoder and closed basing on the stretch out which is expected based on the data is sent to the decoder and large dependent on an expense work that adjusts the trade among rate and mutilate ion, alluded to as rate twisting improvement. These segments gives an outline, forecast, and flagging techniques that are required for executing our profundity signal demonstrating in a coding structure called MVV (Multi View Video).

6.2 Video Analytics Design Using Depth Intra Coding

Flow graph of video analytics design shown in Figure 6.1, using depth intra coding. Pre analysis of coding unit is done for given input. After pre analysis, the features are selected from the obtained data. The fast depth intra coding

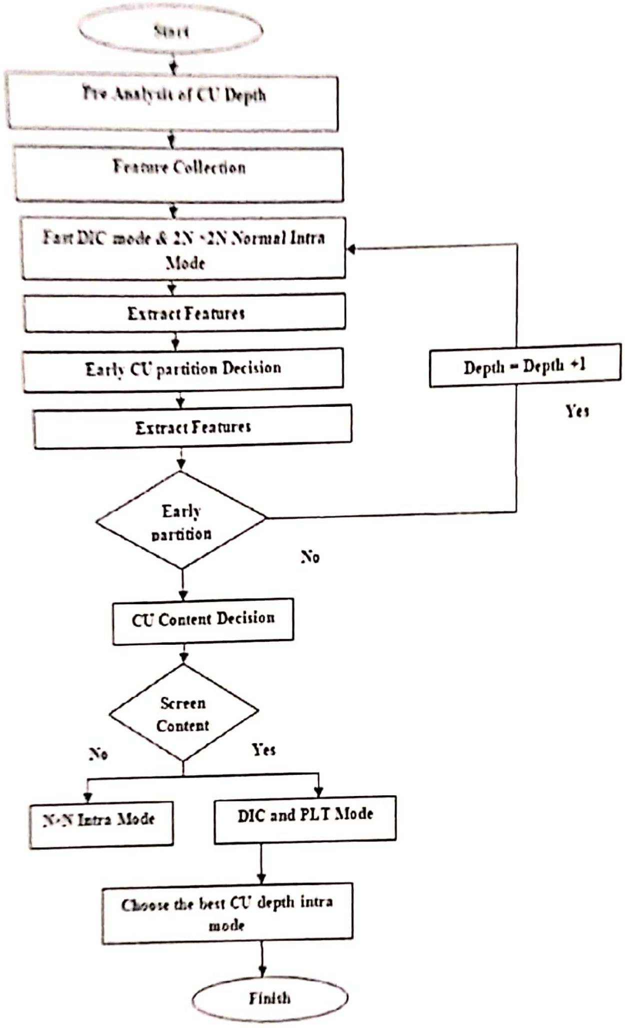

Figure 6.1 Flow graph of video analytics design using depth intra coding.

mode and 2N × 2N intra mode will perform the operation. If the depth size is not equal, then it will again perform its operation from the pre analysis. If the partition is equal then it will depend on the increment of depth and if it is not equal then C content decision will take decision and further process to the screen content. If screen content is not equal then it will perform the N × N intra mode and if it is equal then it performs DIC and PLT mode. At last best coding unit depth intra mode is chosen.

One can track down that enormous coding unit s are bound to be picked as ideal coding unit for "level" or "foundation" locals, where expectation residuals will in general be little and further split for the most part brings little forecast improvement yet expanded side data [9]. For areas which contain last or edges, little coding units are bound to be picked as ideal coding unit size which is expected to be huge. Coding units under the Intra 2N × 2N mode alongside the coding unit split data, where the early partitions address that current coding units should be part and the red spots show that the current coding units are ideal and will not be part further. It tends to be seen that coding units with little residuals like to be coded with enormous coding unit size, which consists of the huge residuals are bound to be part further for more exact expectation. This is particularly valid for coding units at profundity 0. In view of the above perception, this propose to anticipate the coding unit profundity dependent on remaining data where coding unit parting measure will be done.

6.3 Results

Comparison tabular form of existed and proposed system. In this BDBR rate, time saving, signal to noise ratio, complexity and accuracy are given in detail manner. BDBR is decreased in proposed depth intra coding system compared to normal intra coding [10]. Complexity is also decreased in proposed system. Signal to noise ratio is reduced and time saving is increased.

Table 6.1 Comparison of parameters

S No	Parameters	Normal Intra Coding	Depth Intra Coding
1	Bjonteggard Delta Bit Rate (BDBR)	3.05	2.72
2	Time saving	36.70	48.89
3	Signal to noise ration	More	less
4	Complexity	High	low
5	Accuracy	High	Low

Figure 6.2 compares the complexity, accuracy, and signal to noise ratio of normal intra coding and depth intra coding system for video analytics.

Figure 6.3 compares Bjonteggard Delta Bit Rate (BDBR) of normal intra coding and depth intra coding system for video analytics. Compared to normal intra coding, depth intra coding system will reduce effectively.

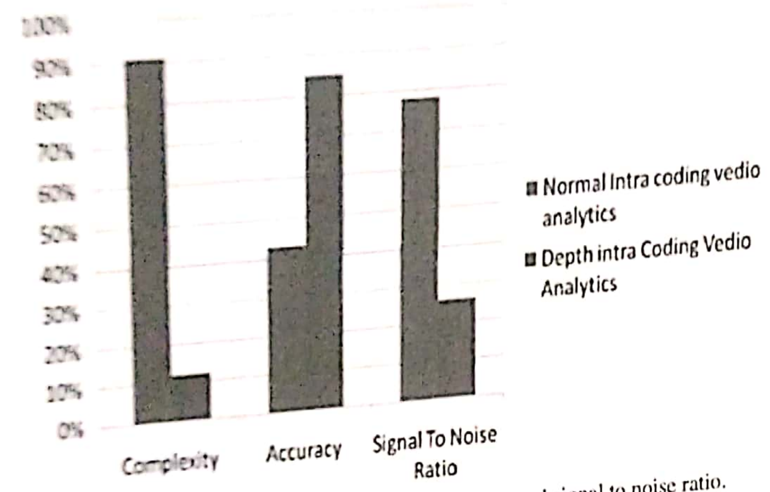

Figure 6.2 Comparison of complexity, accuracy, and signal to noise ratio.

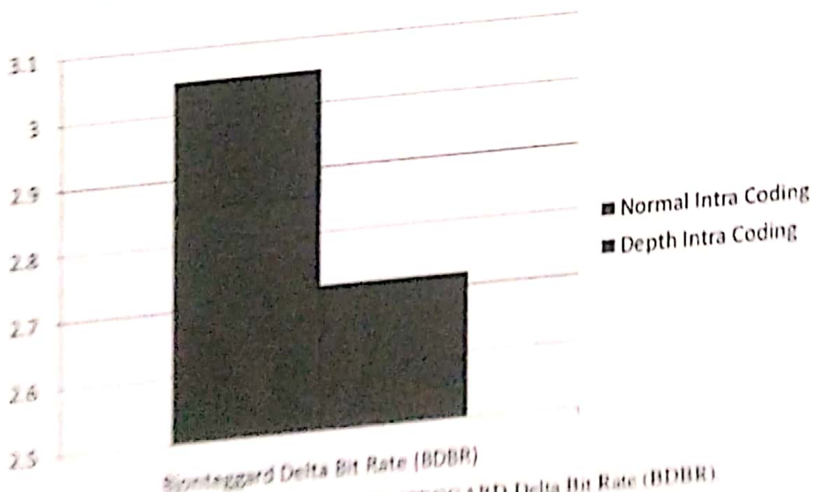

Figure 6.3 Comparison of BJONTEGGARD Delta Bit Rate (BDBR)

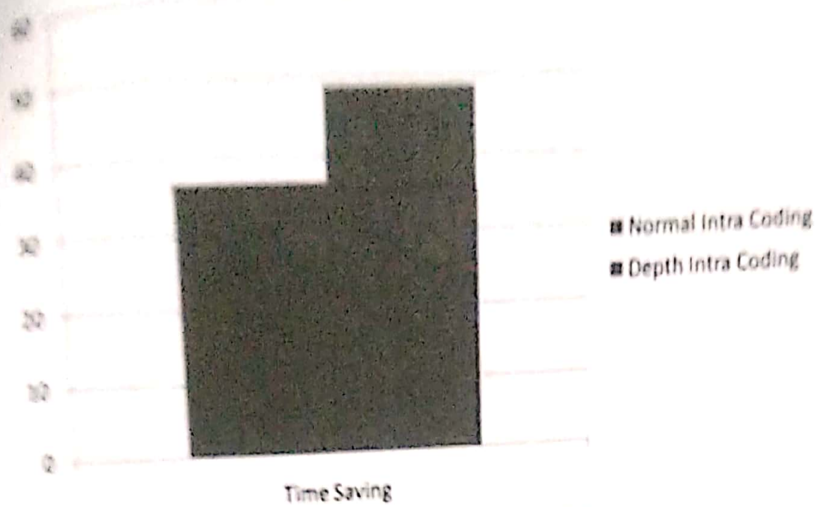

Figure 6.4 Comparison of time saving.

Figure 6.4 compares time savings of normal intra coding and depth intra coding system for video analytics. Compared to normal intra coding, depth intra coding system will save the time very effectively.

6.4 Conclusion

Hence, in this project a novel machine learning based intelligent video analytics design using depth intra coding was implemented. Best CU depth intra mode is chosen at last to get effective output. From results, it can conclude that it gives effective results in terms of complexity, accuracy, and signal to noise ratio, BDBR rate, and time saving. The proposed video analytics using depth intra coding system will improve the efficiency in very efficient way.

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