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AN ENHANCED HYBRID CUCKOO SEARCH AND GENETIC ALGORITHM USING HAAR-LIKE FEATURE FOR SURVEILLANCE VIDEOS

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ABSTRACT

This paper is mainly focused on image processing concept which is used in surveillance videos for security purpose. Image processing technique involves dispensation of image using a mixture of mathematical functions in which image or video is given as input and the extent to which the image is matched is given as output. The main problem found in this paper are edge detection and noise removal in images. Initially this research paper is compared with cuckoo search and genetic algorithm. Then these two algorithms are combined together as an hybrid CS - GA Algorithm and finally the result of this hybrid algorithm is compared with enhanced hybrid CS-GA using Haar-like feature for real time surveillance video. The result is compared in terms of Recognition rate accuracy and time complexity.

INTRODUCTION

As we consider this new millennium, barely a week passes where we do not hear the technological advancements in the areas of digital computation and telecommunication. Particularly, the exciting thing has been the participation of the general public in these developments. The participation of such huge public is possible with the help of computers which are easily affordable and the incredible explosion of the World Wide Web which brought a flood of instant information into a large and increasing percentage of homes and businesses [16].Nearly all of this enhancements aims for visual spreading in means of text, graphics and multimedia presentations. Digital images and digital video are actually pictures and movies that have been converted into a computer-readable binary format consisting of logical 0s and 1s[3]. Frequently, the term image refers to a still picture which does not change by means of time, whereas the term video refers to a picture which evolve with time in addition to generally moving and/or varying objects [8]. Although direct digital systems are becoming more prevalent nowadays, the digital images or video are usually obtained by converting continuous signals into digital format [1]. Likewise, digital visual signals are viewed by using diverse display media which includes digital printers, computer monitors, and digital projection devices [15]. The frequency with which information is transmitted, stored, processed and displayed in a digital visual format is increasing rapidly and thus the design of engineering methods for efficiently transmitting, maintaining, and even improving the visual integrity of this information is of heightened interest. One feature of image processing that makes it such an attractive topic of study is its incredible diversity of applications with analysis technique. Virtually every branch of science has sub disciplines that use recording devices or sensors to collect image data from the universe around us. These data are actually multidimensional at the same time they can be set in an arrangement that is appropriate for human viewing. Viewable datasets like this can be regarded as images, and they can be processed by using recognized image processing techniques, even though the information provided by them has not been derived from visible-light sources. Furthermore, the data may be recorded since they may change in excess of time. By means of quicker sensors and recording strategy, it is extremely easier to obtain and investigate digital video datasets. As a result of removing the rich spatio-temporal feature that is obtainable in video in sequence, the individual can often examine the enlargement or evolutionary properties of active material phenomena of living specimens.

SURVEILLANCE

Surveillance is the monitoring of the activities, or any other information, usually of people for the purpose of influencing, managing, directing, or protecting them. This can include observation from a distance by means of electronic equipment such as CCTV camera, phone calls or internet traffic and it can include simple, relatively low-technology method like human intelligence agent [4]. The word Surveillance comes from the French phrase for "watching over". Surveillance is used by governments for intelligence gathering, the prevention of crime, the protection of a process, person, group or object, or for the investigation of crime[5]. It is used by criminal organizations to plan and commit crimes such as robbery and kidnapping, by businesses people to gather intelligence, and by private sectors. Surveillance cameras are video cameras used for the purpose of observing an area[7]. They are often connected to a recording device or IP network and they are watched by a security guard or a an enforcement officer[23]. Cameras and recording equipment used to be relatively expensive and required human personnel to monitor camera footage, but analysis of footage has been made easier by automated software[19]. The amount of footage is also drastically reduced by motion sensors which only record when motion is detected. With cheaper production techniques, surveillance cameras are simple and inexpensive enough to be used in home security systems, and for everyday surveillance[21]. Governments often Initially claim that cameras are mainly used for traffic control, but many of them use it for general surveillance. For example, Washington, D.C. had 5,000 "traffic" cameras installed under this premise, and then after they were all in place, networked them all together and then granted access to the Metropolitan Police Department, so they could perform "day-to-day monitoring". The development of centralized networks of CCTV cameras watching public areas are linked to computer databases of people's pictures for identifying biometric information and we can able to track people's movements throughout the city, and identify whom they have been with[9] . Trap wire is an example of such a network.

CUCKOO SEARCH ALGORITHM

An optimization algorithm that is used for image processing is cuckoo search Algorithm, it was developed by Xin-she Yang and Suash Deb in 2009. It was stimulated by obligate brood parasitism of various cuckoo class by laying their eggs in the nests of other host birds [2].A few host birds can connect direct argument with the intruding cuckoos. For example, if an egg was discovered by a host bird that the egg is not its own, its motivation moreover will be to throw these alien eggs away or simply throw away its nest and construct a new nest somewhere else[6]. A few cuckoo species such as brood-parasitic Tapera surround evolved in such a way that female sponging cuckoos are frequently very specific in the mimicry in colors and prototype of the eggs of a few chosen host species [10]. Cuckoo looks for idealized such reproduction behavior, and thus can be useful for various optimization problems [12].

Cuckoo Search is based on three important rules:-

All cuckoo lays one egg at a time, and dumps its egg in a random chosen nest.

The most excellent nests with high excellence of eggs will carry over to the next generation [11].

The number of available hosts nests is fixed, and the egg laid by a cuckoo is nests were discovered by the host bird with a probability of $p_a \in (0,1)$. The Discovering phase generally operates on some set of worst nests, and discovered solutions are dumped from further calculations [13].

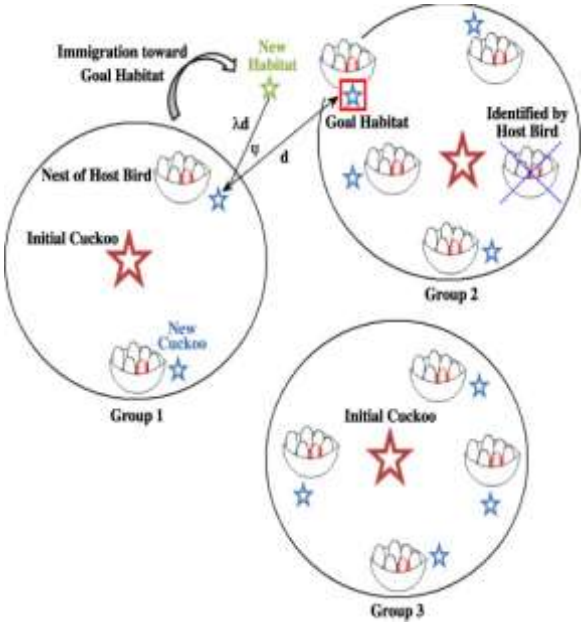


Figure 1 : CUCKOO SEARCH

GENETIC ALGORITHM

Genetic algorithms are stimulated by Darwin's theory of evolution. Explanation to a problem solved by genetic algorithms uses an evolutionary development. Algorithm is in progress with a set of solutions. Initially Solutions from one population are taken and they are used to form a new population. This is aggravated by a hope, that the new population will be enhanced than the old one. Solutions which are chosen to form the original solutions, are actually chosen according to their robustness and the appropriate chances to reproduce. This is repeated until condition is satisfied.

[Start] Generate random population of *n* chromosomes (suitable solutions for the problem)

[Fitness] Evaluate the fitness *f(x)* of each chromosome *x* in the population

[New population] Create a new population by repeating the following steps until the new population is complete

a) [Selection] Select two parent chromosomes from a population according to their fitness (the better fitness, the bigger chance to be selected)

b) [Crossover] With a crossover probability cross over the parents to form a new offspring (children). If no crossover was performed, offspring is considered as an exact copy of parents.

c) [Mutation] With a mutation probability mutate new offspring at each locus (position in chromosome).

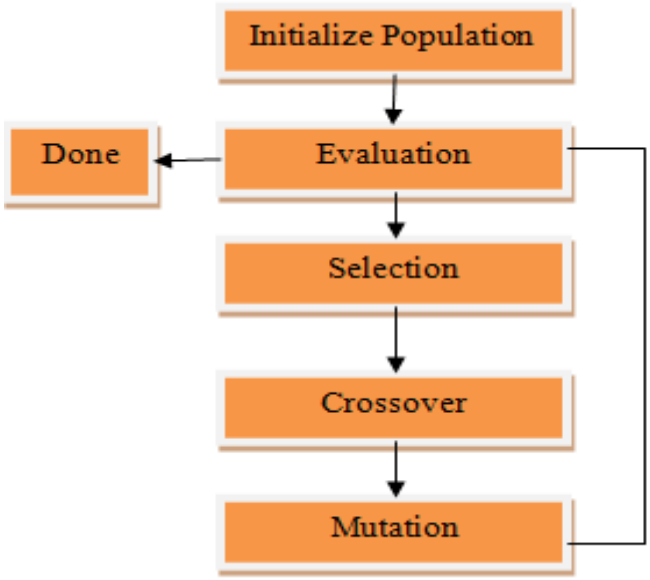
d)[Accepting] Place new offspring in a new population

[Replace] Use new generated population for a further run of algorithm

[Test] If the end condition is satisfied, stop and return the best solution present in the current population

[Loop] Go to step 2

Genetic Algorithm Flow Chart



Pseudo code for genetic algorithm

Define object function
$f(x), x(x1, \ldots . xd)$
Encode the solution into chromosomes
Define fitness F(F$\propto f(x)$ for maximization)
Generate the initial population
initial probabilities of crossover (p_c) and mutation (p_m)
while (t <max generation) or (stop criterion);
if(p_c)> rand, end if
if(p_m)> rand, end if
Accept the new solution;
Select the current best;
end while
Decode the results and visualization
end

HYBRID CUCKOO SEARCH - GENETIC ALGORITHM

The CS-GA and GA-CS algorithms are joint combinations of the CS and GA techniques[22]. In these first step hybrid CS (or GA) explores and investigate the places and isolate the most promising region of the search space in order to arrange[18]. In the second step, to get better global search and keep away from trapping into local optima, GA (or CS) is introduced in order to explore the search space and produce better results[20]. The arrangement of the hybrid CS-GA is exposed by the following pseudo-code. In analogical method the hybrid GA-CS is introduced in the first step, GA explores and investigate the place in order to generate solutions and after that they use the solutions as a primary population for CS[17]. Therefore, the CS determination start with a population, which is considered to be closer to the optimal solution[22]. Additional, CS will be obtained with the most excellent model parameters vector. The structure of the hybrid GA-CS is shown by pseudo-code.

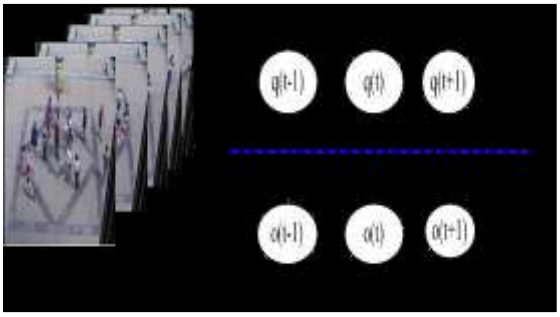
Pseudo code for Hybrid CS -GA

Define object function $f(x), x(x1, \ldots\ldots xd)$
Initial a population of n host nests $x_i(i = 1,2, \ldots\ldots d)$
Define the cuckoo search parameters p_a
Define genetic algorithm parameters pc, pm
begins CS
While (t <Max Generation) or (stop criterion);
Get a cuckoo randomly and generate a new solution by flights:
Evaluate its quality fitness: F_i
Choose a nest among n(say j) randomly:
if $(F_i > F_j)$,
Replace j by the new solution;
end
abandon a fraction (p_a) of worse nests
keep the best solution;
Rank the solution and find the current best;
end while
Final best population of nests;
End being CS
Begin GA
$i - 0$
Initial population $p(0)$ = best population of nests
Evaluate $p(0)$ fitness
while (t<Max Generation) or (stop criterion); do
$i = i + 1$
Evaluate p(i) fitness
end while
Rank the chromosomes, find the current best save result
end begin GA

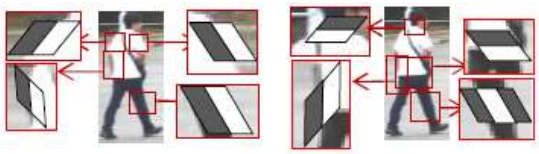
ENHANCED HYBRID CS-GA WITH HAAR LIKE FEATURE

The CS-GA algorithm is modified further with the help of haar like feature .

Haar-like features: The Haar-like features is commonly used by Ada boost learning algorithm. Here thorough examination of the rectangle features is done, since these features consider a local region for the face and involves less computation than the other features[14]. The sum of the pixels within the white rectangles are subtracted from the sum of pixels in the black rectangles. This difference is then used to categorize subsections of an image. In presence these are actually categorized as edges features, line features, and center surround features. Haar-like features can be computed rapidly by using an in-between representation called the integral image as where *ii(x, y)* is the integral image and *i(x, y)*, is the original image. Using the integral image, any rectangular sum can be calculated in four array references. Clearly the difference amongst two rectangular sums can be computed in eight references. Since the two-rectangular features, like edge features, include adjacent rectangular sums, they can be computed in six array references. In the same reason, the three-rectangular features defined above can be computed in eight array references. Haar-like features are sensitive to the presence of edges, bars and other simple image structure. The main difference of haar-like feature from Gabor filters are the available orientations are only vertical and horizontal.



Video Sequential Model



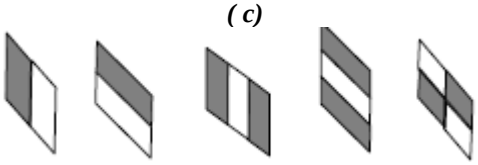
Modified Haar like feature

Image from the video

(a)

(b)

(c)



(d)

The next important step in Haar-like feature is to estimate the computing sum of intensities for the region. This process gets repeated many times for various features and scales.

Time Complexity

Time complexity of an algorithm indicates the total time required by the program in order to run to completion.. Time Complexity is mostly estimated by calculating the number of elementary functions completed by the algorithm. And meanwhile the algorithm's performance may differ with different types of input data. Frequently for an algorithm we use the worst-case time complexity because that is found to take maximum time for any input size.

Dataset

The dataset is a real time data that is captured from the surveillance camera at Coimbatore institute of technology, Coimbatore at various circumstances. Here video movement of same object are captured from surveillance camera at different situations. Camera description is given below.

CAMERA DESCRIPTION

IMAGE SENSOR

Type 22.3 x 14.9mm CMOS
Effective Pixels Approx. 18.0 megapixels
Total Pixels Approx. 18.5 megapixels
Aspect Ratio 3:2
Low-Pass Filter Built-in/Fixed
Sensor Cleaning EOS integrated cleaning system
Colour Filter Type Primary Colour

IMAGE PROCESSOR

Type DIGIC 5

LENS

Lens Mount EF/EF-S
Focal Length Equivalent to 1.6x the focal length of the lens

FOCUSING

Type TTL-CT-SIR with a CMOS sensor
AF System/ Points 9 cross-type AF points (f/2.8 at centre)
AF Working Range EV -0.5 -18 (at 23°C & ISO100)
AF Modes AI Focus, One Shot , AI Servo
AF Point Selection Automatic selection, Manual selection
Selected AF Point Display Superimposed in viewfinder and indicated LCD monitor
Predictive AF Yes, up to 10m[1]
AF Lock Locked when shutter button is pressed
AF Assist Beam: Intermittent firing of built-in flash or emitted by optional dedicated Speed lite
Manual Focus Selected on lens

EXPOSURE CONTROL

Metering Modes

1) TTL full aperture metering with 63-zone SPC Evaluative metering (linked to all AF points)
2) Partial metering at center (approx. 9% of viewfinder)
3) Spot metering (approx. 4% of viewfinder at center)
4) Center weighted average metering

Metering Range

EV 1-20 (at 23°C with 50mm f/1.4 lens ISO100)

AE Lock

Auto: In One-shot AF mode with evaluative metering exposure is locked when focus is achieved.
Manual: By AE lock button in creative zone modes.

Exposure Compensation

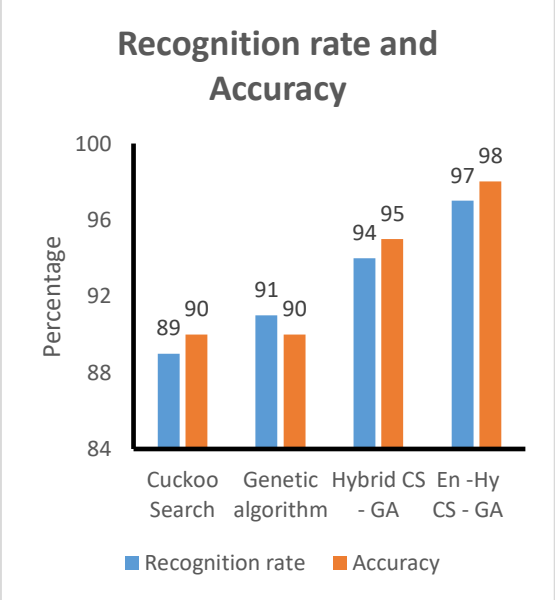
+/-5 EV in 1/3 or 1/2 stop increments (can be combined with AEB).
AEB
3 shots +/- 2 EV, 1/2 or 1/3-stop increments

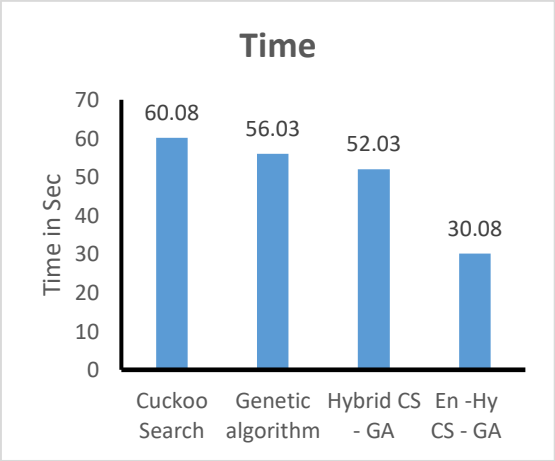
RESULTS

Initially this research paper is compared with cuckoo search and genetic algorithm and then these two algorithms are combined as a hybrid CS-GA and finally the result is compared with enhanced hybrid CS-GA for real time surveillance video. The result is compared in terms of Recognition rate , accuracy and time complexity. It is found that the proposed algorithm have good accuracy when compared with all other variant.

Algorithm	Recognition Rate(%)	Accuracy(%)	Time in seconds
Cuckoo Search	89	90	60.08
Genetic Algorithm	91	90	56.03
Hybrid CS-GA	94	95	52.03
Enhanced Hybrid CS-GA (En-Hy-CS-GA)	97	98	30.08

Comparison Table





The table and the graph shows that Cuckoo Search and Genetic Algorithm has 90% of accuracy, hybrid CS-GA has 95% and Enhanced CS-GA has 98% which is better when compared with all other algorithms. The table and the graph shows that there is an increase in Recognition Rate and decrease in time for all algorithms.

CONCLUSION

This research paper is mainly focusing on the concept of image processing algorithm which is used in surveillance video for security purpose. At first a single image is selected from the video and the noise-level of the image has been reduced with filters. After that the edges are detected with the help of CS-GA algorithm. As a result a good quality image with accuracy is obtained. The performance of the algorithm is measured in terms of its accuracy obtained by the image. And it is found that, when compared with all other algorithm, the enhanced hybrid CS-GA gives good accuracy results for surveillance videos.

REFERENCES

1. G. Aggarwal, A. K. Roy Chowdhury, and R.Chellappa,"A system identification approach for video-based face recognition," in *Proc.ICPR (4)*, 2004, pp. 175–178.

2. R. G. Babukartik and P. Dhavachelvan "Hybrid Algorithm using the advantage of ACO and Cuckoo Search for Job Scheduling", International Journal of Information Technology Convergence and Service (IJTICS)Vol. 2 No. 4, August2012.
3. R. Chellappa, C. L.Wilson, and S. Sirohey, "Human and machine recognition of faces: A survey," Proc. IEEE, vol. 83, pp. 705–740, 1995.
4. D. O. Gorodnichy, "Introduction to the first IEEE workshop on face processing in video," in *Proc. Conf. Computer Vision and Pattern Recognition Workshop (CVPRW '04)*, Jun. 2004, pp. 61–61.
5. D.O.Gorodnichy, "Video-based framework for face recognition in video," in *Proc. 2nd Canadian Conf. Computer and Robot Vision*, May2005, pp. 330–338.
6. A. Kaveh., T. Bakshpoori. "Optimum Design of Space Trusses using Cuckoo Search algorithm with Levy Flights", IJST Transactions of Civil Engineering, Vol. 37, No.Cl, pp. 1-15.
7. E. Kokiopoulou and P. Frossard, "Video face recognition with graph based semi-supervised learning," in *Proc. ICME*, 2009, pp. 1564–1565.
8. H.B. Kekre, Vaishali Kulkarni, Prashant Gaikar and Nishant Gupta, " Speaker Identification using Spectrograms of Varying Frame Sizes", International Journal of Computer Applications(0975-8887) Volume 50- No. 20, July 2012.
9. Ming-Hsuan Yang, David J. Kriegman and NarendraAhuja, „Detecting Faces in Images: A Survey, IEEE Transactions on Pattern Analysis And Machine Intelligence 24 (1), Jan 2004.
10. Moe MoeZaw And EiEi Mon, "Web Document Clustering Using Cuckoo Search Clustering Algorithm Based On Levy Flight", International Journal Of Innovation And Applied Studies Issn 2028-9324 Vol. 4(1), pp. 182-188, September 2013.
11. M. Prakash, R.Saranya, K. RukmaniJothi and A.Vigneshwaran, "An Optimal Job Scheduling In Grid Using Cuckoo Algorithm", International Journal Of Computer Science and Telecommunication, Vol. 3(2), pp. 65-69,February 2012
12. D. Rodrigues, L.A.M Pereira, A. N. Souza, C. C. Ramos, Xin- She Yan "Binary Cuckoo Search: A Binary Cuckoo Search Algorithm For Feature Selection", IEEE International Symposium on Circuits and Systems (ISCAS), PP. 465-468,2013.
13. Srishti, "Technique Based On Cuckoo's Search Algorithm For Exudates Detection In Diabetic Retinopathy", Ophthalmology Research:AnInternationalJournalVol.2(1),pp.43-54,2014,Article No. Or.2014.005
14. Sri-KaushikPavani , David Delgadoa, Alejandro F. Frangi " Haar-like features with optimally weighted rectangles for rapid object detection " Pattern Recognition 43 (2010) 160 – 172
15. A. J. O'Toole, P. J. Phillips, F. Jiang, J. H. Ayyad, N. Penard, andH. Abdi, "Face recognition algorithms surpass humans matching faces over changes in illumination," *IEEE Trans. Pattern Anal. Mach. Intell.*,vol. 29, no. 9, pp. 1642–1646, Sep. 2007.
16. M. A. Turk and A. P. Pentland, "Eigen faces for recognition," J.CognitiveNeurosci., vol. 3, pp. 71–86, 1991
17. VipinkumarTiwari, "Face Recognition Based on Cuckoo Search Algorithm", Indian Journal of Computer Science and Engineering (IJCSE), June-July 2012.
18. S. Walten., O. Hassan., K. Morgan., M. R. Brown. "Modified Cuckoo Search: A new Gradient Free Optimization Algorithm", Chaos Solution and Fractals, Vol. 44, issue 9, pp.710-718.
19. C. Xie, B. V. K. Vijaya Kumar, S. Palanivel, and B. Yegnanarayana,"A still-to-video face verification system using advanced correlation filters," in *Proc. Int. Conf. Biometric Authentication*, 2004, vol. 3072,Springer LNCS, pp. 102–108
20. Xin-She Yang and Suash Deb, "Cuckoo Search via LevyFlight", In: Proc. Of World Congress on Nature & Biologically Inspired Computing (NaBIC 2009) , December 2009, India,IEEE Publication , USA, pp. 210-214(2009).
21. Y. Xu, A. Roy Chowdhury, and K. Patel, "Pose and illumination invariant face recognition in video," in *Proc. CVPR*, 2007, pp. 1–7.
22. X.-S. Yang And S. Deb, "Cuckoo Search Via Levy flight," In Proceeding Of The Nabic – World Congress On Nature & Biologically Inspired Computing, pp. 210-214,2009
23. Y. Zhang and A. M. Martinez, "A weighted probabilistic approach to face recognition from multiple images and video sequences," *Image Vision Computing.*, vol. 24, pp. 626–638, 2006.

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