Improved Object Detection Algorithm using Ant Colony Optimization and Deep Belief Networks Based Image Segmentaion

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***Abstract*— Object detection is a very important application of image processing. It is of vital importance for object dynamic surveillance and other applications. So far, object detection has been widely researched. It shows an efficient coarse object locating method based on a saliency mechanism. The method could avoid an exhaustive search across the image and generate a small number of bounding boxes. After that, the trained DBN is used for feature extraction and classification on sub-images. This paper represents that the a variety of strategies based on object detection and efficiency of object detection framework using a saliency prior and DBNs for remote sensing images. This research works proposed an efficient object detection using the ant colony optimization and deep belief networks. The motivation behind the proposed approach is easy and efficient.**

***Keywords*—Obje4ct Detection, Deep Belief Networks, Object Detection Framework Ant Colony Optimization.**

I. INTRODUCTION

After the unsupervised pretraining, a supervised layer is added to the top of the DBN to build a classifier. The probability distribution of the layer is defined as follows:

$$P(class\ =\ j) = \frac{e^{ft(x)}}{\sum_k e^{ft(x)}}$$

which is also known as softmax regression [15]. P (class = j) is the probability that the data are assigned to class $j.fk(x) = wkx + bk$ is the function of the model. At the fine-tuning stage, the back propagation algorithm is used to fine-tune the whole network until convergence. After training the deep model, detection is conducted for test images.

1.1 Deep Belief Networks

A DBN is a multilayer generative model with several layers of restricted Boltzmann machines (RBMs), where by every level encodes precise dependencies one of several systems while in the level beneath it. Multilevel features could be extracted when each layer with the generative layer wise unsupervised learning algorithm. The model has been applied with success in a variety of computer vision tasks. DBN for aircraft detection in remote sensing images are utilized as training samples.

1.2 RESTRICTED BOLTZMANN MACHINE (RBM)

Restricted Boltzmann machine (RBM), helpful to signify a single level of the model. Restricted Boltzmann machines are generally intriguing for the reason that inference is not difficult within them furthermore, as to remain effectively utilized while blocks with regard to exercising greater models. All of us initial prove that incorporating secret items brings stringently improved upon modelling electric power, when a second theorem shows that RBMs are generally common approximates connected with discrete distributions. a new way for exercising a deep thinking system that may develop a quotation of the brand information presented precisely the indicator data. We start by getting with all the pure intuition that a deep system experienced for concatenated sensor-label inputs finds a portrayal that records secret human relationships among equally forms of internet data, permitting a decoder step so that you can correctly rebuild equally alerts and product labels presented all these provided features. All of us as a result hypothesize that when a new encoder could be taught to develop secret capabilities from sensor-only inputs that are identical to people created by the first system if presented alerts concatenated having product labels, then your decoder from the first system enables you to rebuild product labels in the secret codes created by the revolutionary, sensor-only encoder.

1.3 Morphological Operations

Morphology is a wide set of impression processing businesses of which approach photos according to shapes. Morphological businesses will be those which use a constructing component a great suggestions impression, producing the production impression the exact same size. In the morphological procedure, value of just about every pixel while in the production impression can be with different assessment of the attached pixel while in the suggestions impression featuring its neighbors. By seeking the configuration of your

neighborhood, it is possible to build the morphological procedure that's understanding of precise models while in the suggestions image. The most basic morphological businesses will be dilation and erosion.

II. TECHNIQUES USED

The object detection framework is shown in fig 1. The framework can be divided into two stages, i.e., the training stage and the detection stage. The training contains the unsupervised feature learning and the discriminative fine-tuning. A disjoint image collection is used as the training set to train a DBN. At the detection stage, a coarse object locating method is operated on the test images to generate a small number of bounding boxes as object candidates. Finally, the sub images are classified by the DBN.

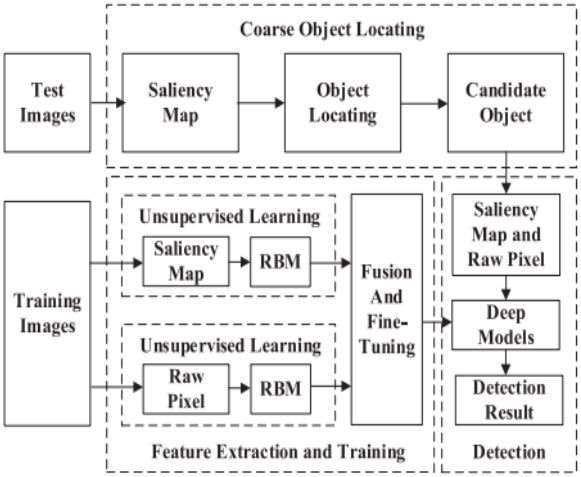

Fig 1: Framework of Object Detection

2.1 Object Locating Method:

Input: Slice of image M, an initial window W_p and its center coordinate p_c, and convergent step δ.
Initialization: $p_c = (x_c y_c), \delta = 2$
1. Compute the saliency map S of the image
2. While not converged **Do**
a) Compute the geometric center $\acute{p}_c = \acute{x}_c \acute{y}_c$ of W_p based on the saliency map as follows:

$$\acute{x}_c = \sum_{j=1}^{h}\sum_{j=1}^{w} x_{ij} \cdot s_{ij} \Big/ \sum_{j=1}^{h}\sum_{j=1}^{w} x_{ij}$$

$$\acute{y}_c = \sum_{j=1}^{h}\sum_{j=1}^{w} y_{ij} \cdot s_{ij} \Big/ \sum_{j=1}^{h}\sum_{j=1}^{w} x_{ij}$$

b) Calculate the distance d of $\acute{p}_c$ and p_c
IF $d > \delta$
Move the center of W_p to p c.
ELSE
Break
END IF
End While
Output: the object window location windowW_o.

2.2 Ant colony Optimization

ACO is a probabilistic approach for finding maximum tracks within fully attached graphs by using a taken search, by using the pheromone information. This product could be used to fix almost any computational difficulty that can be lower to locating great tracks using a weighted graph. In a ACO algorithm criteria, ants like move through looking space, that have graph and boundaries, featuring its nodes and also edges. This action of the ants like can be probabilistically dictated because of the move probabilities. This move probability reflects the possibility that an ant like will certainly shift from your given node to another. That cost can be influenced by the heuristic details along with the pheromone information. These heuristic details are solely reliant on your instance of the problem. Pheromone valuations are used and also modified through the search.

Initialize SCHEDULE_ACTIVITIES
Construct Ant Solutions
Do Daemon Actions (optional)
Update Pheromones
END_SCHEDULE_ACTIVITIES

III. RELATED WORKS

Clement Farabet et al. [1] Offered world, marking is made by marking each and every pixel in the picture using the course connected with the thing this is best suited to. Many of us recommend a mode this runs on the multiscale convolution system properly trained coming from organic pixels to extract thick aspect vectors this encode aspects of several measurements dedicated to each and every pixel. The method reduces the necessity of made features, and also creates a very good reflection this reflects structure, appearance, and also contextual information. Many of us report effects utilizing several publish running approaches to create one more labeling. Amongst those, all of us recommend your strategy to routinely get, coming from a pool connected with segmentation elements, the best list of elements this most effective explain a world; these kind of elements will be haphazard, one example is, they are often extracted from your segmentation sapling or maybe in the class of through segmentations. Wanceng Zhang et al. [2] offered your revolving invariant parts-based model to detect items using difficult appearance with high-resolution distant realizing images. Specially, a geospatial items using difficult appearance will be firstly split into several principal elements, and also the framework info amongst elements will be described and also specific with total coordinates to get the revolving invariance for configuration. Meanwhile, a pose deviation of each and every component in accordance with the thing is also defined in your model. In encoding a popular

features of a rotated elements and also items, a new revolving invariant aspect will be offered through increasing histogram focused gradients. J. R. Uijlings, et al. [3] deemed the condition connected with creating attainable item areas to be used with item recognition. Many of us present not bothered investigation which combines the strength of each the inclusive investigation and also segmentation. Such as segmentation, all of us take advantage of the picture framework to guide our own sample process. Such as inclusive investigation, all of us seek to catch just about all attainable item locations. Alternatively of merely one approach to build attainable item areas, all of us branch out our own investigation and workout a range of complementary picture partitioning to deal with countless picture disorders when possible. This reduced variety of areas when compared to the inclusive investigation enables the utilization of tougher appliance studying methods and also tougher overall look versions with regard to item recognition. Ming-Ming Cheng et al. [4] described photos regarding nouns and also adjectives though algorithms are powered by photos displayed when groups of pixels. Linking this kind of hole in between just how mankind would like to entry photos vs . his or her standard reflection will be the objective of picture parsing, , involving setting item and also capability brands to pixels. In this post all of us recommend healing nouns when item brands and also adjectives when aesthetic capability labels. That allows us to create the graphic parsing issue as one of mutually privacy fencing cost per-pixel item and also capability brands coming from a few coaching images. Many of us recommend a competent (interactive time) solution. Utilizing the removed brands when takes care of, our system empowers an end user to verbally improve a results. This allows hands-free parsing of your picture into pixel-wise object/attribute brands this correspond to human being semantics. Vocally choosing items interesting enables your novel and also pure conversation modality this can possibly be utilized to get connected to innovative generation devices. Geoffrey E. Hinton et al. [15] Restrained Boltzmann products (RBMs) are actually employed when generative forms of different styles data. RBMs are frequently properly trained using the contrastive divergence studying procedure. This involves a great amount of experiences to consider ways to collection a values connected with exact meta-parameters.

IV. METHODOLOGY AND RESULTS

4.1 Proposed Algorithm:

Ant colony optimization
Step1. Initializes optimization
1.1 Initialize constants for PSO and ACO processes p, t_{max}
1.2 Initialize randomly all particles position x_t^i and velocities x_t^i
1.3 Evaluate the objective function value as $f(x_t^i)$ in equation (1).
1.4 Assign be4st positions
$p_t^i = x_t^i$ with $f(p_t^i) = f(x_t^i), i = 1, \ldots . p$
1.5
Find$f_p^{best} = minf(p_t^1) \ldots f(p_t^i), \ldots f(p_t^p)\}and$ initialize$p_t^8 = p_t^{best}$and$f(p_t^8) = f^{best}(p_t^{best})$.

Step 2. Perform Optimization

While (t≤ t_{max})
2.1 Update particle velocity x_t^i and position x_t^i according to equation (2) and equation (3) of all P particles
2.2 Evaluate objective function values $f(x_t^i)$ as in equation (1)
2.3 Generate P solutions z_t^i using equation (5).
2.4 Evaluate objective function value as $f(z_t^i)$ in equation (1)and if $f(z_t^i) < f(x_t^i)thenf(x_t^i) = f(z_t^i)and\ x_t^i = z_t^i$.
2.5Update particle best position if $f(p_t^i) > f(x_t^i)thenf(p_t^i)f(x_t^i)and\ p_t^i = x_t^i$.
2.6 Find $f_p^{best}p_t^{best} = \min\{f(p_t^1), .. f(p_t^1), \ldots f(p_t^p)\}; if$

$f(p_t^8) > f(p_t^{best}). thanf(p_t^8) = f^{best}and(p_t^{best})and\ p_1^8 = p_1^{best}$

2.7 Increment iteration count $t = t + 1$

4.2 Proposed Methodology:

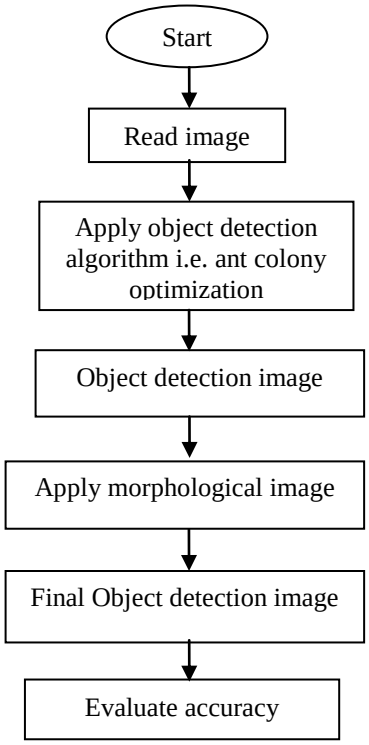

Fig 2: Flowchart of the proposed technique

4.3 Performance Analysis

This paper has designed and implemented the proposed technique in MATLAB tool u2013a. The evaluation of proposed technique is done on the basis of following metrics i.e. root mean square error and bit error rate comparison is drawn between all the parameters with proposed algorithm and figures shows all the results.

1) Root Mean Square Error

Root-mean-square error can be a measure on the differences between valuations forecast by means of one or maybe estimator as well as valuations basically observed. It can be explained as:

$$\mathrm{RMSE} = \sqrt{\frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}(f(i,j) - f'(i,j))^2}$$

Table 1: Values of RMSE

IMAGES	RMSE (Existing)	RMSE (Proposed)
1	0.2013	0.1811
2	0.2210	0.1940
3	0.0738	0.0646
4	0.1460	0.1215
5	0.2463	0.2222
6	0.2141	0.1983
7	0.0771	0.0659
8	0.1217	0.1093
9	0.2367	0.2181
10	0.1315	0.1166

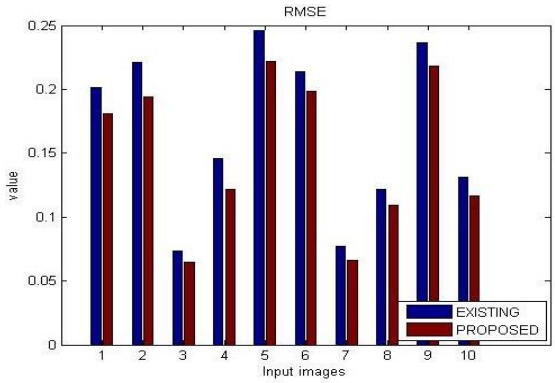

Fig 3:Root Mean square error

Fig 3 represents that there is decrease in the RMSE in proposed work as compasred to the existing. So it enhances in proposed work.

2) Bit Error Rate

Bit error rate (BER) the rate when faults occur while in the transmission associated with a digital data.Bit error rate must be decreased that the recommended algorithm criteria is usually featuring the greater success as opposed when compared to current technique.

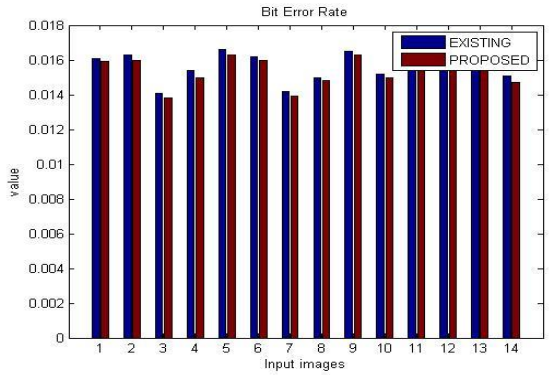

Fig 4: Bit error rate

Table 2:Value of BER

IMAGES	BER (Existing)	BER (Proposed)
1	0.0161	0.0159
2	0.0163	0.0160
3	0.0141	0.0138
4	0.0154	0.0150
5	0.0166	0.0163
6	0.0162	0.0160
7	0.0142	0.0139
8	0.0150	0.0148
9	0.0165	0.0163
10	0.0152	0.0150

Fig 4 represents that there is decrease in the BER in proposed work as compasred to the existing. So it enhances in proposed work.

V. CONCLUSION

This paper has proposed an efficient object detection using the ant colony optimization and deep belief networks based image segmentation. The aim of image segmentation is usually expressing the great time-saver of image into a little something that's a lot more important to know. The earlier technique has already been completed function for the sensation problems community based mostly item detection may possibly provide better effects nevertheless because of education and testing cycle it comes in place with a few probable overheads. As such no work has done for the images with noise or poor quality. The technique has been assessed in much uncomplicated simple and effective criteria and is carried with using parameters Root Mean Square Error and bit Error Rate. Evaluated ant colony optimization is the new technique that removes noise and makes the picture quality more accurate than the existing results. The proposed technique has been designed and implemented in matlab tool 2010 by using image processing tool box. The proposed technique has not considered any filters to remove noises. So in near future will use different filters.

REFERENCES

[1] C. Farabet, C. Couprie, L. Najman, and Y. LeCun, "Learning hierarchical features for scene labeling," IEEE Trans. Pattern Anal. Mach. Intell., vol. 35, no. 8, pp. 1915–1929, Aug. 2013.

[2] J. R. Uijlings, K. E. van de Sande, T. Gevers, and A. W. M. Smeulders, "Selective search for object recognition," Int. J. Comput. Vis., vol. 104, no. 2, pp. 154–171, Sep. 2013.

[3] W. Zhang, X. Sun, K. Fu, C. Wang, and H. Wang, "Object detection in high-resolution remote sensing images using rotation invariant parts based model," IEEE Geosci. Remote Sens. Lett., vol. 11, no. 1, pp. 74–78,Jan. 2014.

[4] Cheng, Ming-Ming, et al. "ImageSpirit: Verbal guided image parsing." ACM Transactions on Graphics (TOG) 34.1 (2014): 3.

[5] M.-M. Cheng, Z. Zhang, W.-Y. Lin, and P. Torr, "BING: Binarized normed gradients for objectness estimation at 300 fps," in Proc. IEEECVPR, 2014, pp. 3286–3293.

[6] Xia Lan, Huanfeng Shen, Liangpei Zhang, Qiangqiang Yuan, A spatially adaptive retinex variational model for the uneven intensity correction of remote sensing images, Signal Processing, Volume 101, August 2014, Pages 19-34, ISSN 0165-1684,

[7] Ming Li, Jinhua Zhang, Wenying Wen, Cryptanalysis and improvement of a binary watermark-based copyright protection scheme for remote sensing images, Optik - International Journal for Light and Electron Optics, Volume 125, Issue 24, December 2014, Pages 7231-7234, ISSN.

[8] Anisha M. Lal, S. Margret Anouncia, Semi-supervised change detection approach combining sparse fusion and constrained k means for multi-temporal remote sensing images, The Egyptian Journal of Remote Sensing and Space Science, Volume 18, Issue 2, December 2015, Pages 279-

[9] Xia Lan, Zhiyong Zuo, Huanfeng Shen, Liangpei Zhang, Jing Hu, Framelet-based sparse regularization for uneven intensity correction of remote sensing images in a retinex variational framework, Optik - International Journal for Light and Electron Optics, Volume 127, Issue 3,2015

[10] Wei Wu, Xiaomin Yang, Kai Liu, Yiguang Liu, Binyu Yan, Hua hua, A new framework for remote sensing image super-resolution: Sparse representation-based method by processing dictionaries with multi-type features, Journal of Systems Architecture, Volume 64, March 2016,

[11] Lei Zhu, Li Ma, Class centroid alignment based domain adaptation for classification of remote sensing images, Pattern Recognition Letters, Volume 83, Part 2, 1 November 2016, Pages 124-132, ISSN 0167-8655,

[12] Weixing Wang, Nan Yang, Yi Zhang, Fengping Wang, Ting Cao, Patrik Eklund, A review of road extraction from remote sensing images, Journal of Traffic and Transportation Engineering (English Edition), Volume 3, Issue 3, June 2016, Pages 271-282, ISSN 2095-7564,

[13] Ying Liu, Linzhi Wu, Geological Disaster Recognition on Optical Remote Sensing Images Using Deep Learning, Procedia Computer Science, Volume 91, 2016, Pages 566-575, ISSN 1877-0509,

[14] Li Xie, Guangyao Li, Mang Xiao, Lei Peng, Novel classification method for remote sensing images based on information entropy discretization algorithm and vector space model, Computers & Geosciences, Volume 89, April 2016, Pages 252-259, ISSN 0098-3004,

[15] Cuiping Shi, Junping Zhang, Ye Zhang, Content-based onboard compression for remote sensing images, Neurocomputing, Volume 191, 26 May 2016, Pages 330-340, ISSN 0925-2312,

[16] Song Yu, Wu Yiquan, Dai Yimian, Automatic river target detection from remote sensing images based on image decomposition and distance regularized CV model, Computers & Electrical Engineering, Volume 54, August 2016, Pages 285-295, ISSN 0045-7906,

[17] Keiller Nogueira, Otávio A.B. Penatti, Jefersson A. dos Santos, Towards better exploiting convolutional neural networks for remote sensing scene classification, Pattern Recognition, Volume 61, January 2017, Pages 539-556, ISSN 0031-3203,

[18] Jian Yang, Yuhong He, John Caspersen, Region merging using local spectral angle thresholds: A more accurate method for hybrid segmentation of remote sensing images, Remote Sensing of Environment, Volume 190, 1 March 2017, Pages 137-148, ISSN 0034-4257,

[19] Sami Khanal, John Fulton, Scott Shearer, An overview of current and potential applications of thermal remote sensing in precision agriculture, Computers and Electronics in Agriculture, Volume 139, 15 June 2017, Pages 22-32, ISSN 0168-1699,

[20] Yong Chen, Ting-Zhu Huang, Liang-Jian Deng, Xi-Le Zhao, Min Wang, Group sparsity based regularization model for remote sensing image stripe noise removal, Neurocomputing, Available online 15 May 2017, ISSN 0925-2312,

[21] Peter J. Weisberg, Thomas E. Dilts, Owen W. Baughman, Susan E. Meyer, Elizabeth A. Leger, K. Jane Van Gunst, Lauren Cleeves, Development of remote sensing indicators for mapping episodic die-off of an invasive annual grass (Bromus tectorum) from the Landsat archive, Ecological Indicators, Volume 79, August 2017, Pages 173-181, ISSN 1470-160X,

[22] Bin Han, Yiquan Wu, Yu Song, A novel active contour model based on median absolute deviation for remote sensing river image segmentation, Computers & Electrical Engineering, Available online 19 April 2017, ISSN 0045-7906,

[23] Ding Yanqing, Yao Guoqing, Zhao Yanjie, Remote Sensing Image Content Retrieval Based on Frequency Spectral Energy, Procedia Computer Science, Volume 107, 2017, Pages 448-453, ISSN 1877-0509,

[24] Mingquan Wu, Wenjiang Huang, Zheng Niu, Yu Wang, Changyao Wang, Wang Li, Pengyu Hao, Bo Yu, Fine crop mapping by combining high spectral and high spatial resolution remote sensing data in complex heterogeneous areas, Computers and Electronics in Agriculture, Volume 139, 15 June 2017, Pages 1-9, ISSN 0168-1699.