

**HYPER TUNING OF CNN BASED IMAGE CLASSIFICATION
MODEL USING DIFFERENT AI BASED OPTIMIZATION
TECHNIQUE**

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Abstract

AI based image classification is the most preferable method in image processing with the development in techniques multiple method evaluation to optimized the classification model. The hyper tuning of CNN parameters is required to achieve the best performance for image classification. In this paper multiple CNN is used for classifying the standard Intel image dataset. Further methods like modified CNN, GA, WOA, MFO have been achieved to the hyper tuning parameters of CNN to improve the performance of image classification based on iterations and iteration per epochs with learning rate to solve complex problem. The Comparative results of these are discussed in the result section of the paper.

Keywords: GAs, CNN, Deep Learning, Image classification, Intelligence Algorithms, WOA, MFO.

I. Introduction:

The assortment of Fully CNNs is foresee on their exhibit adeptness in segmentation capacity to tell the difference spatial dependencies and learning ability convoluted compositions within fundus images lacking relying on by hand tricked features [1]. Hyper parameter based classification of images on CNN model with AI based optimization technique for kaggle data set consists of 150x150 images classify into 6 groups structure, forest, lane, mountain, marine and glacier hold fourteen thousand photographs ,three thousand testing folder with seven thousand prediction folder[2]. SE-RES-CNN trained only activities picture categorization dataset commencing Kaggle to achieve improve accuracy [3]. The MFO has brought together noteworthy significance to high elasticity and execution to fast convergence with optimization [4]. SEWOA show evidence of act in giving 3 engineering blueprint predicaments, showcasing its worth and broad array of impending applications [5]. WOA method examine vibration based damage detection with the help of updating of matrix [6]. The WOA is most archetypal Meta heuristic method for inadequate population assortment, inequity among misuse and examination, and near to the ground clarification accuracy [7]. The WOA also uses particle reminiscent of configuration disparity advancement entities as quantum involuntary activities [8]. CNNs with AI optimization methods empower the image

classification accuracy with performance [9]. Deep convolution neural network take out features and umpire image categories to improving the efficiency [10]. Hyper spectral image classification using spectral information in regulates to accomplish higher performance [11]. Seven hyper parameters are the center of optimization learning rate, optimizer, kernel size, filter count, activation function, layer count, and pooling strategy showing results the significant performance by CNNs lend a hand by GA [15]. Image classification using residual network with GA improve the classification concert of only multi-modal remedial images based on model ResNet50[16]. NSGA to get better the hyper parameters of the CNN Architecture for MNIST, Cifar-10 and Cifar-100 data with studying rate ranges as of 0.0004 to 0.0012[17]. CNN using GA for classification of croup cough representations. Optimizing mass of CNN with dissimilar bunch size and epoch with the help of GA to detect the preeminent weights of classifier to get better precision [19]. Whale optimizer introduced PRISMA methodology to select eligible papers by detection, assessment, and exposure also with other variant and with additional method [22]. Whale optimization method is solving unbalanced explore precision and time-consuming convergence velocity by scattered association and reverse education ability [23]. MFO producing multi objective version in terms of accuracy and performance with other methods [29]. WOA method formulate for the optimization task using hyper parameters to get precision of 89.85% along with 80.60% in favor of Fashion MNIST [33].

II. Related Work

CNN model for image classification methods using hypothetical data samples and model predictions only for retina disease [1]. Modifies CNN reduces the classification accuracy while diminish the training images during the process [2]. MFO has produced better optimization performance due to the randomness of the enhanced version [4]. Spiral enhanced WOA algorithm reflecting better-quality optimization capacity diagonally fluctuating dimensions [5]. The Whale Optimization Algorithm evaluated throughout equally mathematical simulations and investigational tests by matrix updating [6]. WOA giving the pressure container design problem, the 3-bar tie up devise problem, and the stress and solidity spring devise problem solution to appraise its performance in realistic dilemma-solving scenarios [7]. WOA only improves optimization meticulousness and stops the procedure from go down into local convergence [8]. CBIR gets the reclamation accuracy of 99.45% only on natural images of 20 Wang dataset classes but CNN image classification scores have been reduced [12]. The 9-layer CNN on Modified MANIT image dataset classification accuracy of CNN's is 4% superior than SVM model to prepare the network model for optimizing parameters [13]. CNN framework demonstrating the only CBIR average precision is 96.8% on the OT, Caltech-101 and Corel-1000[14]. CNN with GA based accuracy rate of approximately 99.38% on only the detection of English-Devanagari handwritten digits [15]. Multi-modal medical images quality and performance still issue by 98.61% accuracy [16]. 8 image classification assignments and actual industrial assignment are done by LF-MOGP algorithm in terms of precision, model and computation [18]. Moth flame optimization

algorithm answer the COVID-19 CT image difficulty using dissimilar level entrancing by Otsu's method [20]. MFO have developed AI model to negative, positive, neutral emotions by classification using ChatGPT on different stages of operations like tuning of parameter [21]. CNN for recognizing the image by convolution and pooling procedure for categorizing the image in trained dataset using prediction [24]. Image Classification using CNN detecting only person based on the facts with 95% accuracy with tensor flow by sorting thousands of photographs [25]. GA pointed the most favorable analogous deep learning by iterative training process to train model on the CIFAR 10 and CIFAR 100[26]. Genetic Programming extract feature, classification automatically by mutation operator based algorithms [27]. Training accuracy only for dog and cat database is 77 percent with 61 percent validation by GA based CNN [28]. WOA verdict COVID- 19 chest X-ray images and get better the scale of verdict by fragment six standard images with multilevel entrancing move toward [30]. WOA using multiple local optimal elucidations to move along by means of the convergence part to find out best optimum solution to enhance the performance [31]. Improved MFO method providing best solution of mechanical engineering difficulty by investigational and geometric results [32]. Improve WOA method provide three facets of preliminary population, junction part, and mutation procedure on comprehensive investigation skill and local utilization aptitude [34].

III. Methodology

1. Now in very first step Image classification is performed on kaggle image data set and classify into training dataset and testing data set to perform hyper tuning in further steps.
2. In subsequent the training data set is categories into images and classes to carry out the operation with different AI practices.
3. Third steps carry out the images and classes goes as an input to CNN training model and get a hold of training accuracy and trained CNN.
4. After that GA/MFO and WOA Algorithm apply individually on training accuracy and acquire CNN parameters as a result.
5. These acquired tuned CNN parameters are input to CNN architecture and get result.
6. The result of CNN architecture, images and classes goes as an input CNN training model to find out training accuracy and trained CNN.
7. Repeat the step 3 to step 6 until get the higher the training accuracy and validate trained CNN.
8. In further step testing data set is classify into images and classes to perform the processing operation with validate trained CNN.
9. Validate trained CNN, images and classes are the input to image classification stage to achieve high testing accuracy.

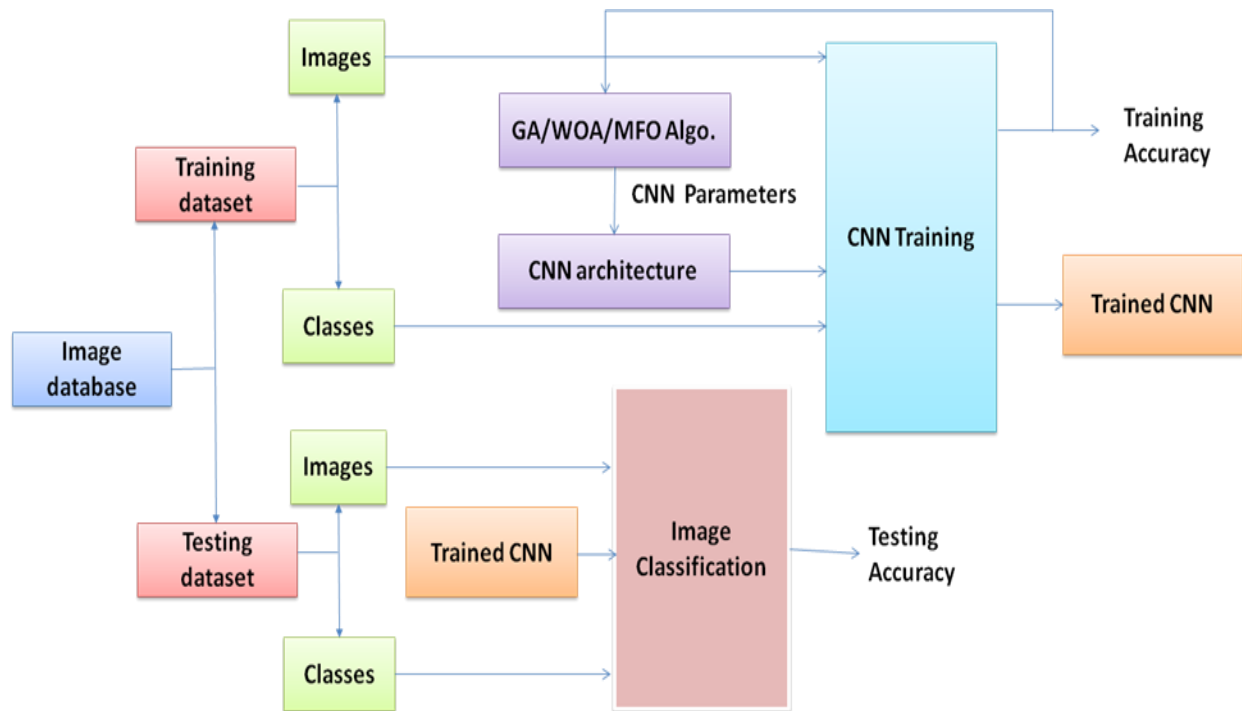


Figure 1: Proposed Methodology

IV. RESULT AND DISCUSSION:

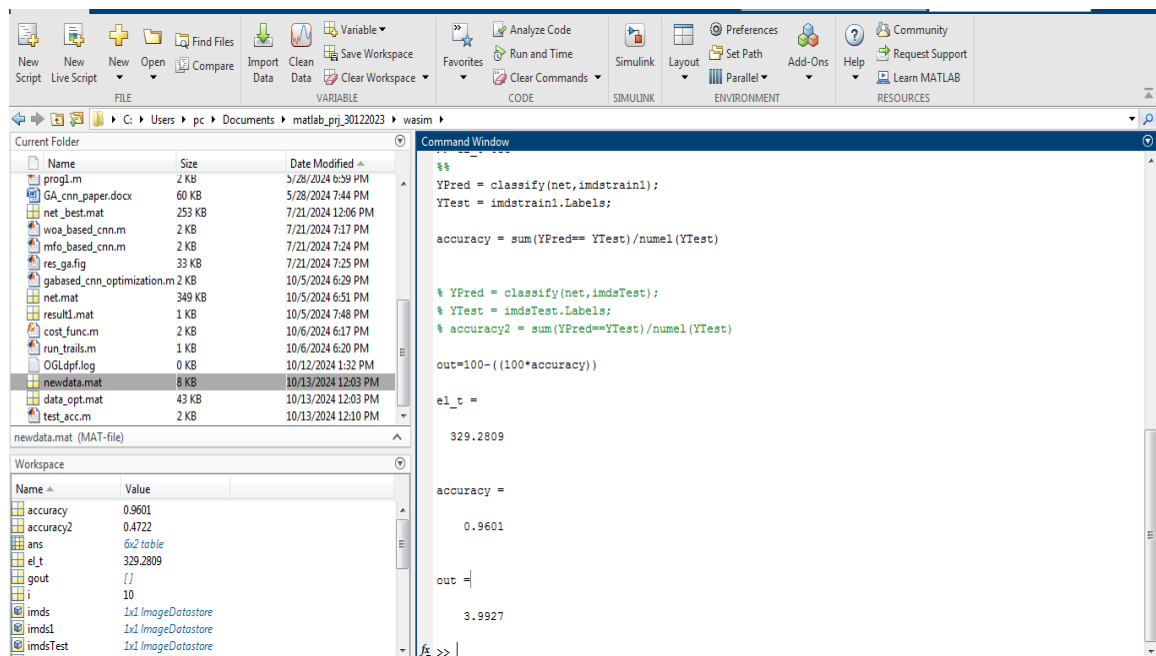


Figure 2: Snapshot of MATLAB environment for GA based hyper tuning

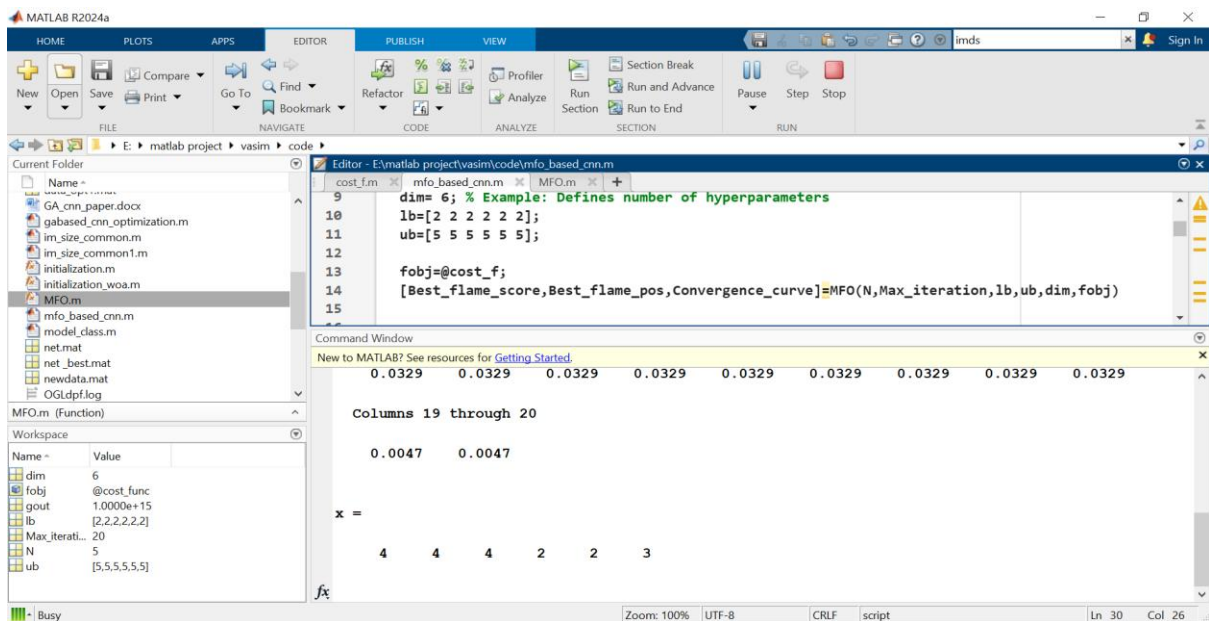


Figure 3: Snapshot of MATLAB environment for MFO based hyper tuning

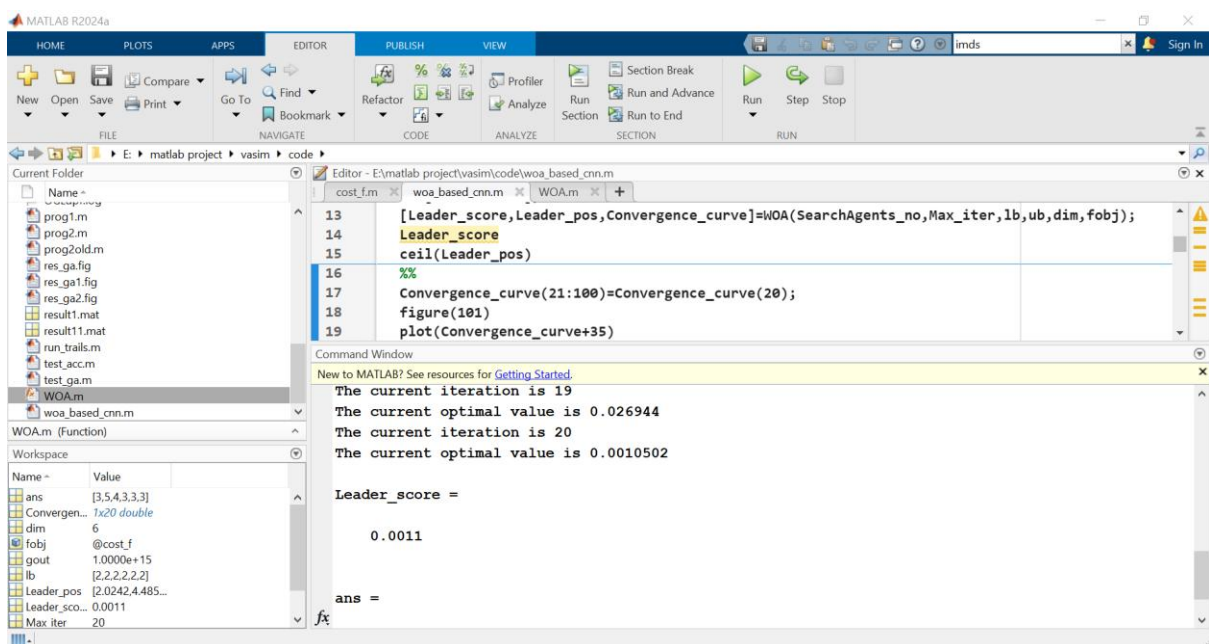
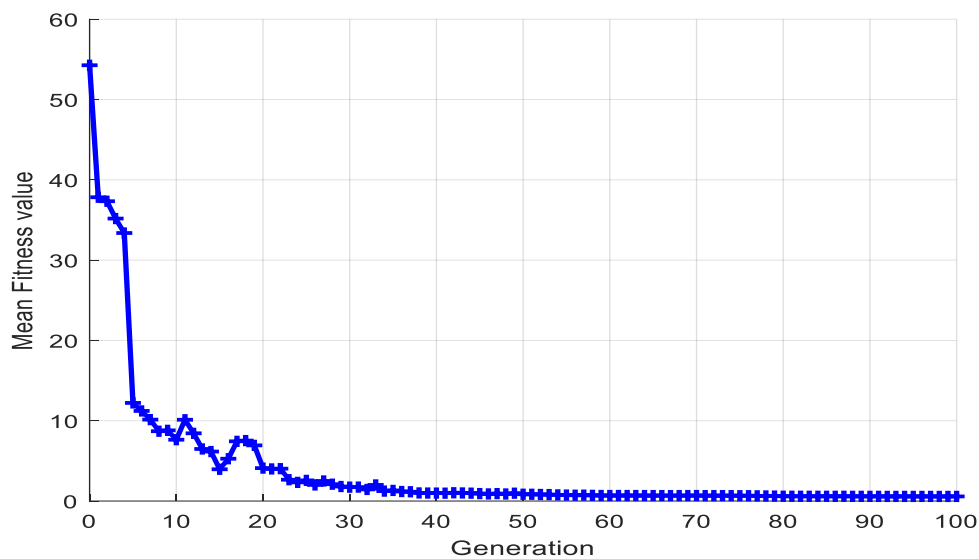


Figure 4: Snapshot of MATLAB environment for WOA based hyper tuning

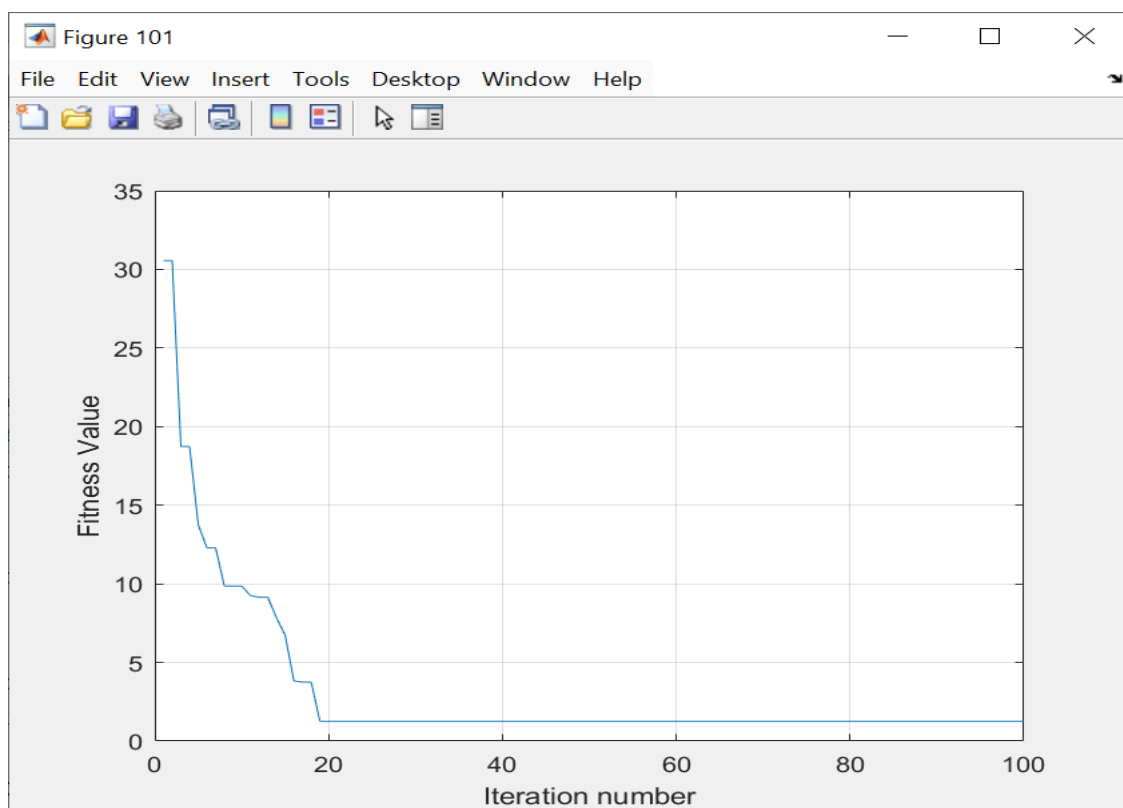
In graph 1 curve demonstrating, rising the generation then reducing the mean fitness value upto 55% for Image training =120

In graph 2 curve demonstrating, rising the generation then reducing the mean fitness value upto 32% for Image training =120

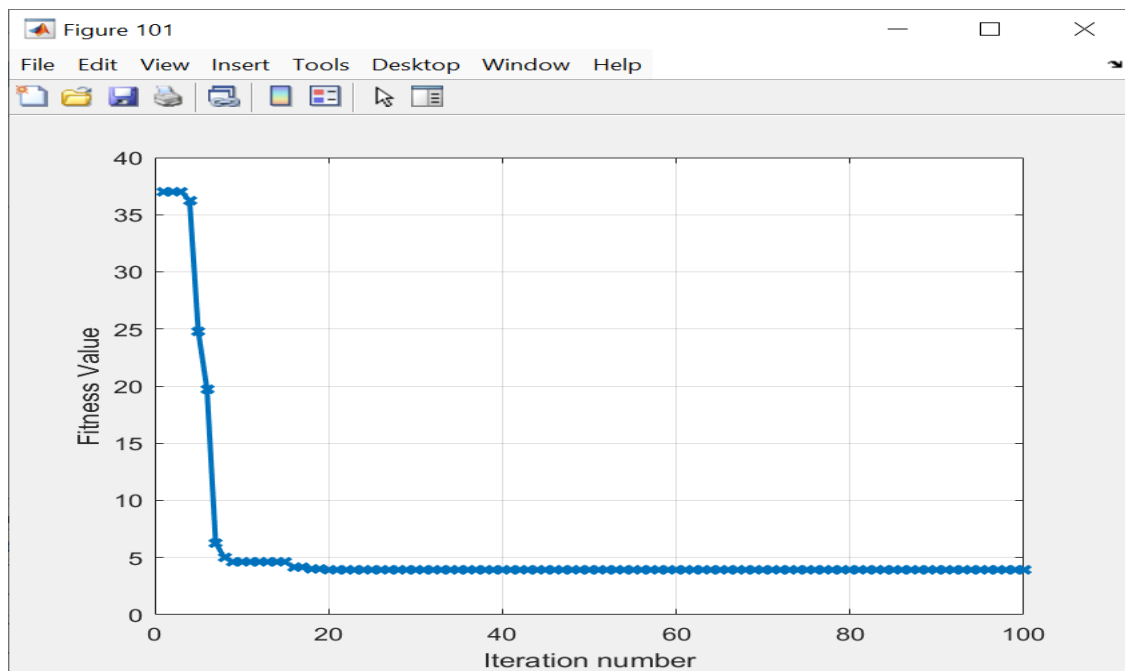
In graph 3 curve demonstrating, rising the generation then reducing the mean fitness value upto 34% for Image training =120



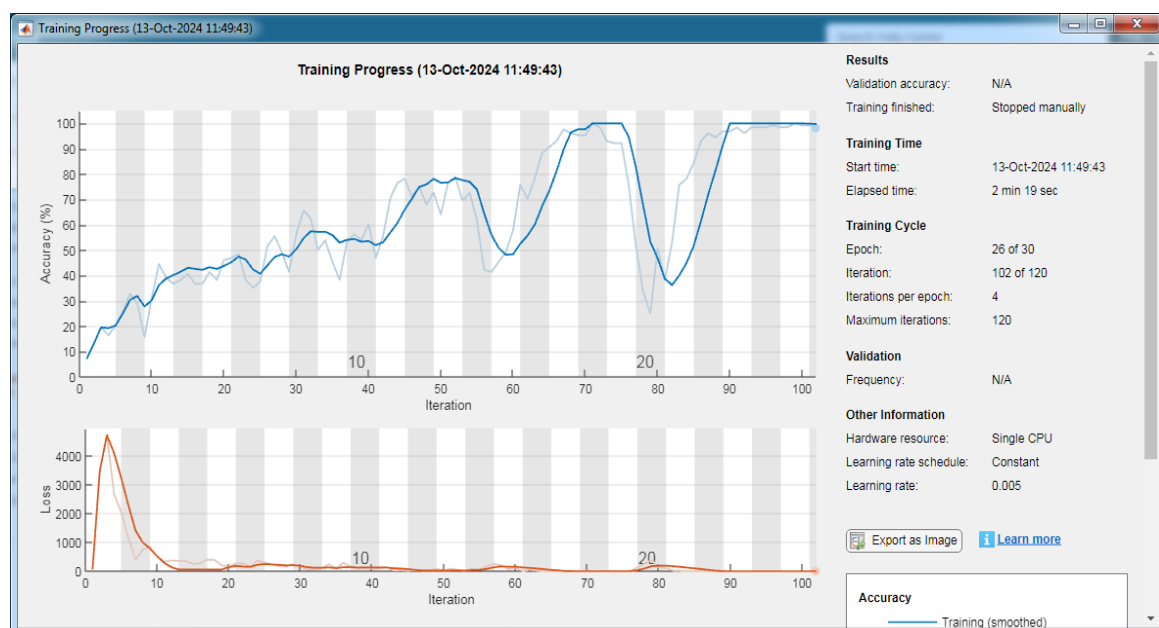
Graph 1: Convergence curve of GA based for hyper tuning of Image classification model of CNN



Graph 2: Convergence curve of MFO based for hyper tuning of Image classification model of CNN



Graph 3: Convergence curve of WOA based for hyper tuning of Image classification model of CNN



Graph 4: Training progress of Optimised CNN using GA

In graph 4 Optimised CNN using GA results are:

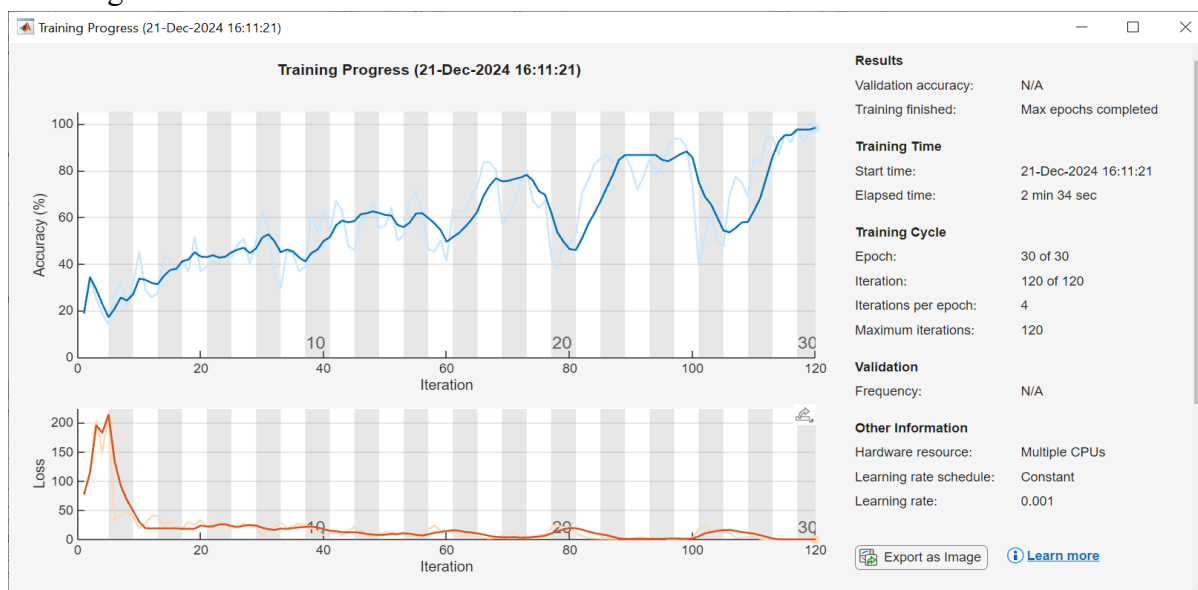
Training Elapsed Time: 2 min 19 sec

Training Epoch Cycle: 26 of 30

Iterations per epoch: 4

Maximum Iterations: 120

Learning rate: 0.005



Graph 5: Training progress of Optimised CNN using MFO

In graph 5 Optimised CNN using MFO results are:

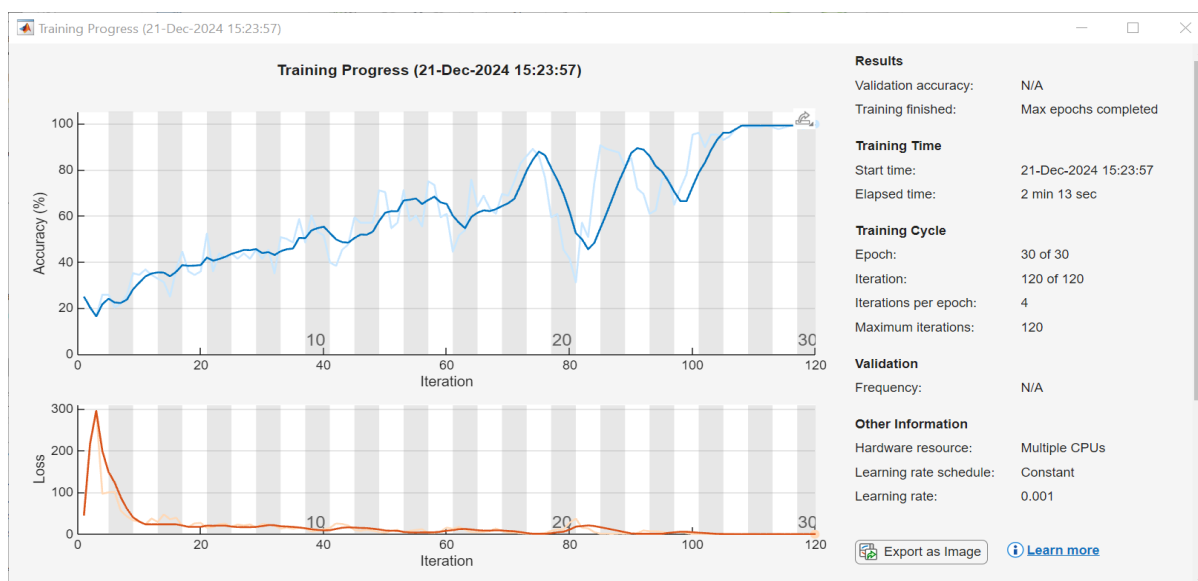
Training Elapsed Time: 2 min 34 sec

Training Epoch Cycle: 30 of 30

Iterations per epoch: 4

Maximum Iterations: 120

Learning rate: 0.001



Graph 6: Training progress of Optimised CNN using WOA

In graph 6 Optimised CNN using GA results are:

Training Elapsed Time: 2 min 13 sec

Training Epoch Cycle: 30 of 30

Iterations per epoch: 4

Maximum Iterations: 120

Learning rate: 0.001

Conclusion

Image classification model using CNN standard Intel image was developed. The parameters of model were tuned using modified CNN, GA, MFO and WOA method optimization. The comparisons these methods were done using convergence duration and accuracy of image classification. The WOA has come deviation of 17 epochs which is better than MFO that is 19 epochs and GA that is 28 epochs. However the MFO provides the tune parameters of CNN for giving accuracy of 96.4% which is better than WOA that is 96.2%, GA accuracy which accuracy is 96.01 and modified CNN which accuracy is 93.61. The validation data set also provided the similar nature for classification accuracy of all four models.

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