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doi:10.15199/48.2024.01.26

Helipad Detection and Classification for Safe Helicopter landing

Abstract. *One of the most important factor that plays a great role in the safty issue of the helicopter and the pilot is the response to system failure and pilot conciousness, so the helicopter must be delivered a safe landing point.in this reseach a helipad detection and recognition for helicopter autolanding have been presented , where the comparison tool was specifically used vgg19 and resnet50 CNN algorithms were used to classify safe helipads or occupied one to achieve autolanding, a dataset consisting of 4012 images divided into training and validation of the performance of the Resnet50 model and VGG19 where the accuracy was 94% VGG19 and Accuracy 96% Resnet50 was the best.*

Streszczenie. *Jednym z najważniejszych czynników odgrywających ogromną rolę w kwestii bezpieczeństwa śmigłowca i pilota jest reakcja na awarię systemu i świadomość pilota, dlatego śmigłowiec musi otrzymać bezpieczne miejsce lądowania. W tym badaniu wykrycie i rozpoznanie lądowiska dla helikopterów dla automatycznego lądowania helikoptera, gdzie specjalnie wykorzystano narzędzie porównawcze vgg19 i resnet50, zastosowano algorytmy CNN do klasyfikacji bezpiecznych lądowisk dla helikopterów lub zajętych w celu osiągnięcia automatycznego lądowania, zbiór danych składający się z 4012 obrazów podzielonych na trening i walidację działania modelu Resnet50 i VGG19, gdzie dokładność wyniosła 94%, VGG19 i dokładność 96% Resnet50 był najlepszy.* (***Wykrywanie i klasyfikacja lądowisk dla helikopterów w celu bezpiecznego lądowania helikoptera***)

Key ward: VGG19,RESNET 50 ,Helipad image detection
Słowo kluczowe: VGG19,RESNET50,Wykrywanie obrazu lądowiska dla helikopterów

Introduction

Helicopter landing platform, which is a flat area created to facilitate the safe take-off and landing of helicopters without human or mechanical losses, as helipads vary in size, design, and location according to need and use, and there are some types of helipads for common helicopters:

1-Helipads on the surface of the earth, which are built on the surface of the earth in a flat and safe place, as they are intended for take-off and landing, and they have a mark such as the letter (H)[1].

2-Helipads for helipads on the roofs of buildings that are built on the roofs of buildings designated for take-off and landing, such as hotels, hospitals and government buildings[2].

3-A helipad for helicopters above the sea surfaces, where the platform is established above ships and ships to facilitate take-off and landing, especially in military operations[3].

For the safety of the aircraft and the pilot, there are some factors for helicopter landing that need to be taken into consideration:

1-Reducing the speed: the plane's speed must be reduced upon landing if the pilot is present working to reduce it, but if something happens to the pilot, the plane's automatic system works to reduce the plane's speed[4].

2-Monitor and determine the height: To maintain the aircraft, the appropriate height must be determined to land safely without losses[5].

3-Determine the helipad: In the event that the pilot is present, he performs the process of determining the runway, or in the event that something happens to the pilot, there are several ways to determine the helipad via the Global Positioning System (GPS) or through the camera.

4-Final landing:When the aircraft heads to its designated helipad, it should be slow and steady toward the helipad deck [6].

Among the factors dependent on the success of landing are: Is the situation suitable for landing in terms of air or the location of the airstrip, is it safe or not [7] .Due to its capabilities to take off, maneuver and land, helicopters have achieved significant improvement and due to their complex system, they require a certain mechanism to ensure the success of their mission in take-off and landing [8]. One of the wrong methods used in landing is the use of an infrared camera in the plane because it will lead to a disaster in the landing process due to delays Because it takes a smaller amount of images using the fractionation method, it misses one image [9]. Contrary to the convention, the airstrip can detect aircraft instead of the plane detecting the airstrip, and this has been proven to be possible even in low light conditions using deep learning[10].

Proposed method

1-VGG19

To put it simply, VGG is a deep CNN used for picture classification.You get an RGB image with a fixed size of (224 * 224) in this grid, proving that the matrix has the shape (224,224,3).The average RGB value for each pixel throughout the entire training set was calculated to be.They used beads that were (3 * 3) in size and had a step size of 1 pixel to completely cover the image.The image's spatial resolution was preserved by applying spatial padding using SRIDE 2 and performing maximum pooling on a 2 by 2 pixel window.The corrected linear unit (ReLu), which included nonlinearity to improve model classification precision and computing effectiveness, came next. Contrary to earlier models, this one performed significantly better.Three completely connected layers have been implemented; the first two layers are 4096 pixels each, and the third layer is the softmax function. The next layer has 1000 channels for classification utilizing ILSVRC 1000 directions. The VGG19 method's architecture is shown in Fig 1 [11][12].

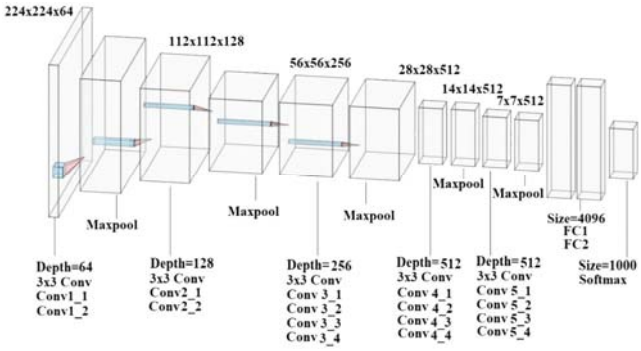


Fig 1:The VGG19 method's architecture

2-Resnet50

It is a 50-layer deep convolutional neural network (cnn) introduced in 2015 by microsoft reseach researchers to confront it in network training[13]. It was designed to train

very deep neural networks and is a good tool in computer vision. It is used for image classification, object detection and image segmentation. It is trained on a set of data from image netwhere it is used as a starting point for deep learning transfer in which the training data is limited. In Model Resnet50 easily trains networks with large layers without increasing the training error [14]. As mentioned in this paper, it is composed of 50 layers, including 48 layers of fascia, 1 layer of maximum pooling, and 1 layer of average pooling as shown in the fig 2[15][16].

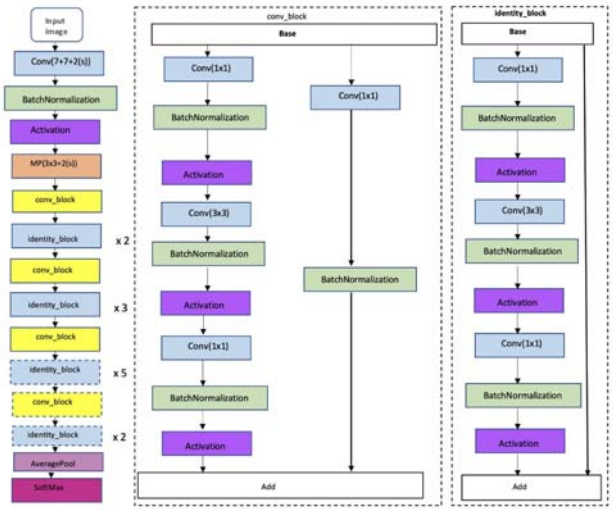


Fig 2: The ResNet-50 architecure

workflow architecture

1-Dataset

Pictures helipad were collected from the Internet, as they numbered 4012 pictures divided into two categories helipad and nonhelipad. The data was divided into two groups, the first, which is training, and it was 80%, while thesecond group was 20%, as shown in the fig 3[17] .

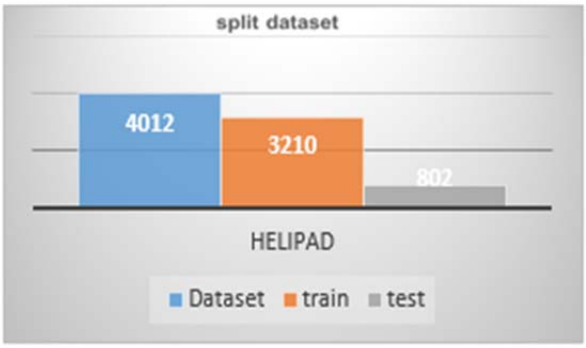


Fig 3: Split dataset .

2-Image data agumention

It is a process of data augmentation that includes data augmentation techniques, image modification, some of these techniques are reflection, image rotation, cropping, and other[18].

Experiment Analysis and Results and comparition

1-Training models

Data (images of helicopter platforms) were collected from the Internet, numbering 4012 images, where the data was divided into training and verification to be ready for the training process, then the images were processed, which included resizing the image. . for its fixed size. Techniques were used to augment the data from these techniques, namely flipping, cropping, and rotating the images, and then initializing the pre-trained models with the version available in the tensorflow library, where the VGG19 and Resnet50 models were trained, and they were trained to classify the images with the input size (224 * 224* 3) .

a)

b)

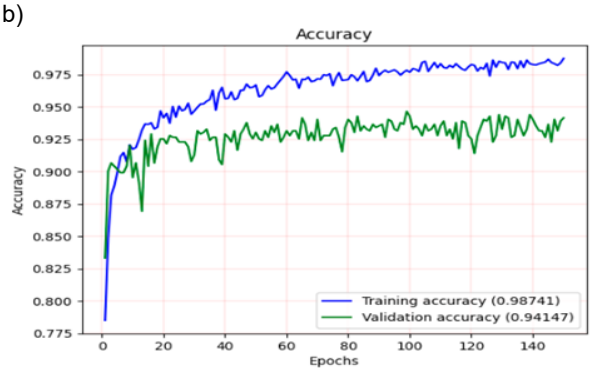
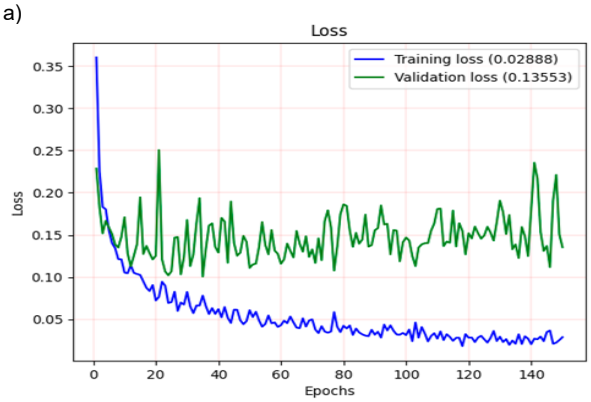


Fig 4: Training and validation accuracy curves for models(a) vgg19 (b) Resnet50

a)



b)

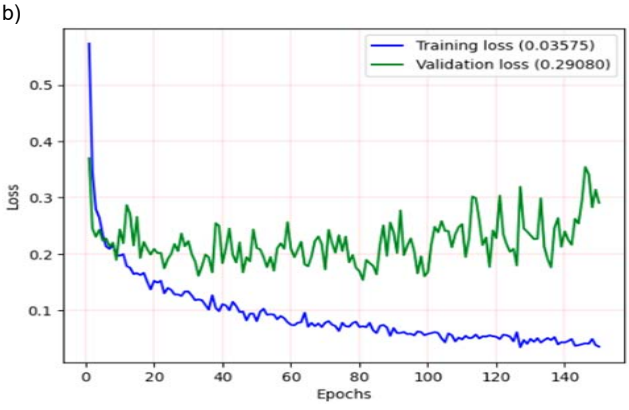


Fig 5: Loss curves for models (a)Resnet50 (b)vgg19

Then, the model parameters were obtained by two stacks related to classifier density batch size (32) and epochs(150), then the loss via categorical entropy was determined, and Adam optimization was used to optimize the image data for the cross parameters. The vgg19 model curve is shown as traning and validation accuracy, and the other model curve is shown traning and validation accuracy, as in the Fig4.[10]

As well as displaying the loss curve of the model VGG19 and the loss was 0.29080and the model of the Resnet50 and the loss was 0.13553 as shown in Fig 5 . and in the VGG19 model it achieved 94% accuracy, while in the RESNST50 model it achieved 96% accuracy.

As well as displaying the loss curve of the model VGG19 and the loss was 0.29080and the model of the Resnet50 and the loss was 0.13553 as shown in Fig 5 [11].

2-Results and comparisons

Using images of size 224 * 224, a test was conducted using two models of vgg19 and Resnet50 a number of Epochs were tested in the two models to obtain accuracy, and the modelResnet50 was better than VGG19 in terms of classifying images as accuracy and less loss, as shown in the table 1.

Table 1. comparison between two models(vgg19,Resnet50)

Epochs	MODEL	Accuracy	Loss	Dropout
50	VGG19	93%	0.19235	0.25
	Resnet50	95%	0.13895	
100	VGG19	93%	0.22621	0.25
	Resnet50	95%	0.15191	
150	VGG19	94%	0.29080	0.25
	Resnet50	96%	0.13553	

Conclusion

Because of the failure of the system for the helipad, or the injury of the pilot, or a malfunction occurred in the handle of the aircraft. Use deep convolutional neural networks to make the landing decision, is it safe or not, based on the information used from the model, and determine the appropriate time for landing. In this paper, two models for the classification of helipads will be presented. The two convolutional deep neural networks (VGG19 and RESNET50) were used to detect the helipad, It gave results in terms of speed, accuracy, and detection, and the accuracy was 96% to be the best of the VGG19 network, and the accuracy VGG19 was 94%.

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