The Effects of BRISK and HARRIS Algorithms in Image Noise Models for Coved-19 detection

تأثيرات خوارزميات BRISK و HARRIS في نماذج ضوضاء الصورة لاكتشاف Coved-19

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Abstract

The spread and spread of the COVID-19 virus, infecting societies and causing many deaths, led to social, economic and political problems, and this prompted the extraction of human efforts to preserve the human race from extinction. It is known that the sources of medical images such as (X-rays, tomography, resonance imaging) suffered and is still suffering from the noise sources that it is exposed to during imaging or treatment. The (BRISK, HARRIS) technique came to treat and try to identify the injury or not, and this topic has a future impact, relying on it to set the healing mechanism. Where (200) images of infected and non-infected people with COVID-19 were taken, and the (BRISK, HARRIS) method was applied for the purpose of extracting image features, finding and maintaining pure image qualities and excluding noise.

Experimental results showed the ability to interpret and extract the injured from the non-affected, as well as excluding other associated effects. Other methods such as Binary big and hybrid models can be adopted and results are compared.

Keywords

MRI, Covid-19 , Brisk ,Harris, Image Features , Gaussian Noise, Photon Noise, Mean Filter ,Median Filter

الملخص

ان انتشار وتفشي فايروس COVID-19 واصابه المجتمعات والحدوث العديد من حالات الوفاه ادى لحدوث مشاكل اقتصادية واجتماعية واقتصادية وسياسة وذلك دفع الاستخراج الجهود البشرية في سبيل المحافظة على جنس البشري من الانقراض ومن المعروف ان مصادر الصور الطبية مثل(الاشعة السينية, والتصوير المقطعي, التصوير الرنين المغناطيسي) عانت وما زالت تعاني من مصادر الضوضاء التي تتعرض لها اثناء التصوير او المعالجة جاءت تقنية (BRISK,HARRIS) لمعالجة ومحاولة التعرف على الاصابة من عدمها ولهذا الموضوع تاثير مستقبلي الاعتماد عليه لوضع الية الشفاء . حيث تم اخذ ١٠٠ صورة

مصابين وغير مصابين COVID-19 وتم تطبيق طريقة (BRISK,HARRIS) لغرض استخلاص سمات الصورة وايجاد والحفاظ على صفات الصورة نقية واستبعاد الضوضاء .
ولقد اظهرت النتائج القدرة على تفسير واستخلاص المصاب من غير المصاب وفضلا عن استبعاد التأثيرات الاخرى المصاحبة ويمكن اعتماد طرق اخرى مثل Binary big والنماذج الهجينه ومقارنة النتائج.

1-General Introduction

The spread of COVID-19 has led to economic, social, military, security and health problems that lead to the extinction of the human race. Perhaps the most important means of confrontation is through early diagnosis of cases of infection and giving appropriate treatment, and for this purpose, this research came to try to correct all these problems.

Image feature extraction technology as it provides image features and noise effects associated with image capture operations or some processing operations. For this purpose, many advanced studies and research were conducted, in which in 2019 Jiangtao Feng and others used a Harris angle detection algorithm to discover the points of a still image feature, There are some problems such as low accuracy of positioning and detecting corner positions without a descriptor. This new algorithm has been proposed, which scans the image twice, then Harris Corner is used, and the corner position is improved by iterative algorithm and rapid extraction of the rotation constant. The results showed that the proposed algorithm effectively overcomes on the Harris algorithm.

In 2021, Abolfazl Zargari Khuzani and others used machine learning to diagnose COVID-19 disease and that similarities between features and X-ray images of a person with COVID-19[5].

Pneumonia makes diagnosis by doctors difficult, so using machine learning classifiers to reliably distinguish CXR images with high accuracy and extract sham features and classify each feature into a group by dividing the original image data set randomly into a training set (80%) and a test set (20%). It indicates that a model needed a short time of 15.4 seconds to learn the training set and 2.03 seconds to predict one test sample.

2-Research Problems

There is noise associated with the medical image of image processing operations and the impact of the diagnosis of injury by the image noise model

3-Importance of Research

The diagnosis of infection with covid-19 and the exclusion of the noise that accompany the picture and the important topics have a great impact in determining the treatment for taking the picture and accurate diagnosis of the infected

4-Research objectives

Employing an algorithm (HARRIS, BRISKF) that helps diagnose injury and exclude noise associated with the pickup process or even the treatment process.

5-Digital Image

Digital images are represented as a two-dimensional matrix where each pixel corresponds to the image brightness value at a specific point. Each column or row is called one vector and the image

is monochrome, usually what we call the black and white image, and there are several types of image data that are dealt with are (1) Binary (2) gray (3) color (4) multi-spectral[6].

5-1 Binary Image

It is a digital image and takes two values for each pixel, white 1 and black 0. The binary image elements are represented by 1 binary digit. An example of this is texts, which are images of writing in the word system.

5-2 Gray Scale Image

They are images that represent monochrome images. Images contain information about luminosity only and do not contain information about color. Luminosity levels are determined by the number of bits assigned to each image element. Typical images of this type have 8 bits per image element, which gives 256 (0-255) different gray levels.

5-3 Color Image

This data type is represented by three monochrome packets for each color packet. The color image is represented by using three bands of colors red, green and blue that mix to form the color image. Each image element is made up of 24 binary (24 bits/pixels) (8 bits per red, green, and blue color packet) and these images are sometimes called true images.

5-4 Multi-Scale Image

Multi-spectrum images of this type include infrared, ultraviolet and x-ray data, acoustic and radar data. These are not real images that cannot be perceived by humans, and there is no formula for their information.

6-Image Noise Models

It is unwanted information that occurs in pixel values and noise is a result of low image quality by the occurrence of unrealistic effects on edges, corners and lines that are not visible. To reduce or treat unwanted noise by learning noise models in advance. We use the probability density function (pdf) to design and characterize noise models. We will talk about some noise models, including[3]:

6-1 Gaussian Noise Model

Electronic noise is called electronic noise because it is generated by loudspeakers and detectors. Gaussian noise resulting from natural sources such as thermal vibration of separated natural atoms of warm body radiation. Gaussian noise has a function of probability density and standard frequency

$$p(a) = \sqrt{\left(\frac{1}{2\pi\sigma^2}\right)}\, e^{\left(-\frac{(a-\mu)^2}{2\sigma^2}\right)} \quad \dots (1)$$

With

a represent gray value

μ the mean value

σ^2 the variance

Figure (1) represent the Gaussian noise

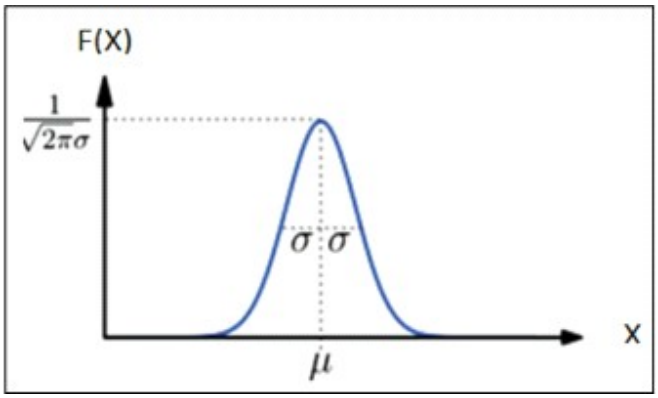


Figure (1) the probability density function for Gaussian noise

Because of this equal randomness, the normal Gaussian noise curve appears to be bell-shaped. That is, the noisy pixel values from(70% to 90%)for the degraded image between (μ-σ) and (μ+σ).The shape of the normal graph is almost the same in the spectral range.

It is often mistakenly assumed that Gaussian noise is white noise because Gaussian values are distributed because they refer to the gray scale, while white noise indicates no correlation between pixel values. This amount of randomness leads to the presence of all frequencies at the same time, ie a flat energy spectrum.

6-2 Photon Noise Model

Photon noise, also known as Poisson noise, is a fundamental form of photometric uncertainty, rooted in the quantum nature of light and the independence of the detection of photons. Its expected magnitude is signal dependent and is the dominant source of image noise except in low light.

It treats individual photon detections as independent events that follow a random time distribution. As a result, a photon is a practical classic Poisson form. The number of photons measured by a particular sensor element during a time period within a discrete probability distribution is subject to a Poisson distribution.

$$p\left(f_{(pi)}\right) = k = \frac{\lambda^k i^{e-\lambda}}{k!} \quad \dots (2)$$

7- Feature extraction

It is the process of characterization and representation of the original image in a simplified form to facilitate the decision-making process and discover patterns and classification of the image. Obtaining and extracting reliable features is important and necessary for image recognition and computer vision. We will talk about some of the features, including[4,7]:

7-1 The Harris Detector

It is an angle detector commonly used in computer vision algorithms to extract image features. The detector works to determine the flat area, edge, or angle. If an angle is found, there will be a significant change in intensity in all directions. And discovering important points and discovering more of its features, rotation stability, variable scale, lighting difference, and image noise.

$E(u,v) = \Sigma_{x,y} w(x,y)[I(x+u,y+v)I(x,y)]^2$ ... (3)

with

(E) is the difference between the original window and the moved window.

(u) is the offset of the window in the x direction.

(v) is the window offset in the y direction.

(w (x ,y)) is the window at position (x,y).

Make sure to use only the required window.

(I) is the intensity of the image at (x, y) position.

(I (x + u, y + v)) is the intensity of the moving window.

(I(x,y)) is the intensity of the origin.

7-2 The Brisk Detector

The (BRISK) algorithm includes three main units, key point detection, base point description and descriptor matching. First the pyramid space scale is built, and the stable extreme points of the sub-pixel resolution in the continuous scale space are extracted by(AGAST (Angle Adaptive Detection Factor)). Then a binary feature descriptor for the local image is generated using the gray scale relationship of random sample point pairs in the vicinity of the local image. Finally, the Hamming distance is used to match the feature. So I suggested (BRISK) to work with this methodology. Figure (2) shows the keys to the clarification points of the (BRISK) algorithm according to the preview method.

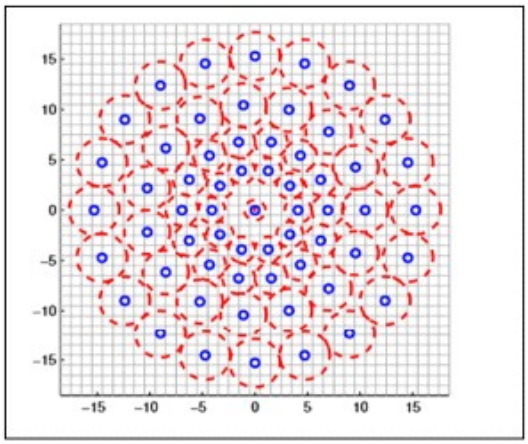


Figure (2) Point Clarification Keys for BRISK Algorithm

8-Space Invariant Artificial Neural Networks (SIANN)

It is one of the deep learning methods that are used to classify medical images, financial time-series data, and others, depending on the image features or internal information that can be obtained. The method depends on creating a kernel for each group that the data is required to classify, and considering that the response is equal to joining this kernel, Figure (3) represent the (SIANN) work details[1]

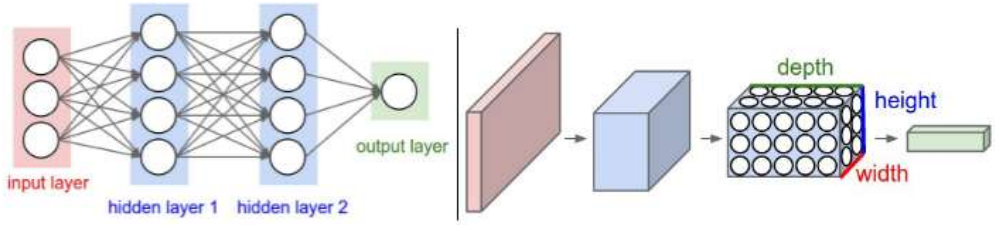


Figure (3) represent the (SIANN) components

There are many formulas can be use to complete the algorithm work such that The convolution

$$z^l = h^{l-1} * w^l \quad \dots(4)$$

And the max pooling

$$h_{xy}^l = max_{i=0,j=0}\, h^{l-1}(x+i),(y+j) \quad \dots(5)$$

And the full connecting layer

$$z_l = w_l * h_{l-1} \quad \dots(6)$$

The Rectifier will be

$$ReLU(z_i) = \max(0, z_i) \quad \dots(7)$$

The soft max step will be

$$z_i = \frac{e^{z_i}}{\sum_j e^{z_j}} \quad \dots(8)$$

9-Spatial Image Filters

There are many filters that can be applied in the field of excluding the effect of image noise The arithmetic mean filter, in which the filter is employed in the following spatial filter ($f1$) to obtain the resulting image[2]

$$f1 = \begin{bmatrix} 1/9 & 1/9 & 1/9 \\ 1/9 & 1/9 & 1/9 \\ 1/9 & 1/9 & 1/9 \end{bmatrix} \quad \dots(9)$$

The median filter is one of the non-linear filters in which the value of the resulting graphic element is equal to the median of the window of the open graphic elements, and the middle of its elements after their ascending or descending order ($f2$)

$$f2 = Median\ of\ (p11, p12, \dots . p33) \quad \dots(10)$$

10- The Suggested Work

The research included a proposed work to classify digital images into injured and uninjured by inserting an image and converting it to gray scale, then adding noise and performing a filtering process for the resulting image and applying the Harris and Brisk method to both the normal image and the image with noise and the image with filter, All of the above are applied to the images for research and the application of the deep learning method for the purpose of classifying images and extracting the average squares of classification error. Figure (4) illustrates the proposed work.

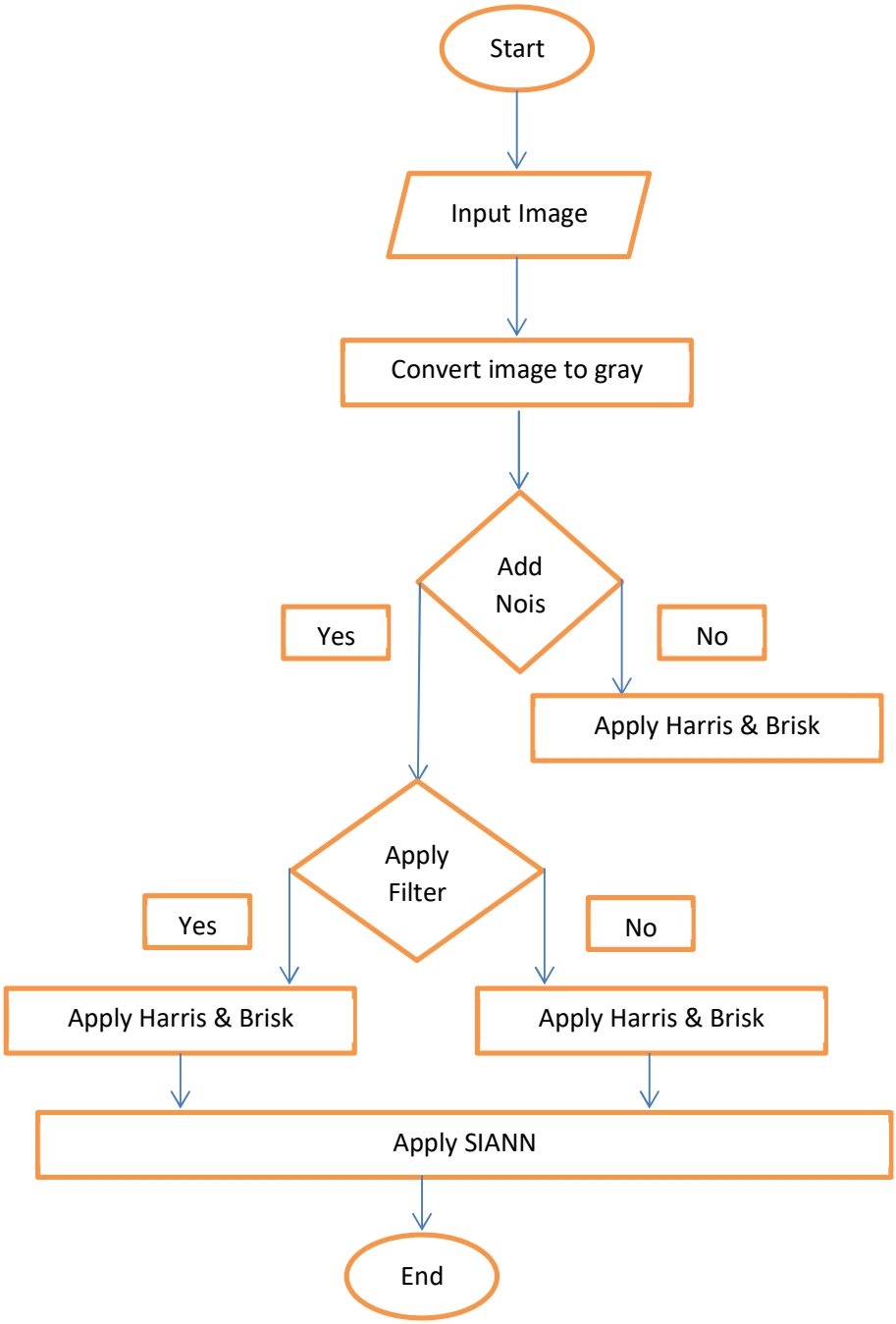
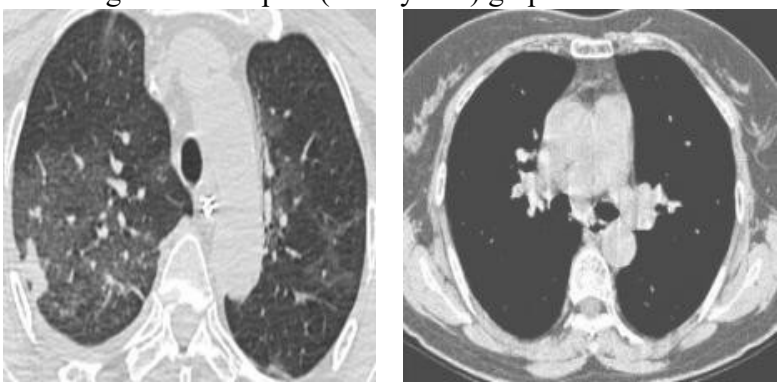


Figure (4) the steps for proposed work

11- The Experimental Data

The search data consisted of a set of magnetic resonance images of a number of injured (100) and non-injured (100) and of the chest area , Figure (5) shows a sample of the images for the research, Each image is made up of (224 by 224) graphic elements



Injured Non- injured

Figure (5) magnetic response images of injured and non-injured

12-Evaluation Classification Results

Many criteria can be used to evaluate the classification for each case by using the following form

$$MSE = \frac{\sum_{i=1}^{n}[y_i - x_i]^2}{n} \quad \dots(11)$$

13-The Experimental Results

After applying the stages of the proposed work in the research to the research data, the following results appeared which represent the (MSE) for each case

Table (1) represents the (MSE) for each data set

The Data Set		Harris	Brisk
Normal Set		0.95	0.96
Photon Noise	Mean Filter	0.92	0.91
	Median Filter	0.88	0.89
Gaussian Noise	Mean Filter	0.93	0.94
	Median Filter	0.87	0.86

The results showed the effect of different classification methods on noise models, as well as the type of image filter used to reduce the impact of classification on the associated sampling noise.

14-The Conclusions and Suggestions

After applying the proposed work to the research data for magnetic response images, a number of Conclusions and Suggestions such that :-

Classification operations were affected by noise models and the type of image filter used, and the best classification operations were for natural data according to(Brisk) algorithm with (0.96),mean

filter gives best classification in Gaussian noise with (Brisk) algorithm with (0.94), median filter gives best classification in Photon noise with (Brisk) algorithm with (0.89).
Other classification algorithms can be use such that (Morris) with other spatial fitters such that (laplacian) filter.

15- References

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