HIDDEN FEATURES DETECTION USING HISTOGRAM MODIFICATION IN MRI IMAGES

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Abstract

Magnetic Resonance Imaging (MRI) uses magnetization and radio waves, rather than x-rays to make very detailed, cross- sectional pictures of the brain. In this work we are going to explain some procedures belongs contrast and brightness improvement which is very important in the improvement the image quality such as the manipulation with the image histogram. Its has been explained in this worked "the histogram shrink i.e. reducing the size of the gray level gives a dim low contrast picture is produced, where, the histogram stretching of the gray level was distributed on a wide scale but there is no increase in the number of pixels in the bright region. The histogram equalization has also been discuss together with its effects of the improvement of the image clarity.

Introduction

Images can differ in their clearly according to several parameters linked with its quality such parameters as contrast, resolution and brightness and noise, in many cases a dim or unclear picture can be processed and made much more clear than its original such image enhancement can be made to improve any of these factors mentioned earlier (Mather,1987). several procedures have been developed to improve the images such as filters (high pass, low pass) brightens adjustment, histogram equalization and histogram specification and many other procedures are used in image enhancement (Pratt,2003). In each of these procedures there is an improvement in the picture vision done in a different way. The image enhancement procedures should be used with care also should be chosen as compatible as possible to fit the purpose of the image to be enhanced (Zhou, 2002). For example a noisy image may get worse when histogram equalization is used if noise is not removed first (preprocessing) (Bovik, 1995).

Method

In this work we are describing the effect of grey level distribution on the image clearly. Grey level distribution is important for medical images and images in any other fields. It is well known that the grey level distribution between (0-255) for 8 bit image where 0 represent the darkest (black) and 255 the brightest (white) (Russ, 1992). the contrast of any image is dependant on the distribution of the gray level that the image over the scale of 0-255 for example if a picture of gray level is distributed between 50-100 or 120 this will show a dark picture and no mach information can be gathered from it, we can improve contrast by extending the gray level to a wider scale this can be done several procedures such as: histogram equalization Specific histogram equalization and histogram Stretching (Gonzalez, 1992).

In each of these procedures we are extending the image gray level but in different way. We are going to explain the modification of gray level in extending the size and the number of pixels for the gray level which, in turn, improves contrast and more picture feature can be seen. This can be done by the method called histogram equalization; this procedure does not only increase the range (stretch) the gray level of the picture it is also flatten the histogram of the picture. Another procedure can also improve the contrast is that the histogram stretching. In this method we can just increase the range of the gray level and the general shape of the histogram remains virtually the same (MATLAB, 1995; Goldszal, 1998).

We have taken an MRI image for the brain and we have processed it in the following way to explain the effect of gray level distribution on the image clarity

A- We take the original picture and applied histogram shrink the picture appeared quite dim.
B- We applied the histogram equalization on the same original picture.

C- Histogram stretching has also been applied on the shrunken image.

The corresponding histogram distrib-ution were shown (Figs. 1, 2, 4).

Results

To show the effect of gray level distribution on the image contrast for brain MRI image was taken and different histogram modifications were performed. First we have shown the effect of histogram shrink Fig. (2). in this figure the histogram (the gray level size) were reduced in two different patterns the first gray level was between 0 and 100 and the second was between 50 and 140 in these two images the histogram general shape is similar to the original one but the size of the gray level is different from the original. It can clearly be seen that both images are of lower quality than the original Fig. (1). When the histogram stretching was performed the same image clarity was obtained. in this example; the original image histogram spread all over the gray level and we shrink it, but if the original image has small gray level size it will be more clear than the original when image histogram stretching is applied.

Another procedure was applied, this time we have used the histogram equalization. In this procedure the image histogram is not only stretched but the gray level histogram height is also increased meaning that the number of pixels this also increased. This treatment has improved the quality of picture it has greatly improved brightness and contrast; we can see more details than original Fig. (4). To show the changes in the brightness level we have taken a line plot passing through the center of the image horizontally the increase in the brightness level for dim features was clearly seen Fig. (5).

Discussion

As has been mentioned earlier that the picture clarity depends on many parameters. The contrast and the brightness adjustment are of prim importance to get a good picture. We have seen in our results the effect of these two parameters. First the histogram shrink i.e. reducing the size of the gray level gives a dim low contrast picture is produced. Second On using the histogram stretching the gray level is distributed on a wide scale but there is no increase in the number of pixels in the bright region, the stretched histogram is still have the same shape as the shrunken one, so the picture quality still poor but better than the latter one and this is because the brightness distribution. In the third treatment to the picture the histogram equalization were used in this procedure the number of pixels in the bright region have increased this has given a better distribution for the gray level, for this reason the picture quality has been greatly improved. This can be observed on the plot of the line through the center of the image shows the increase in the brightness in the dim region which in turn, can show more hidden feature in the image. Fig. (5). Although this procedure does not fully flatten the histogram but it makes it nearly flat. It is possible to make the whole histogram more or approximately flat but this needs more complicated procedure and it does not improve the picture so the histogram equalization is enough as it is good and easy (Scott, 1998; Jenkinson et al., 2006).

Insofar we have explained the image enhancement by either extending the gray level size or brightness or both. As has been explained earlier these treatments may make the image worse and this is because of the fact that any image enhancement through the gray level can enhance noise in the same way of original image which, in turn, deteriorate the image quality.

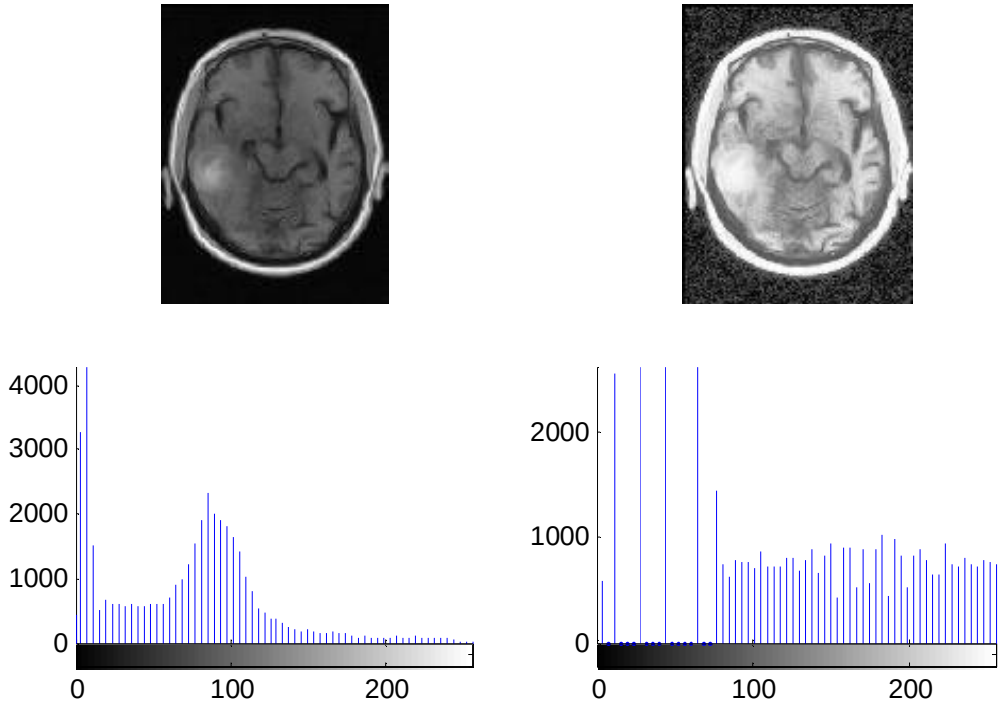

Fig. (1) : Brain MRI.
(Top left original) (Top right histogram equalization)

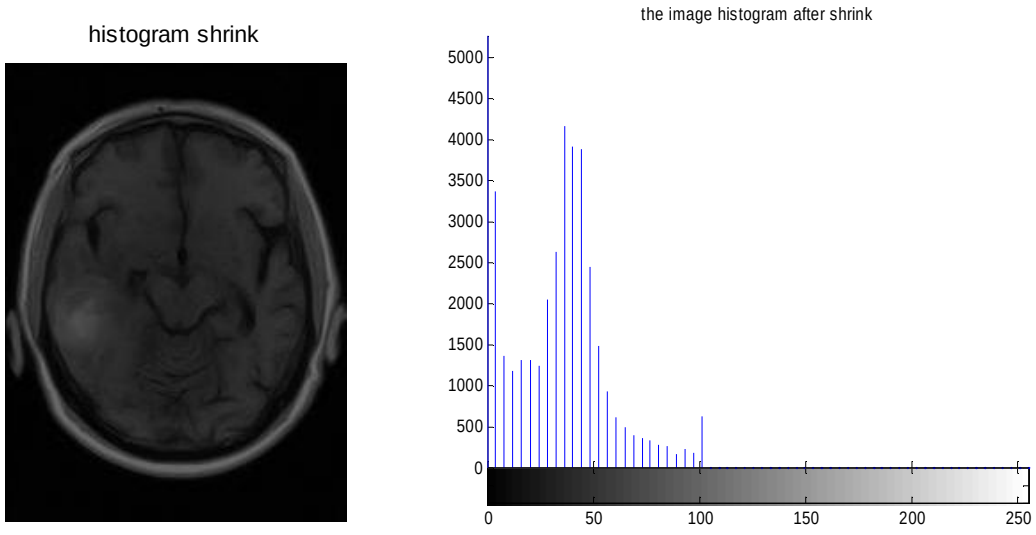

Fig. (2) : Histogram Shrink (gray level 0-100).

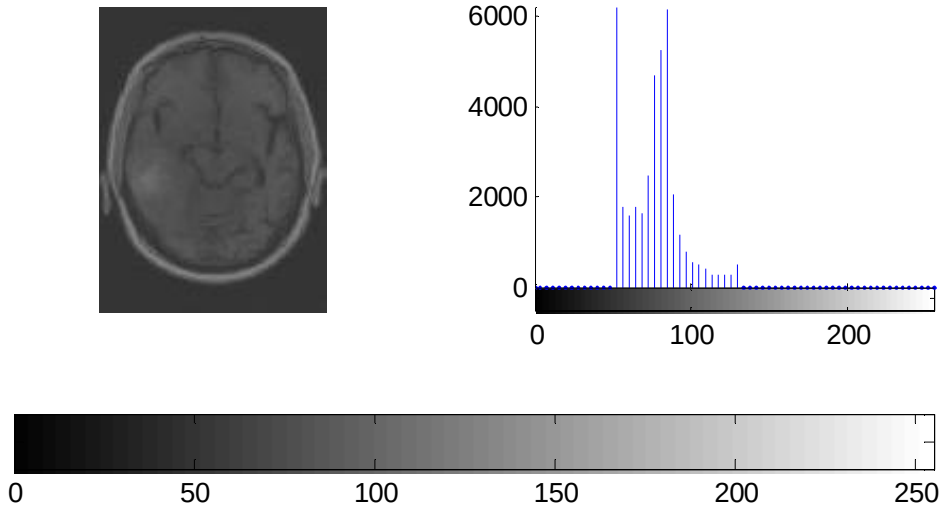

Fig. (3) : Histogram Shrink (gray level 50-140).

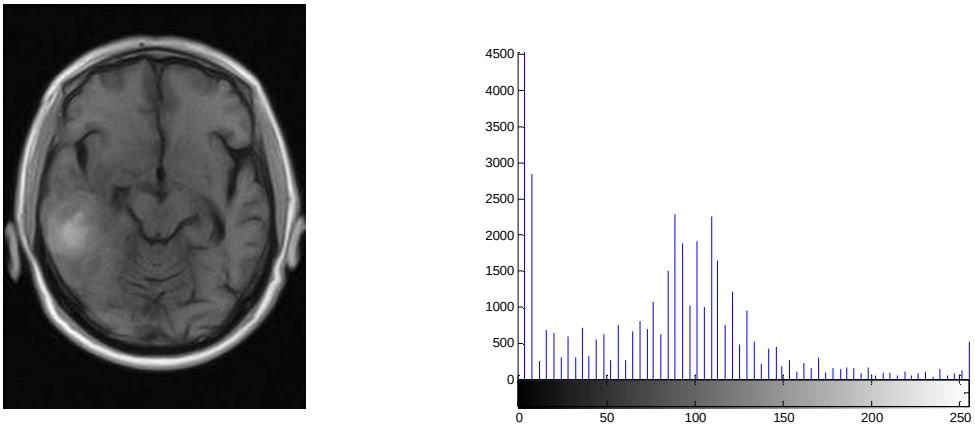

Image after histogram stretching

Fig. (4) : Histogram after stretching.

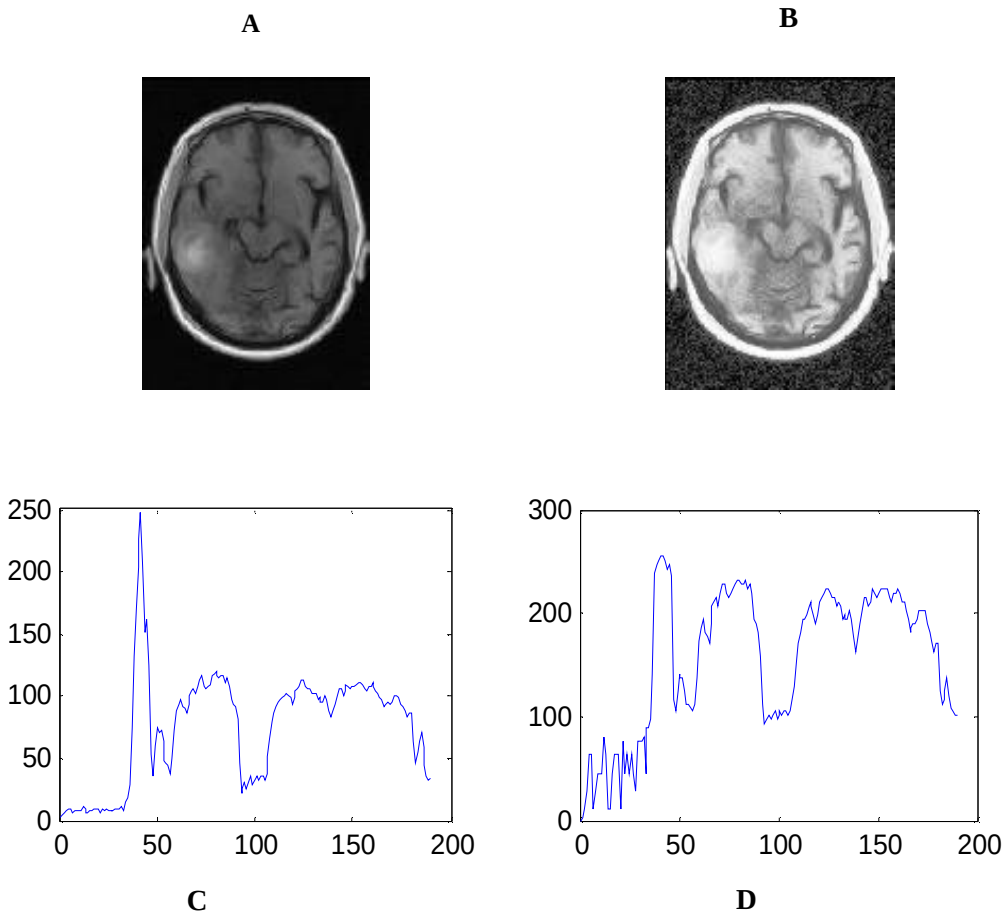

Fig. (5) : A- Original image.
B- Histogram equalization.
C- Brightness change for plot line horizontal passing through the center of the original image.
D- Brightness change for line plot horizontal passing through the center of the histogram equalization.

في هذا البحث يتم شرح منهاج التباين وتحسين الوضوح في الصورة وهو مهم جدا لتحسين نوعية الصورة وقد استعمل في هذا البحث طريقة الرسم البياني لمعالجة الصورة. خلاصة نتائج البحث هي "تقليص الرسم البياني للصور يؤدي إلى نقصان حجم التدرج اللوني، وبالتالي ينتج عنها مناطق مظلمة قليلة التباين، إما طريقة مط الرسم البياني للصورة فتعطي توزيع التدرج اللوني بشكل أوسع بدون زيادة بعدد الوحدات الصورية للمناطق المضيئة.

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الخلاصة

تضمن البحث استخدام صور أجهزة الرنين المغناطيسي والمستخدمة امواج راديوية ومغناطيسية على عكس اشعة اكس للكشف عن حالات سرطان الدماغ. أن استخدام هذه التقنية الحديثة لأغراض الكشف المبكر عن الأورام السرطانية يعتبر من التطبيقات الطبية المهمة إلا أن اغلب الصور المستحصلة تحوي على ضوضاء عالية بحيث يصعب في بعض الأحيان تحديد الورم ودرجة تطوره، وكذلك يتطلب ذلك مفسرين متمرسين في هذا الموضوع.