## 影像處理作業2

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(20%) Use binary morphological operations to 1) fix the image shown below ("text-broken.tif") and 2) find the boundaries of each characters like 'Historically.'

## dilation

Historically, certain computer programs were written using only two digits rather than four to define the applicable year. Accordingly, the company's software may recognize a date using "00" as 1900 rather than the year 2000.

左方圖片將text-broken.tif 進行dilation所產生出來 的影像,用dilation可以 將影像修飾一些殘破的 缺角。

## boundary

Historically, certain computer programs were written using only two digits rather than four to define the applicable year. Accordingly, the company's software may recognize a date using "00" as 1900 rather than the year 2000.

左方圖片將text-broken.tif 扣除erosion所產生出來 的影像,其方法可以取 出文字的邊界。 2. (20%) Please use linear stretching to enhance the contrast of the image "aerialview-washedout.tif."

Original Image



Linear stretching



linear stretching 
$$f(x) = \left(\frac{x - \min(x)}{\max(x) - \min(x)}\right) * 255$$

其中x代表像素值。

左方是原本的圖像,右方則是經過Linear stretching的圖像,由於原本的圖像的像素質最大為255與最小為0,因此再進行linear stretching則是無效果的。

## 3. Following Q.2, please use gamma stretching instead.

Original Image



Gamma streching with gamma 0.2



Gamma streching with gamma 0.5



Gamma streching with gamma 2



Gamma streching with gamma 5



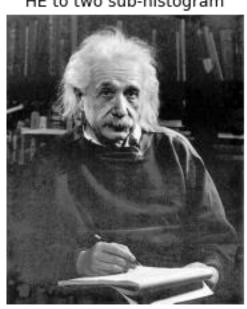
gamma stretching 
$$f(x) = \left(\frac{x - \min(x)}{\max(x) - \min(x)}\right)^{\gamma} * 255$$

其中x代表像素值,f(x)是經過gamma stretching後的像素。

圖片由左至右的gamma值分別為0.2、0.5、2和5,由此可以發現隨著gamma值增加,整體而言,圖片由淺色變換至深色。

4. Please divide the histogram of "einstein-low-contrast.tif" into two sub-histograms using the mean  $\mu$  of the image and apply HE to two sub-histograms separately (one ranging from  $0^{\mu}$  and the other from  $(\mu+1)^{255}$ ). You should implement it by yourself without using built-in APIs.

下圖為將愛因斯坦的影像分層2部分,將低於平均像素的像素值視為一類,高於平均像素值視為另一類,再對這兩類各別進行histogram equalization.所產生出來的影像如下:



HE to two sub-histogram