Digital Image Processing - Homework #1

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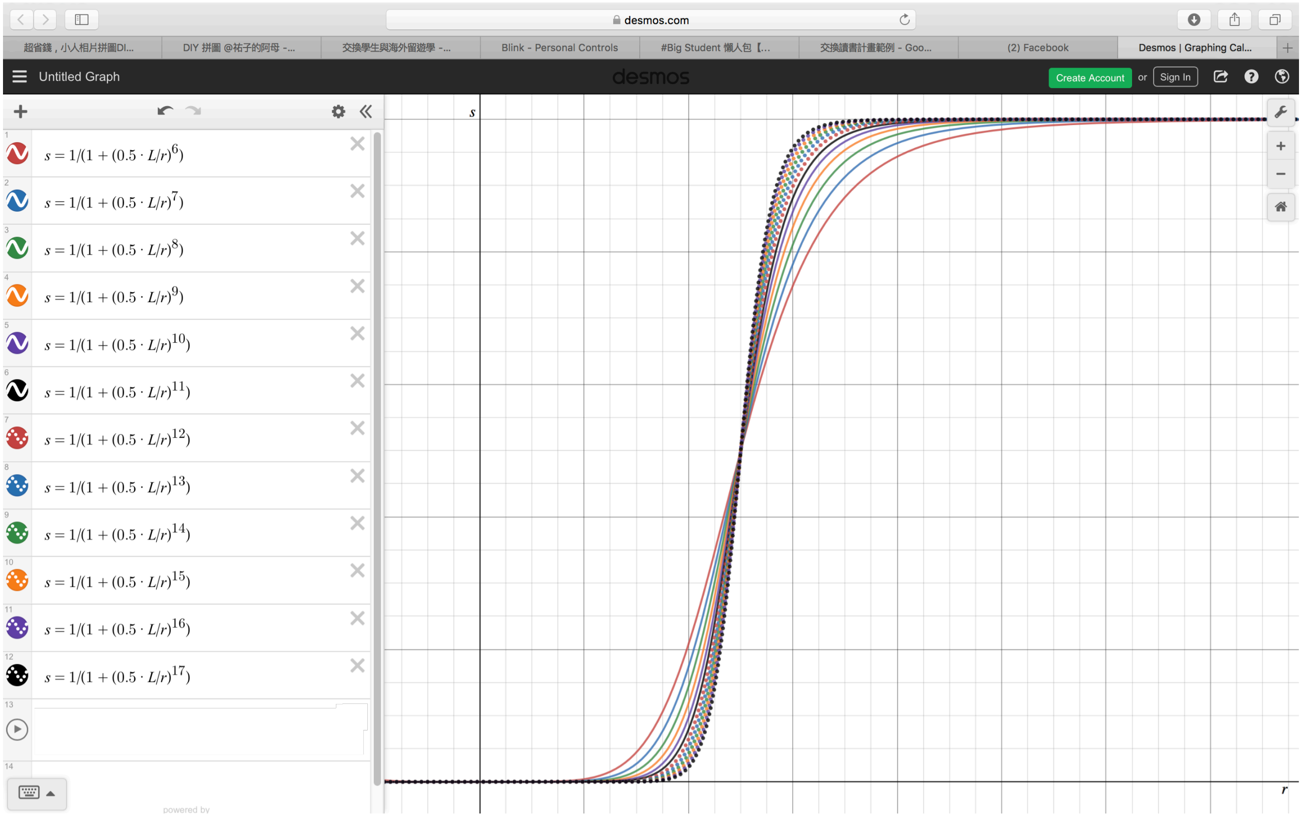
1. *(a) The continuous function is*

$$s = T(r) = \frac{1}{1+(\frac{m}{r})^E}$$

(b) $m = 0.5L$, and $E = 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17$, respectively.



2. *Because $z_q = G^{-1}(s_k)$ and $s_k = G(z_q)$ are inverse functions, they are always symmetric about $y = x$.*

3. *I use Python to write the program for histogram equalization. Use python2 and the command **"python DIP.py"** to run the program. Because the pictures are too big, I put the original picture named "DIP.jpg" and the result picture named "result.png" on the google drive and here is the link: https://drive.google.com/drive/folders/1Md3u0Rx-cqmtALkPuYzWTYSCwmhf_5co?usp=sharing*

   The left one is the original histogram, and the right one is the histogram after histogram equalization. Besides, I also save the original picture and the picture after histogram equalization in "result.png" with an eye to telling the difference between these two pictures easily.

The histogram concentrates on the left side of the original graph; however, the new histogram distributes more evenly on the whole graph. In addition, you can tell the difference by the blue lines of two graphs. The blue line is the accumulation of the histograms through some modification showed bellow.

$$CDF_{normalized} = CDF \times \frac{hist.max()}{CDF.max()} \quad \text{(CDF: the real accumulation of all histograms.)}$$

This equation makes sure that the final value of CDF, namely, the total value of histograms, is the same as the highest value of all histograms.

By observing the blue line, the difference between these two pictures is quite significant. The original one grows dramatically at the beginning and then almost stops growing. As for the new one after histogram equalization, it increases smoothly and steadily, which means all the histograms distribute evenly on the graph.

(p.s. Seeing that my camera is broken, I use the photo taken before instead of my selfie.)