

# TNM087 – Image Processing and Analysis

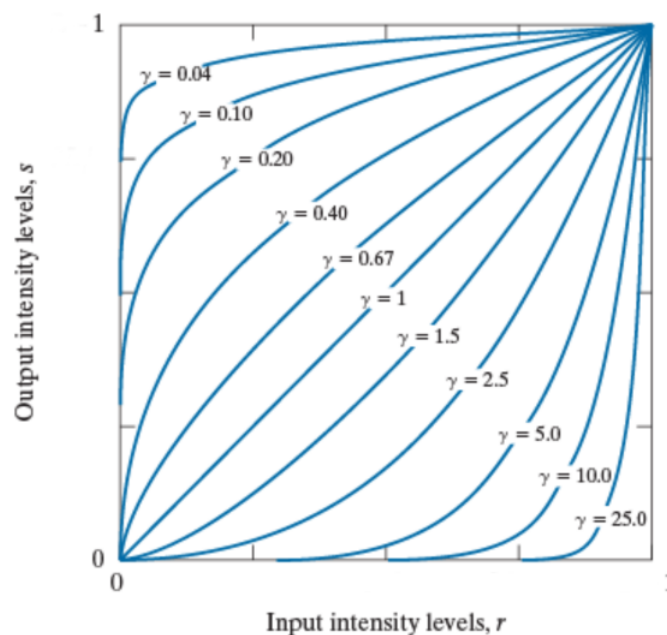
## Lab 1 –Intensity Transformations

### Task 2 - Gamma correction

Intensity transformations are simple, pixelwise image operations, often used for tasks such as contrast manipulations and thresholding. One common intensity transformation is *gamma-correction* (or *power-law transformation*). It is often used in display calibration (accounting for non-linearities in the display), as well as for contrast enhancement in images. The general form of gamma correction is:

$$s = cr^\gamma$$

where  $s$  being the output intensity level,  $r$  is the input intensity level,  $c$  and  $\gamma$  are positive constants. The figure below displays the relation between input and output values for various  $\gamma$  ( $c=1$  in all cases).



#### Task:

Select a gray value range in the input image, and apply gamma correction to the specified range. Modify the provided m-file 'GammaCorrection'

```
function GImage = GammaCorrection(OImage, Gamma, Lower, Upper)
```

OImage is the input grayscale image, which can be of type uint8 or double

Gamma is the value of the exponent

Lower and Upper define the truncation rule, where Lower and Upper are quantiles. For example: Lower = 0.01 and Upper = 0.98 will ignore the lower 1% of the dark pixels and 2% of the lighter pixels. Note that the quantiles Lower and Upper are not gray level values in the image! They are used to compute the corresponding gray values in the image (using the command quantile).

GImage is the output gamma corrected image, which should be of type double

The images 'aerialview-washedout.tif' and 'spillway-dark.tif' are suitable for experimenting with gamma correction. Use your code to enhance contrast in these images. Try to

predict reasonable values for  $\gamma$  before applying your code, by looking at the properties of the images and the effect of different  $\gamma$  in the figure, above. Describe your findings as comments in your m-file.

The image 'IntensityRampGamma25.tif' illustrates the effect of an intensity ramp displayed on a monitor with  $\gamma=2.5$  (a value typical for CRT monitors). Which  $\gamma$  should you use to correct the image so that it will appear as a completely linear intensity ramp? It should ideally be identical to the image 'IntensityRamp.tif' (test and compare). Write your answer as comments at the end of your m-file. Note that 'IntensityRampGamma25.tif' is a 16-bit image in the data format `uint16`, i.e. in the range [0, 65535].