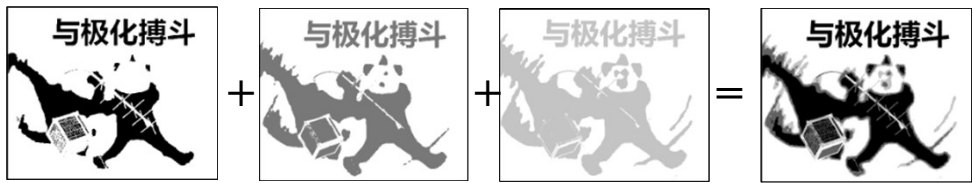


# Grayscale display principle

A grayscale image can be composed by combining sub-images of different gray levels:



In a monochrome screen, temporal dithering (referred to by some as PWM) can be used to show grayscale images. For example, if 3 sub-images are used in one refresh cycle, pixels that are lit up in all three images will appear the darkest color, pixels that are lit up only in one image will have the lightest color, and pixels that aren't lit up at all in any of the images will remain uncolored:



# LCD data storage format

UVK5 uses a monochrome LCD with a resolution of 128×64 pixels, where each pixel requires only 1 bit of data. Thus, in the LCD internal memory, every vertical group of 8 pixels is bundled together and stored as one byte. These bytes are then arranged horizontally. Therefore, the pixel storage in the LCD memory is as follows:

$$\{ \text{Column 1 row 1-8, Column 2 row 1-8, } \cdots, \text{C128 R1-8, C1 R9-16}, \cdots, \text{C127 R57-64} \}$$

We can group it into 128-byte segments to form an 8×128 array, this can be considered as dividing the entire screen from top to bottom into 8 lines, each line has 128×8 pixels corresponding to 128 sets of 8-bit data. If you want to display a 4-level grayscale image, 3 different graylevel images are required; thus, three such arrays are needed for storing the entire image.

