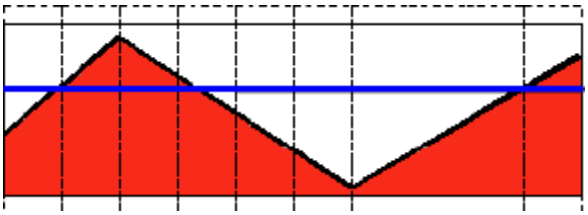
Types of Thresholding

- OpenCV offers the function threshold to perform thresholding operations.
- We can effectuate 5 types of Thresholding operations with this function. We will explain them in the following subsections.
- To illustrate how these thresholding processes work, let's consider that we have a source image with pixels with intensity values $\texttt{src}(x, y)$. The plot below depicts this. The horizontal blue line represents the threshold $\texttt{thresh}$ (fixed).

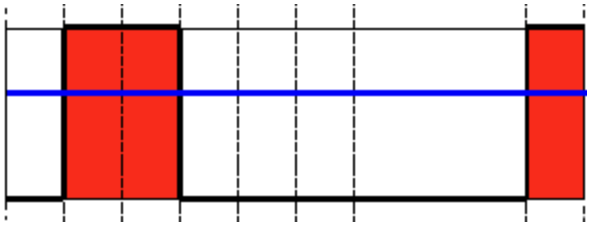


Threshold Binary

- This thresholding operation can be expressed as:

$$\texttt{dst}(x, y) = \begin{cases} \texttt{maxVal} & \text{if } \texttt{src}(x, y) > \texttt{thresh} \\ 0 & \text{otherwise} \end{cases}$$

- So, if the intensity of the pixel $\texttt{src}(x, y)$ is higher than $\texttt{thresh}$, then the new pixel intensity is set to a $\texttt{MaxVal}$. Otherwise, the pixels are set to 0.

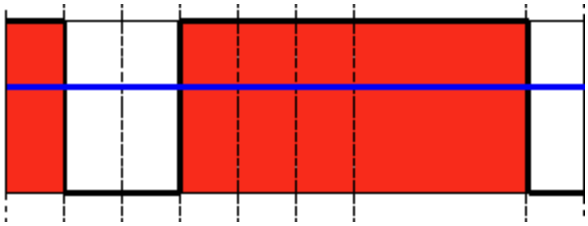


Threshold Binary, Inverted

- This thresholding operation can be expressed as:

$$\texttt{dst}(x, y) = \begin{cases} 0 & \text{if } \texttt{src}(x, y) > \texttt{thresh} \\ \texttt{maxVal} & \text{otherwise} \end{cases}$$

- If the intensity of the pixel $\texttt{src}(x, y)$ is higher than $\texttt{thresh}$, then the new pixel intensity is set to a 0. Otherwise, it is set to $\texttt{MaxVal}$.

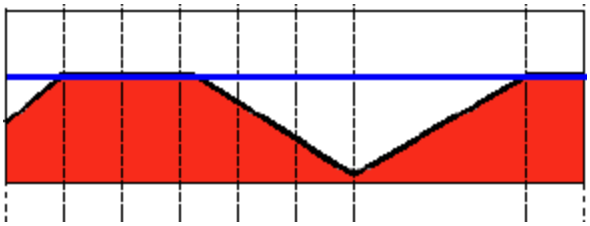


Truncate

- This thresholding operation can be expressed as:

$$\texttt{dst}(x, y) = \begin{cases} \texttt{threshold} & \text{if } \texttt{src}(x, y) > \texttt{thresh} \\ \texttt{src}(x, y) & \text{otherwise} \end{cases}$$

- The maximum intensity value for the pixels is $\texttt{thresh}$, if $\texttt{src}(x, y)$ is greater, then its value is *truncated*. See figure below:

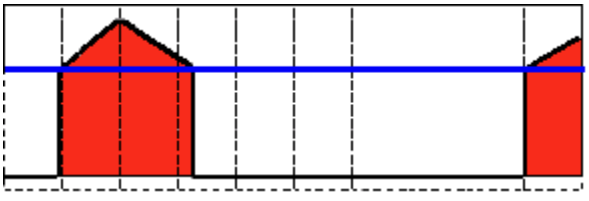


Threshold to Zero

- This operation can be expressed as:

$$\texttt{dst}(x, y) = \begin{cases} \texttt{src}(x, y) & \text{if } \texttt{src}(x, y) > \texttt{thresh} \\ 0 & \text{otherwise} \end{cases}$$

- If $\texttt{src}(x, y)$ is lower than $\texttt{thresh}$, the new pixel value will be set to 0.



Threshold to Zero, Inverted

- This operation can be expressed as:

$$\texttt{dst}(x,y) = \begin{cases} 0 & \text{if } \texttt{src}(x,y) > \texttt{thresh} \\ \texttt{src}(x,y) & \text{otherwise} \end{cases}$$

- If $\texttt{src}(x,y)$ is greater than $\texttt{thresh}$, the new pixel value will be set to 0.