|  |  |  |
| --- | --- | --- |
| Transformation | Transformation Matrix | Generating the Transformation Matrix |
| Translation | Here, tx and ty represent translation in the x and y directions, respectively. | M = np.float32([[1,0,tx],[0,1,ty]])  Here, tx and ty represent the translation. |
| Rotation | Here,    center.x and center.y represent the x and y coordinates of the point (center) around which the image has to be rotated. | M = cv2.getRotationMatrix2D((centerX,centerY),angle,scale)  Here, (centerX, centerY) are the coordinates of the point around which rotation will be performed, angle is the angle by which the image has to be rotated, and  scale is the factor by which the output image has to be scaled up or scaled down. |

Figure 2.19: Table with transformation matrices for different transformations

|  |  |
| --- | --- |
| Bitwise Operation | Table |
| NOT  Used for generating the negative of a binary image.  Function: cv2.bitwise\_not. | |  |  | | --- | --- | | Input Bit | Output Bit | | 0 | 1 | | 1 | 0 | |
| OR  The OR operation will return a 1 if at least one of the images has a 1 in that pixel. This can be used to generate unions of two binary images.  Function: cv2.bitwise\_or. | |  |  |  | | --- | --- | --- | | Input Bit 1 | Input Bit 2 | Output Bit | | 0 | 0 | 0 | | 0 | 1 | 1 | | 1 | 0 | 1 | | 1 | 1 | 1 | |
| AND  The AND operation will return a 1, but only if both of the images have a 1 in that specific pixel. This can be used to generate the intersection of two binary images.  Function: cv2.bitwise\_and. | |  |  |  | | --- | --- | --- | | Input Bit 1 | Input Bit 2 | Output Bit | | 0 | 0 | 0 | | 0 | 1 | 0 | | 1 | 0 | 0 | | 1 | 1 | 1 | |
| XOR  The XOR operation will return a 1, but only if one of the pixels is 1 for the images. This can be used to identify the moving object in two subsequent frames.  Function: cv2.bitwise\_xor. | |  |  |  | | --- | --- | --- | | Input Bit 1 | Input Bit 2 | Output Bit | | 0 | 0 | 0 | | 0 | 1 | 1 | | 1 | 0 | 1 | | 1 | 1 | 0 | |

Figure 2.41: Bitwise operations and truth tables