Because the object is already a binary image, we can assume that the image has been modified to get this way. This would mean there is no noise or distortions, with crisp lines surrounding each object. Each object would have to be found using the following features: size, position, and orientation. Let’s assume that the image has only one object. We would then find the zeroth moment of that object by multiplying the sums of the rows and columns of black pixel, as seen in equation 1.

. (1)

The first moment would then need to be found in order to find the centroid, as seen in equations 2 – 5, with 4 and 5 being the actual centroid.

(2)

(3)

(4)

(5)

The second moment, and every moment after that can be calculated using equation 6.

(6)

Using equation 6, central moments can now be calculated. This allows for orientation and scale around the origin to be determined. Orientation is then determined by equation 7, where θ is the orientation with respect to the x-axis.

(7)

A set of seven invariant moments can be derived from the second and third moments, which are invariant to translation, scale change, mirroring (within a minus sign) and rotation. (equations 8 – 15)

(8)

(9)

(10)

(11)

(12)

(13)

Because we know the shape of the objects we are looking for, we can therefore take the invariant moments of each object. By comparing the invariant moments of an image with each object, it can be determined if the object of value is in the image by checking the value of the moment invariants versus the table of invariants created by each object. If the objects are within parameters specified, it is the same object.