In this note the relationship between sum of squared difference (SSD) and cross correlation template matching approaches are reviewed. SSD matching is defined as follows,
\[ d(u, v) = \sum_{x,y} \left( f(x, y) - t(x - u, y - v) \right)^2 \] (1)
and cross correlation,
\[ c(u, v) = f(x, y)t(x - u, y - v) \] (2)
where \( f \) is the image, \( t \) the template and summation is over positions \( x, y \) under the template positioned at \( u, v \). SSD can be viewed as the squared Euclidean distance.

Expanding (1), yields,
\[ d(u, v) = \sum_{x,y} f^2(x, y) - 2f(x, y)t(x - u, y - v) + t(x - u, y - v)^2. \] (3)

Note that the term \( \sum_{x,y} t(x - u, y - v)^2 \) is constant. Assuming that the term \( \sum_{x,y} f^2(x, y) \) (i.e., the local image energy) is approximately constant, the remaining term (i.e., cross correlation term)
\[ c(u, v) = f(x, y)t(x - u, y - v) \] (4)
is a measure of the similarity between the image and the template; the larger the value of \( c \), the more similar the image and template are.