
Interpolate Points on a Shape

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1 UNIFORMLY SPACED INTERPOLATED POINTS

We assume we have two vectors, \mathbf{x} and \mathbf{y} , that store the N points $\{x_i, y_i\}_{i=1}^N$ defining a shape. We want to find n evenly spaced points between every point defining the shape. Consider the line segment connecting the points (x_i, y_i) and (x_{i+1}, y_{i+1}) , as shown in Fig. 1. The length, ℓ , of this line segment (i.e. the distance between the two points) is

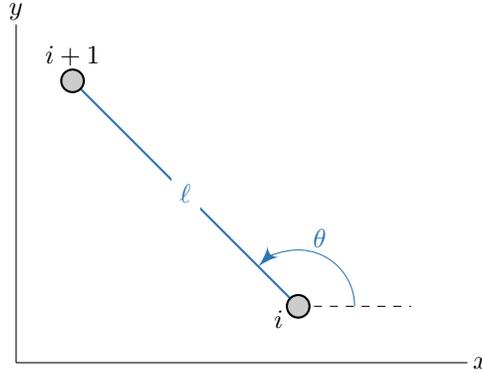


Figure 1: Line segment connecting points i and $i + 1$.

$$\ell = \sqrt{(x_{i+1} - x_i)^2 + (y_{i+1} - y_i)^2} \quad (1)$$

The angle (measured counter-clockwise) that the line segment forms with the horizontal line $y = y_i$ can be found using the four-quadrant inverse tangent.

$$\tan \theta = \frac{y_{i+1} - y_i}{x_{i+1} - x_i} \quad \rightarrow \quad \theta = \arctan2(y_{i+1} - y_i, x_{i+1} - x_i) \quad (2)$$

We want to interpolate n uniformly spaced points between points i and $i + 1$, which means that the distance between each interpolated point is then ℓ/n . It follows that the first interpolated point is a distance ℓ/n from point i , the second interpolated point is a distance $2\ell/n$ from point i , and so on. Thus, the j^{th} interpolated point is a distance $j\ell/n$ from point i . Since all the interpolated points lie on the line segment connecting points i and $i + 1$, they all make the same angle θ with the horizontal line emanating from point i (see Fig. 1). Thus, the x - and y - coordinates of the j^{th} interpolated point can be calculated as

$$x_{ji} = x_i + \frac{j\ell \cos \theta}{n} \quad (3)$$

$$y_{ji} = y_i + \frac{j\ell \sin \theta}{n} \quad (4)$$