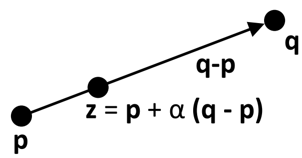
Affine combination of two points

Suppose we are given two points **p** and **q (assume these are represented by vectors in R^n)**. Now a vector from **p** to **q** is given by **q - p**. Now a point **z** on the line segment connecting the two points can be found by starting from **p** and going some distance in the direction of **q-p** vector (in other words adding a scalar multiple of **q-p** to **p**).

$\mathbf{z} = \mathbf{p} + \alpha\,(\mathbf{q} - \mathbf{p}) = \alpha\,\mathbf{q} + (1-\alpha)\mathbf{p}$



Now is the scalar multiple α is between 0 and 1 we get any point in the line segment connecting **p** and **q. In that case,** $\alpha\,\mathbf{q} + (1-\alpha)\mathbf{p}$ **is called an Convex combination.**

In case of convex combination, we can also write,

$\mathbf{z} = \lambda\,\mathbf{p} + (1-\lambda)\mathbf{q}$ where $0 \le \lambda \le 1$, to represent the same point as $\mathbf{z} = \alpha\,\mathbf{q} + (1-\alpha)\mathbf{p}$ (just use, $\lambda = 1-\alpha$)

For example,

Suppose $p = [2\ 4]^T$ and $q = [16\ 8]^T$. then

$\mathbf{z} = 0.25\,\mathbf{p} + 0.75\,\mathbf{q} = [0.5\ 1]^T + [12\ 6]^T = [12.5\ 7]^T$ (assume, $\alpha = 0.7$ or as $\lambda = 0.3$)

Now, in case of general affine combination α does not have to be between 0 and 1. What point do we get if $\alpha > 1$ or $\alpha < 0$?