Taking uncertainty seriously

A Bayesian approach to word embedding bias estimation

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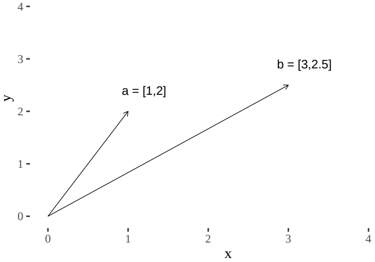
Boston, April Fools' Day

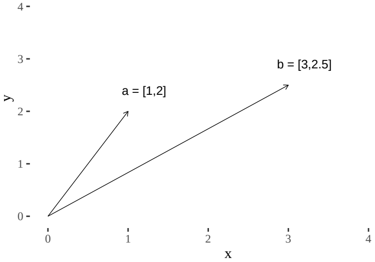
Cosine similarity



Vectors

$$a = [1, 2]$$
$$b = [3, 2]$$

Cosine similarity



Vectors

$$a = [1, 2]$$
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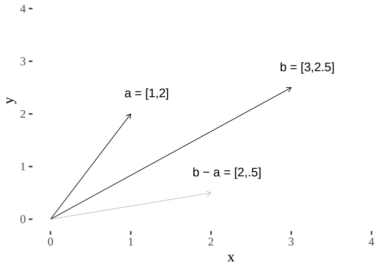
Dot product

$$a \cdot b = a_1 b_1 + a_2 b_2$$
$$a \cdot a = a_1^2 + a_2^2$$
$$\|a\| = \sqrt{(}a \cdot a)$$

Cosine similarity



Vectors

$$a = [1, 2]$$
$$b = [4, 4]$$

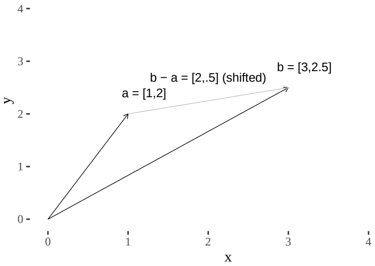
Dot product

$$a \cdot b = a_1 b_1 + a_2 b_2$$
$$a \cdot a = a_1^2 + a_2^2$$
$$\|a\| = \sqrt{(a \cdot a)}$$

Vector difference

$$b - a = [b_1 - a_1, b_2 - a_2]$$

Cosine similarity



Vectors

$$a = [1, 2]$$
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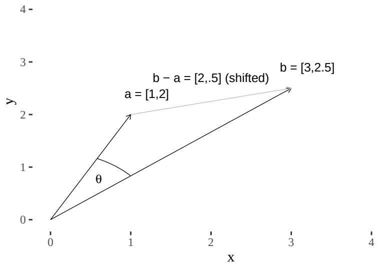


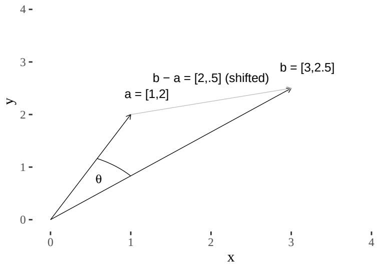
Angle

$$\|b-a\|^2 = \|b\|^2 + \|a\|^2 - 2\|b\|\|a\|\cos\theta$$

$$b \cdot a = \|b\|\|a\|\cos\theta$$

$$\cos\theta = \frac{b \cdot a}{\|b\|\|a\|}$$

Cosine similarity



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Orthogonality

$$\cos(90^\circ) = 0$$
$$\frac{b \cdot a}{\|b\|\|a\|} = 0$$
$$b \cdot a = 0$$