Q3. Cosine Similarity Between Word Vectors

Given word vectors:

- $\vec{a}=[3,4]$
- $\vec{b}=[4,3]$

Tasks:

- (a) Compute the dot product $\vec{a}\cdot\vec{b}$

  $\bar{a} \cdot \bar{b} = (3)(4) + (4)(3)$
  $= 12 + 12$
  $= 24$
  $\mathbf{\bar{a} \cdot \bar{b} = 24}$

- (b) Compute magnitudes $\|a\|$ and $\|b\|$

  $\|\bar{a}\| = \sqrt{(3^2 + 4^2)} = \sqrt{(9 + 16)} = \sqrt{25} = 5$
  $\|\bar{b}\| = \sqrt{(4^2 + 3^2)} = \sqrt{(16 + 9)} = \sqrt{25} = 5$
  $\mathbf{\|\bar{a}\| = 5, \|\bar{b}\| = 5}$

- (c) Compute cosine similarity:

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

  $\cos(\theta) = (\bar{a} \cdot \bar{b}) / (\|\bar{a}\| \times \|\bar{b}\|)$
  $= 24 / (5 \times 5)$
  $= 24 / 25$
  $= 0.96$

  Cosine similarity = 0.96