Activation Functions

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UIC CS 421

There are many different activation functions!

exponential linear unit (elu)

softmax

scaled exponential linear unit (selu)

softplus

softsign

rectified linear unit (relu)

hyperbolic tangent (tanh)

sigmoid

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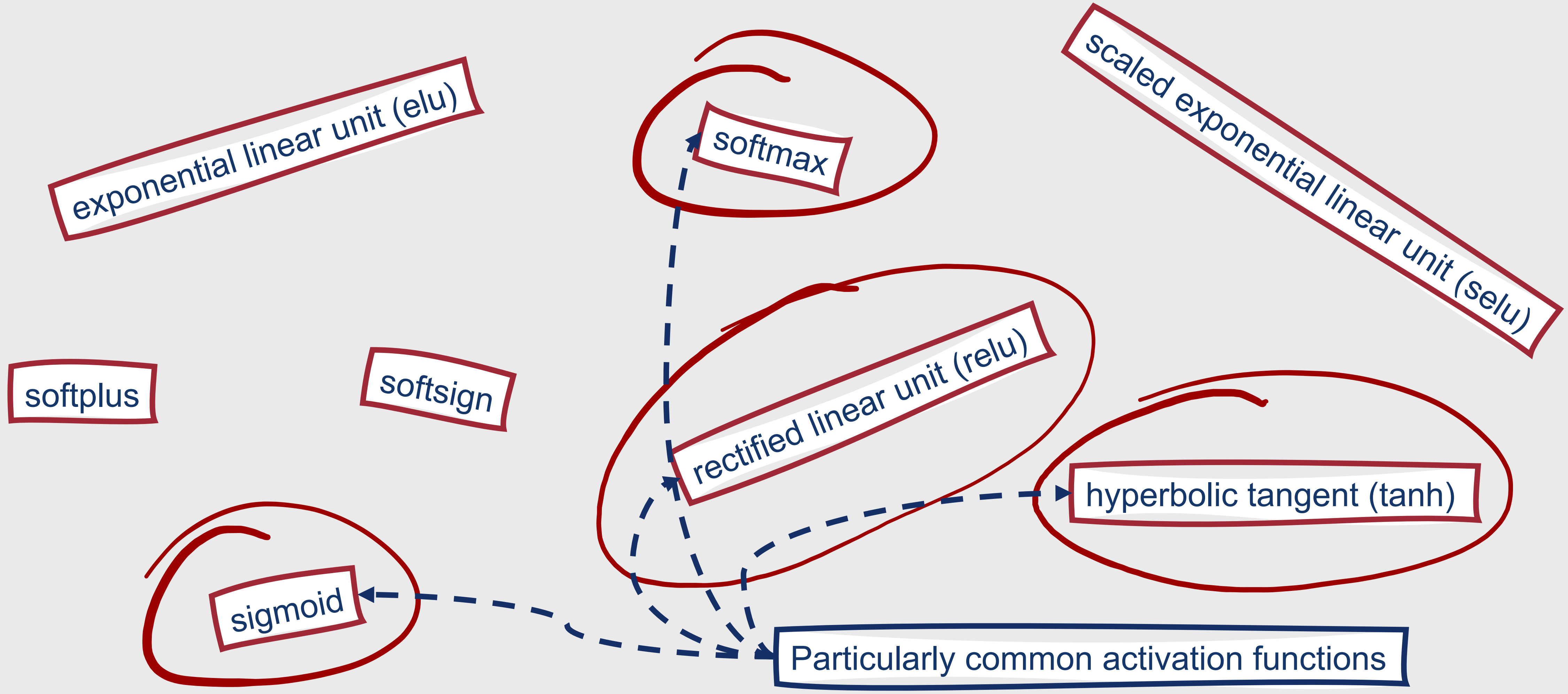
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softmax
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softplus
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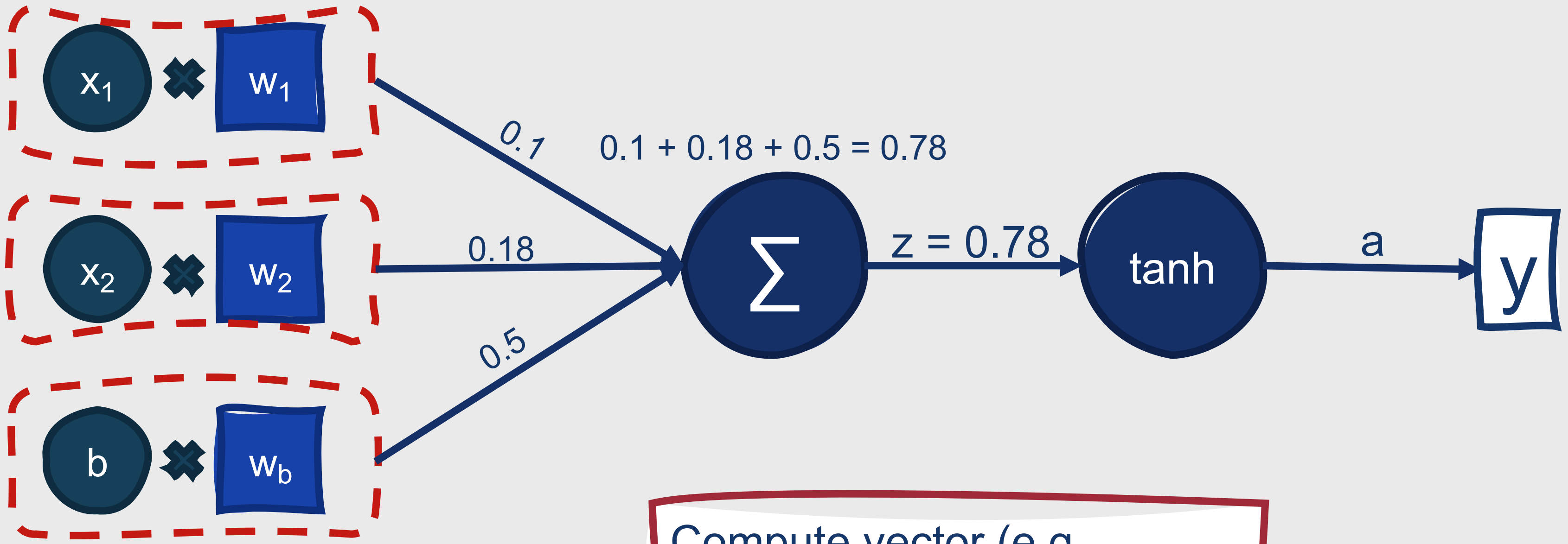
rectified linear unit (relu)
hyperbolic tangent (tanh)
sigmoid
Particularly common activation functions

Activation: tanh

- Variant of sigmoid that ranges from -1 to +1
  - $y = \frac{e^z - e^{-z}}{e^z + e^{-z}}$
- Once again differentiable
- Larger derivatives → generally faster convergence

Example: Computational Unit with tanh Activation



Input: “beautiful brutalist architecture”

Compute vector (e.g., averaged Word2Vec embeddings for “beautiful,” “brutalist,” and “architecture”)

[0.5, 0.6]

Weights (Input): [0.2, 0.3]
Weight (Bias): [0.5]

Bias: 1.0

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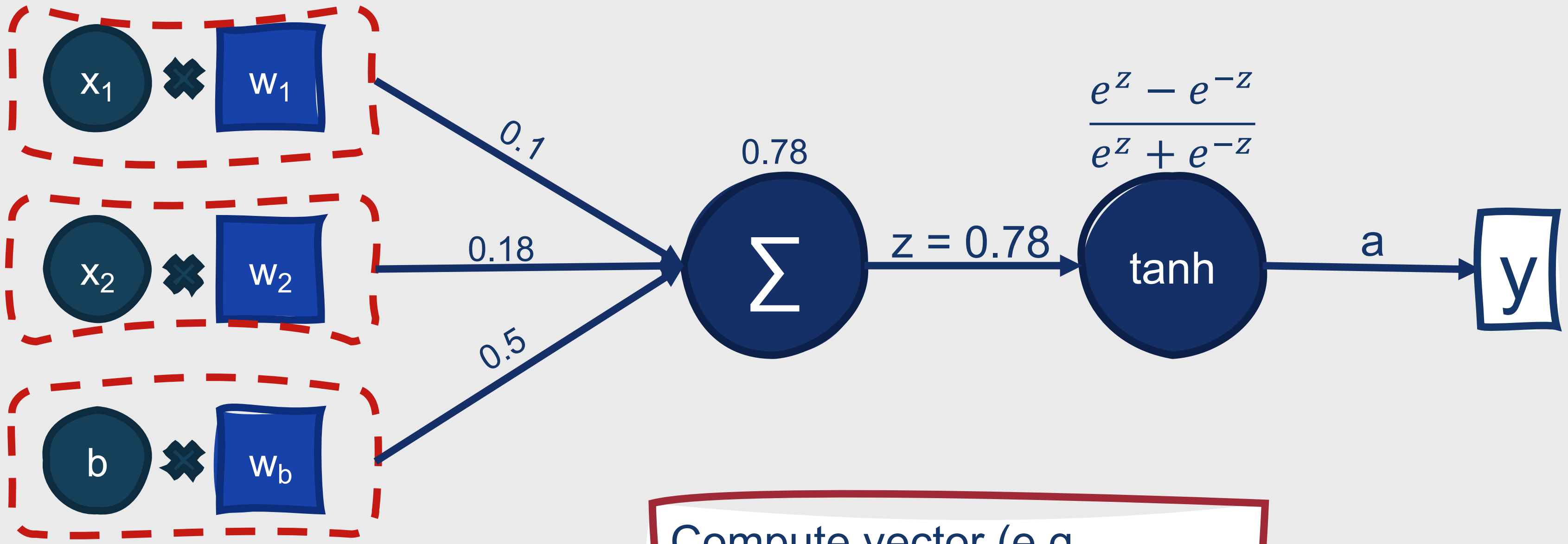

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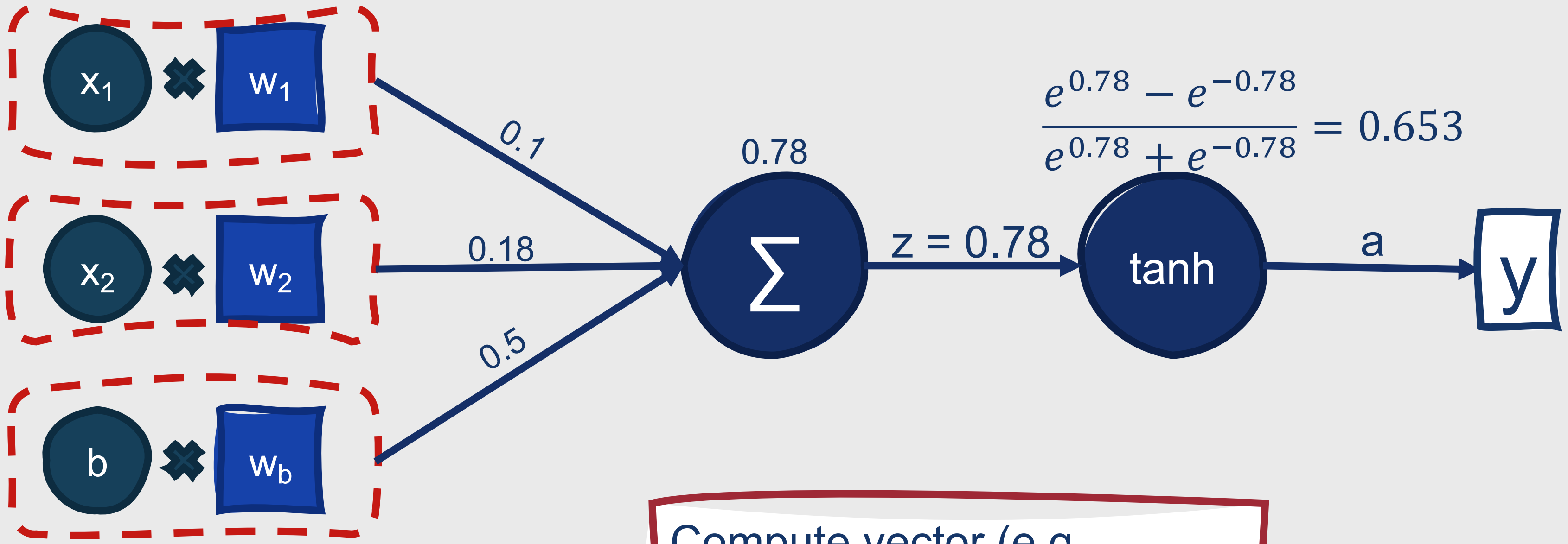

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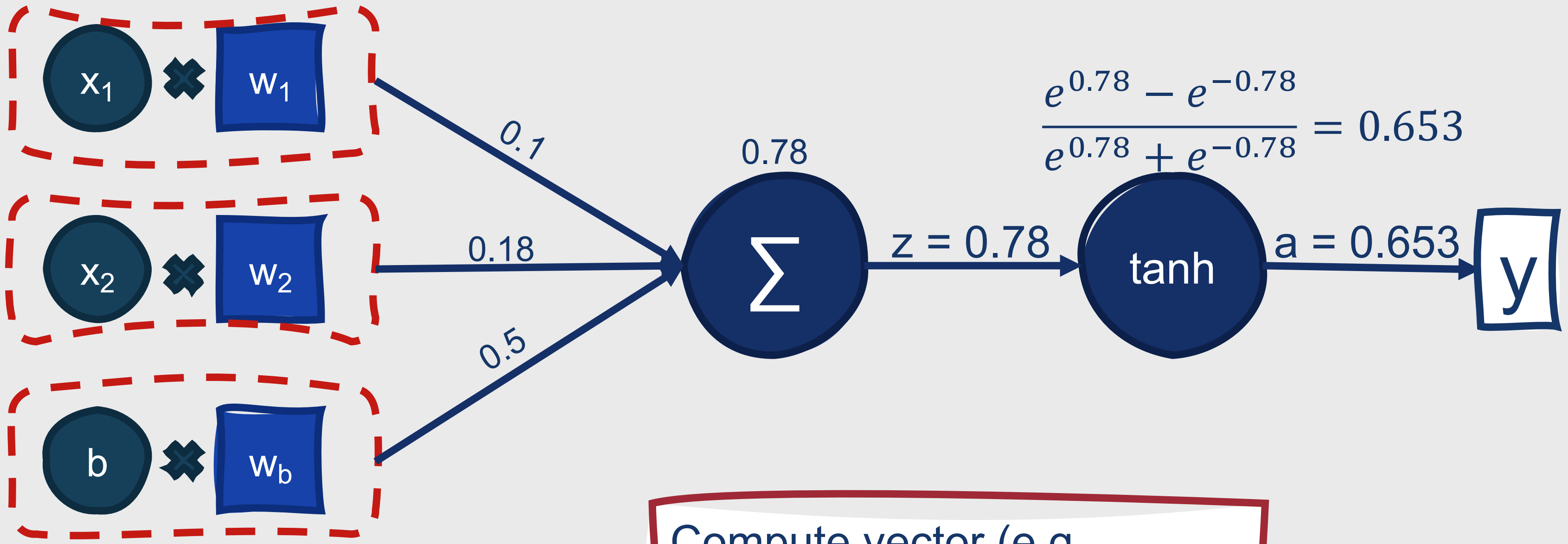

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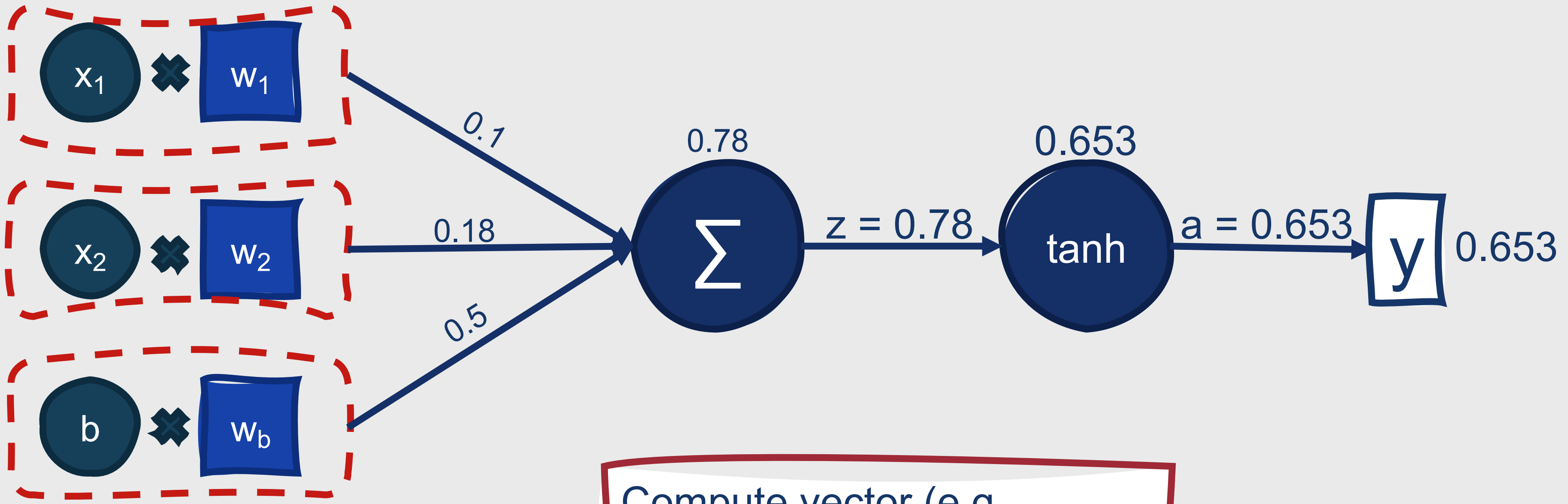

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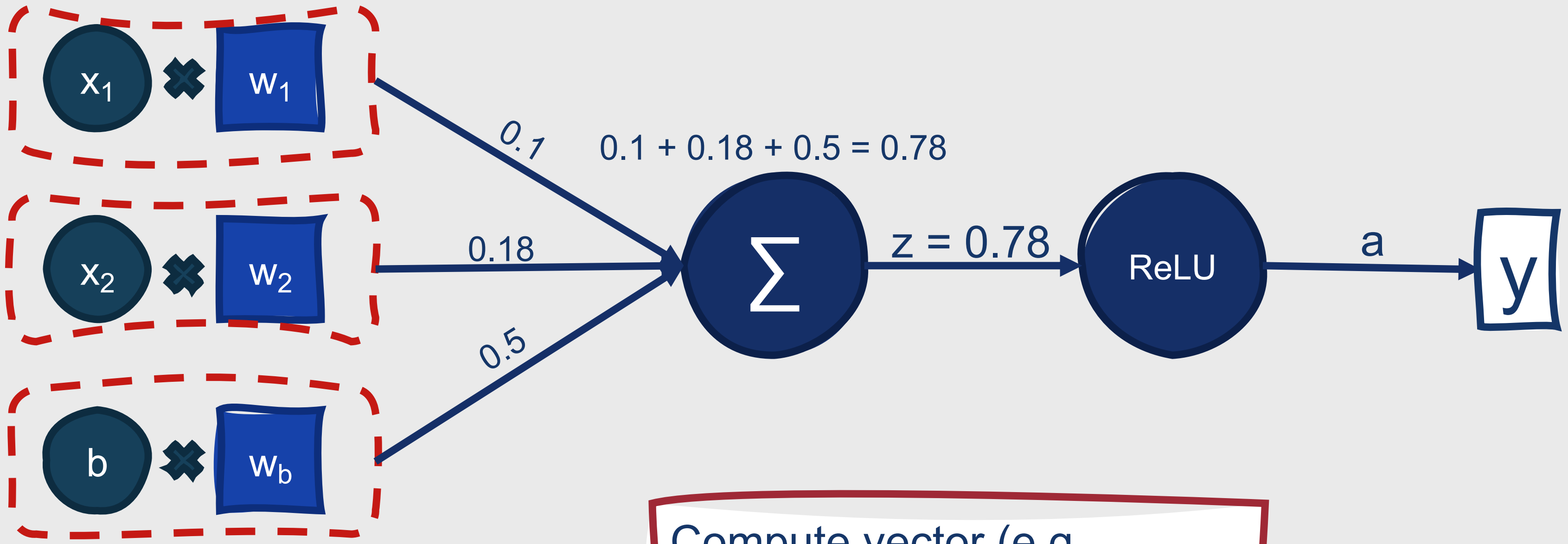
Activation: ReLU

- Ranges from 0 to ∞
- Simplest activation function:
  - $y = \max(z, 0)$
- Very close to a linear function!
- Quick and easy to compute

Example: Computational Unit with ReLU Activation



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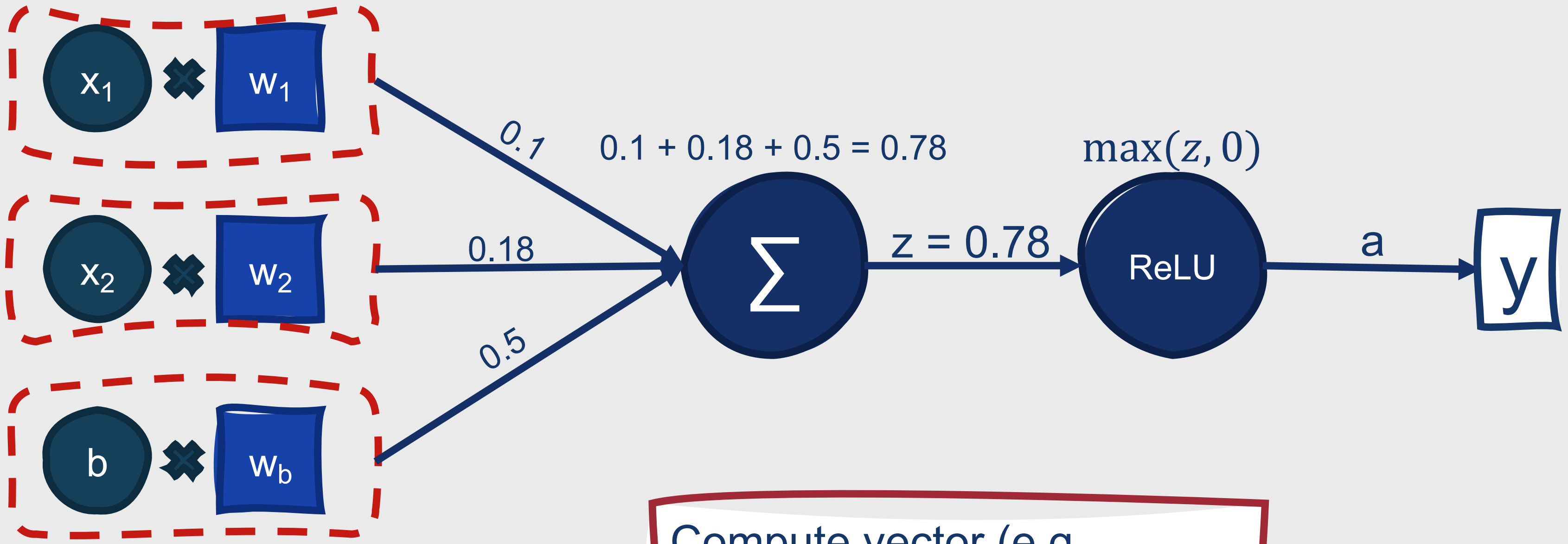

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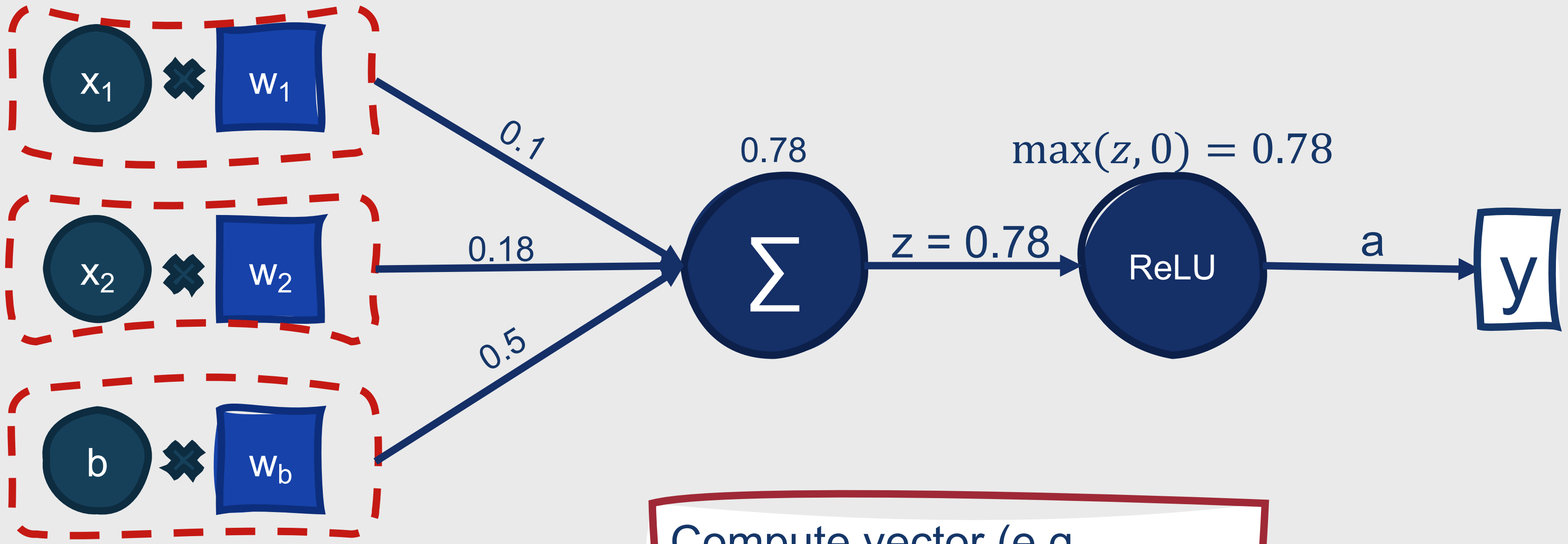

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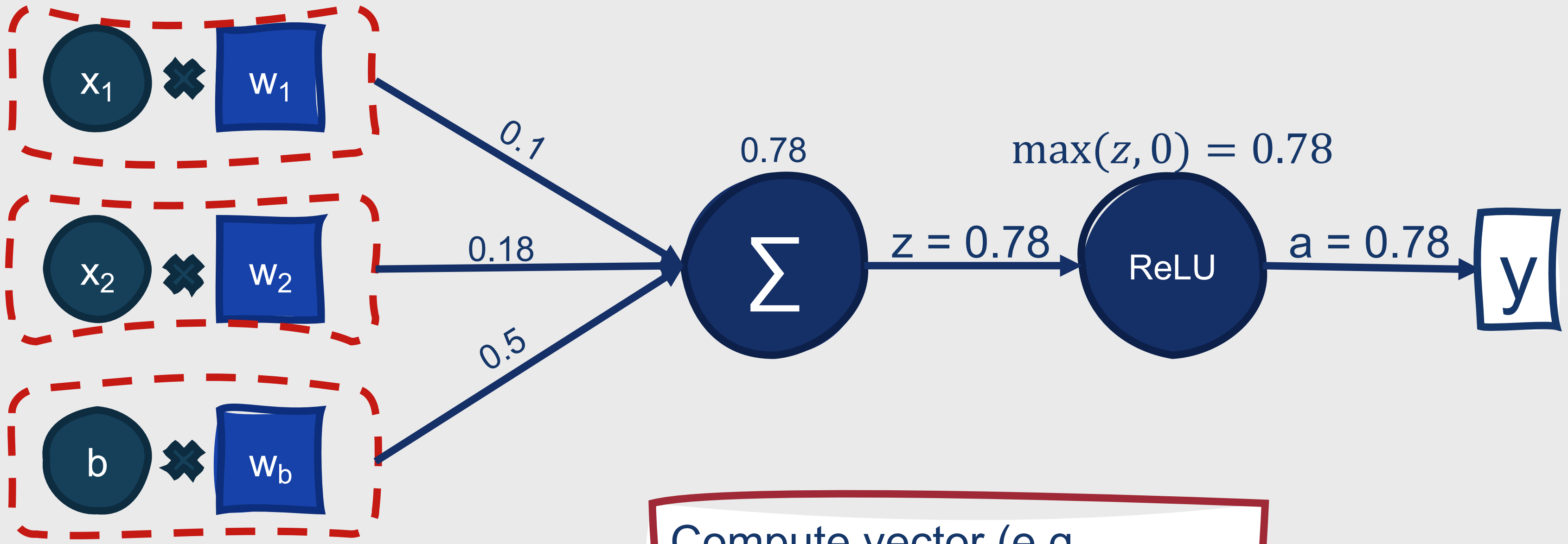

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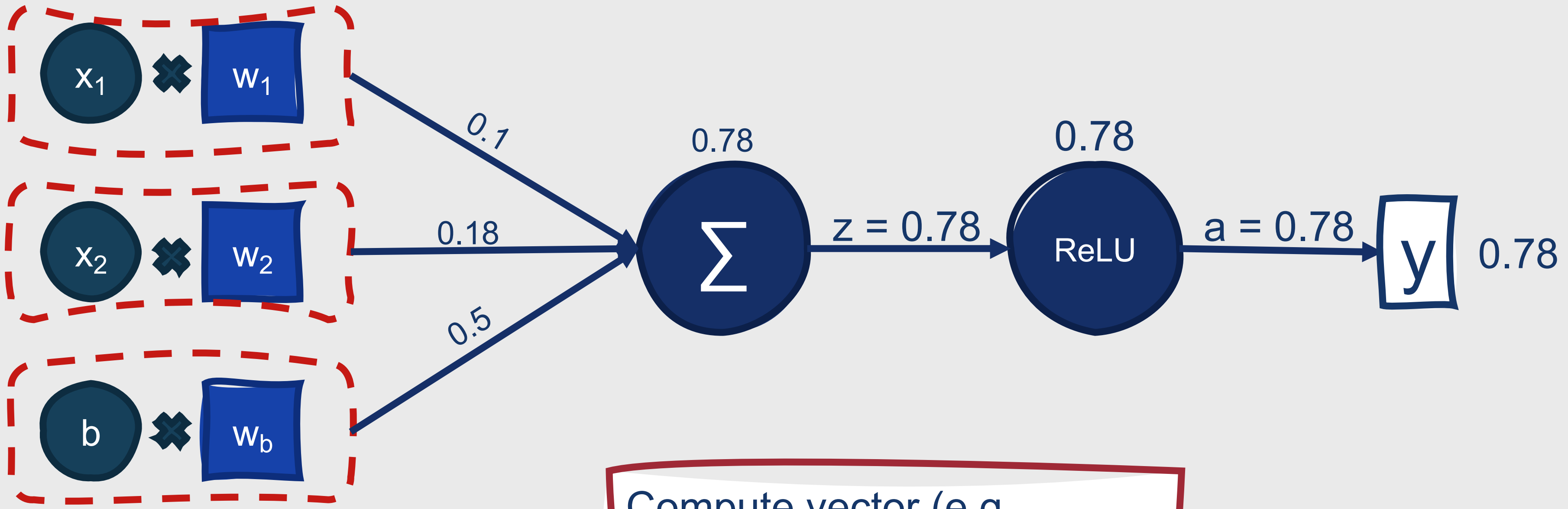

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Comparing sigmoid, tanh, and ReLU

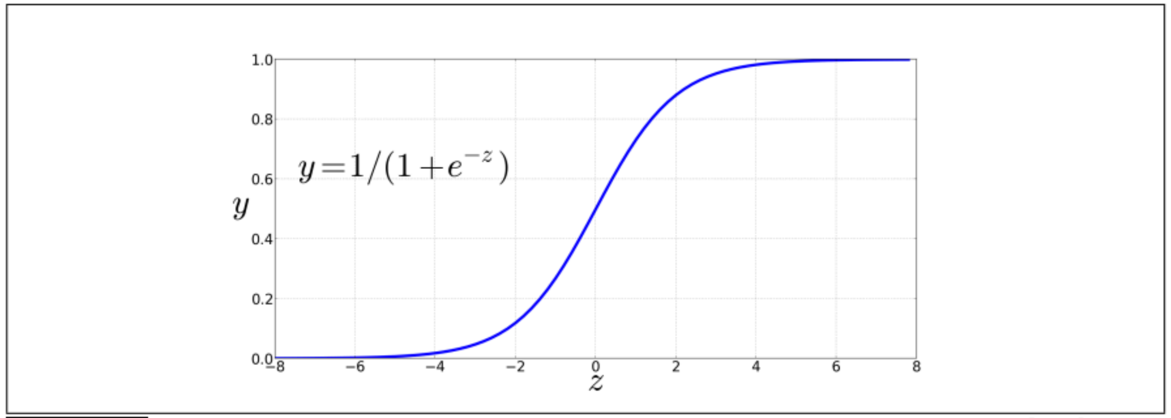

Figure 7.1 The sigmoid function takes a real value and maps it to the range [0,1]. It is nearly linear around 0 but outlier values get squashed toward 0 or 1.

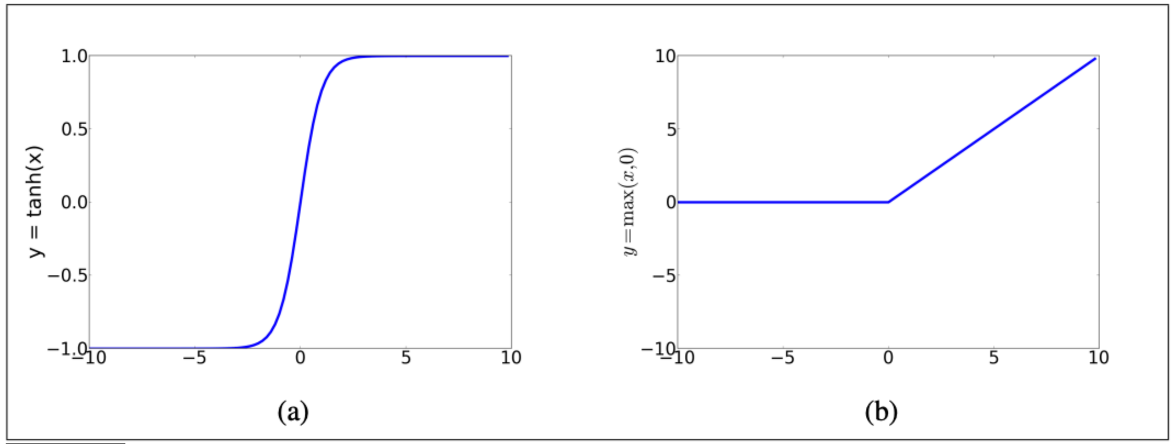

Figure 7.3 The tanh and ReLU activation functions.