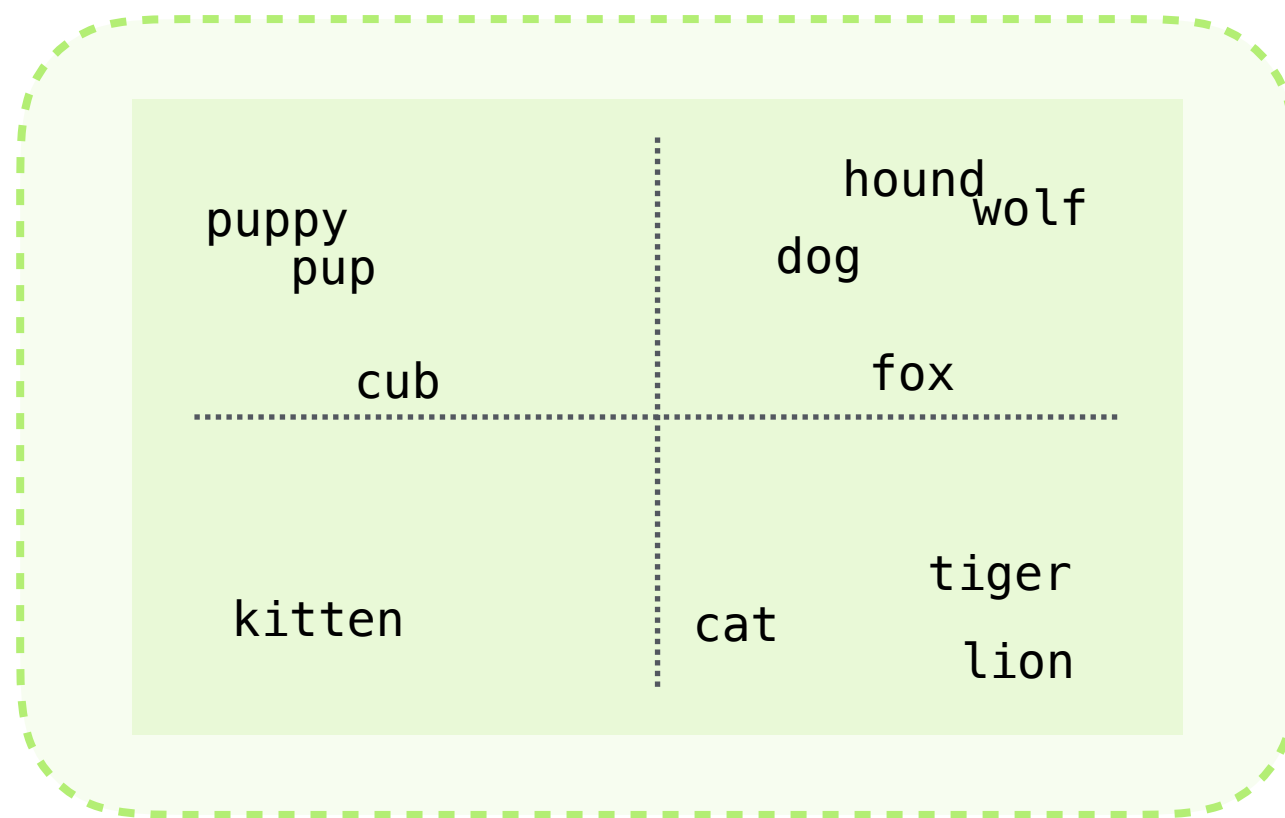


# A Generative Model of Words and Relationships from Multiple Sources



*tamoxifen* CAN\_TREAT *breast\_cancer*  
*dog* APPEARS\_IN\_SENTENCE\_WITH *fox*  
*brain* IS\_LOCATION\_OF *glioma*  
*fox* IS\_HYPONYM\_OF *carnivore*

Stephanie L. Hyland<sup>1,2</sup>, Theofanis Karaletsos<sup>1</sup>, Gunnar Rätsch<sup>1</sup>

<sup>1</sup>Computational Biology, Memorial Sloan Kettering Cancer Centre, New York

<sup>2</sup>Weill Cornell Graduate School of Medical Sciences, New York

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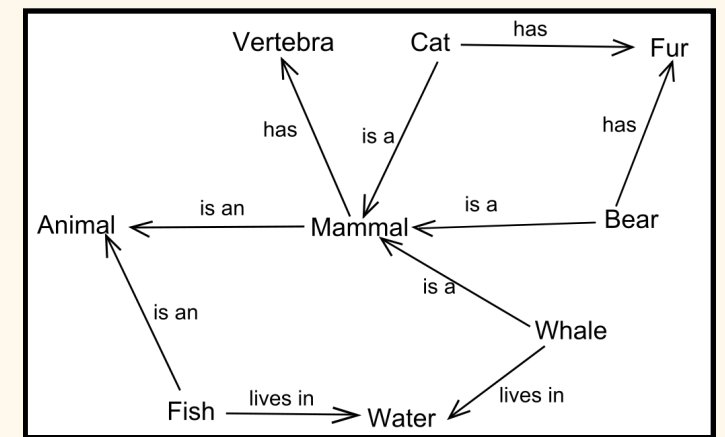
# A Generative Model of Words and Relationships from Multiple Sources

$$\mathcal{E}(S, R, T|\Theta) = -\frac{\mathbf{v}_T \cdot G_R \mathbf{c}_S}{\|\mathbf{v}_T\| \|G_R \mathbf{c}_S\|}$$

$$P(S, R, T|\Theta) = \frac{1}{Z(\Theta)} e^{-\mathcal{E}(S, R, T|\Theta)}$$

$$P(R|s, t; \Theta) = \frac{e^{-\mathcal{E}(s, R, t|\Theta)}}{\sum_{r'} e^{-\mathcal{E}(s, r', t|\Theta)}}$$

...aker than  
nt coastline dates back to abo  
of "a clockwork orange", itse  
perimental mix of hip hop, liturg  
e three other smaller financial  
n amsterdam. the ice hockey t  
try of transport, but he was st



( clockwork, **sentence**, orange )  
( cat, HAS, fur )  
( smaller, **sentence**, financial )  
( cat, IS A, mammal )  
( ice, **sentence**, hockey )

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