1 Co-occurence

Let A_w be the number of times a word w, (e.g. "foo") appears throughout the corpus.
Let C_w be the number of times w appears in documents that also contain the target word.
Then we define

$$\text{co-occurrence} = \begin{cases} \frac{C_w \log^3(C_w)}{A_w} & : C_w > 0 \\ 0 & : \text{else} \end{cases}$$

2 Co-occurence with distance weighting

Let $d(w, x)$ be a function describing the distance between two instances of words w, x such that $d(w, x)$ is equal to the number of spaces between w and x, or ∞ if w, x are not in the same document.
Let f be a function such that $f(\infty) = 0$ and $f(x) \geq 1$ if x is positive.
Let W be the set of all occurrences of a given word throughout the corpus.
Let T be the set of all occurences of the target word in the corpus.
Then we define

$$S_w = \sum_{w \in W} f(\min_{t \in T}(d(w, t)))$$

And let

$$\text{co-occurrence} = \begin{cases} \frac{S_w \log^3(S_w)}{|W|} & : S_w > 0 \\ 0 & : \text{else} \end{cases}$$

3 Co-occurence with distance weighting and n-grams

Let $d(g, t)$ be a function describing the distance between two instances of grams g, t such that $d(g, t)$ is equal to the number of spaces between g and t, or ∞ if g, t are not in the same document.
Let f be a function such that $f(\infty) = 0$ and $f(x) \geq 1$ if x is positive.
Let G be the set of all occurrences of a given gram throughout the corpus.
Let T be the set of all occurences of the target gram in the corpus.
Then we define

$$S_g = \sum_{g \in G} f(\min_{t \in T}(d(g, t)))$$

And let

$$\text{co-occurrence} = \begin{cases} \frac{S_g \log^3(S_g)}{|G|} & : S_g > 0 \\ 0 & : \text{else} \end{cases}$$