Formula in lectures

$$k = \lceil Null/2 \rceil + \min(Plus, Minus)$$

No correction for number of ties being odd

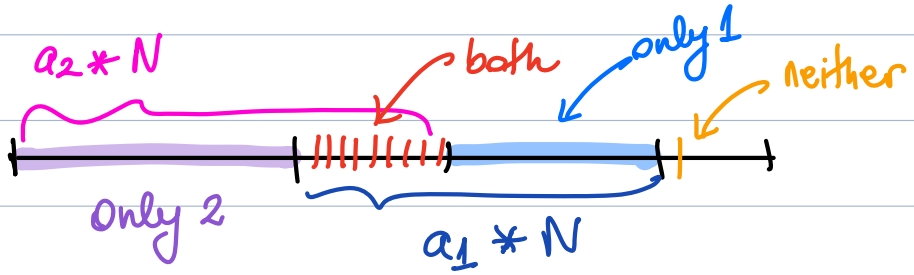
$$\Rightarrow \quad k = Null/2 + \min(Plus, Minus)$$

Let a_1 = accuracy of system 1

a_2 = accuracy of system 2.

Assume N documents in collection

Now, we can split these N documents as follows:



only 2: # document that only System 2 gets right

only 1: —"— System 1 gets right

both: —"— both get right

neither: —"— neither gets right.

Now $\quad only\,1 + both + only\,2 + neither = N$

$$only\,1 + both = a_1 * N$$

$$only\,2 + both = a_2 * N$$

Assume without loss of generality that $a_1 \geq a_2$.

$\Rightarrow$

Plus = only 1

Minus = only 2

Plus > Minus $\Rightarrow$ min(Plus, Minus) = Minus

(# ties) Null = both + neither

Now we can rewrite k as follows:

$$k = \text{Null}/2 + \text{Minus}$$

$$= \frac{\text{both} + \text{neither}}{2} + \text{only 2}$$

$$= \frac{N - \text{only 1} - \text{only 2}}{2} + \text{only 2}$$

$$= \frac{1}{2}(N - \text{only 1} + \text{only 2})$$

$$= \frac{1}{2}(N - \text{only 1} - \text{both} + \text{both} + \text{only 2})$$

$$= \frac{1}{2}(N - N * a_1 + N * a_2)$$

$$= \frac{N}{2}(1 - a_1 + a_2)$$

Hence $$k = \frac{N}{2}(1 - a_1 + a_2)$$