(5) SHAP for text

Corpus:

D_1 : Sastra university located Thanjavur

D_2 : Sastra university good.

D_3 : placement good

D_4 : Sastra university good student. life.

Find the shapely value for { Sastra University student}

Contribution Values are calculated using probability (laplace law).

Subsets

{ } $\frac{0+1}{4+14} = 1/18$ (By laplace law; 4 = No of Doc, 14 = No of words)

{Sastra} $\frac{3+1}{18} = 4/18$

{university} $\frac{3+1}{18} = 4/18$

{student} $= \frac{1+1}{18} = 2/18$

{Sastra University} $= \frac{3+1}{18} = 4/18$

{Sastra student} $= \frac{1+1}{18} = 2/18$

$\{university\ student\} = \frac{1+1}{18} = \frac{2}{18}$

$\{sastra\ university\ student\} = \frac{1+1}{18} = \frac{2}{18}$

* Excluding sastra

Subset	$V(S)$	$V(S \cup \{sas\})$	$V(S \cup \{sas\}) - V(S)$
$\{\}$	1/18	4/18	3/18
{university}	4/18	4/18	0
{student}	2/18	2/18	0
{university student}	2/18	2/18	0

$\{\} = \frac{|S|!\,(N-|S|-1)!}{|N|!} = \frac{0!\,(3-(0|-1)!}{3!}$

$= \frac{2!}{6} = 1/3$

$\{university\} = \frac{1!\,(3-|1|-1)!}{3!} = 1/6$

$\{student\} = \frac{1!\,(3-|1|-1)!}{3!} = 1/6$

$\{university\ student\} = \frac{2!\,(3-|2|-1)!}{3!} = \frac{2}{6} = 1/3$

$\phi(SASTRA) = 1/3 * 3/18 + 1/6 * 0 + 1/6 * 0 + 1/3$

$\boxed{\phi(SASTRA) = 1/18}$

Similarly Calculate ϕ {university}.

Excluding university

Subset	V(S)	V S∪{univ}	V(S∪{uni} − V(S)	weigh
{ }	1/18	4/18	3/18	1/3
{sastre}	4/18	4/18	0	1/6
{student}	2/18	2/18	0	1/6
{sastre student}	2/18	2/18	0	1/3

$$\{\text{sastre}\} = \frac{1!\,(3-|1|-1)!}{3!} = 1/6$$

$$\{\text{sastre student}\} = \frac{2!\,(3-|2|-1)!}{3!} = \frac{2*1}{6} = 1/3$$

$$\phi(\text{university}) = \frac{1}{3} * \frac{3}{18} + 0 * \cdots$$

$$\boxed{\phi\{\text{university}\} = 1/18}$$

Calculate for {student}

Exclude student

Subset	v(S)	v(S ∪ {student})	v(Sustud − v(S))	
{ }	1/18	2/18	1/18	1/3
{sastra}	4/18	2/18	−2/18	1/6
{university}	4/18	2/18	−2/18	1/6
{sastra univ}	4/18	2/18	−2/18	1/3

$$\{\text{sastra university}\} = \frac{2!\,(3-|2|-1)!}{3!}$$

$$= \frac{2!\;0!}{6} = 1/3$$

$$\phi\{\text{student}\} = 1/3 * \frac{1}{18} + \frac{1}{6} * \frac{-2}{18} + \frac{1}{6} * \frac{-2}{18} + \frac{1}{3} * \frac{-2}{18}$$

$$= \frac{1}{54} - \frac{2}{108} - \frac{2}{108} - \frac{2}{54}$$

$$= \frac{-6}{108} = \frac{-1}{18}$$

$$\boxed{\phi\{\text{student}\} = \frac{-1}{18}}$$