$\alpha = 0.1$

$\beta = 0.01$

D1 = Lion Grazelle

D2: Elephants giraffes

D3: Soccer. stadium

Topic 1: Animals and wildlife

Topic 2: Sports

Frefluency table:

words	Doc1	Doc2	D3
lion	1	0	0
Grazzele	1	0	0
Elephant	0	1	0
giraffes	0	1	0
Soccer	0	0	1
stadium	0	0	1

total vocab v = 6

step 1:

D1:

lion = t1

Grazzele = t1

D2:

elephant = t1

giraffes = t1

D3:

soccer = t3

stadium = t3

step-2: doc vs topic

doc	topic	topic2
1	2	0
2	1	0
3	0	2

word vs topic

words	topic1	topic2
lion	1	0
Grazzele	1	0
Elephants	1	0
giraffes	1	0
soccer	0	1
stadium	0	1

tion in topic1:

$$\frac{n_{d,k}+\alpha}{n_d+k\alpha} * \frac{n_{k,w}+\beta}{n_k+v\beta}$$

$$= \frac{1+0.1}{1+2.(0.1)} * \frac{0+0.01}{0+6.0.01} = 0.000015$$

$$= 0.92 *$$

lion topic2:

$$\frac{n_{d,k}+\alpha}{n_d+k\alpha} * \frac{n_{k,w}+\beta}{n_k+v\beta}$$

$$= \frac{0+0.1}{1+2.(0.1)} * \frac{0+0.01}{0+6(0.01)} = 0.0000014$$

$$= 0.084$$

Normalize $= 0.000015 + 0.0000014$

$= 0.0000164$

$$P(\text{lion}|\text{topic1}) = \frac{0.000015}{0.0000164} = 0.91$$

$$P(\text{lion}|\text{topic2}) = \frac{0.0000014}{0.0000164} = 0.09$$

Grazzele in topic1:

$$\frac{n_{d,k}+\alpha}{n_d+k\alpha} * \frac{n_{k,w}+\beta}{n_k+v\beta} = 0.000015$$

$= 0.92 *$

Gazzle in topic 2:

$$\frac{n_{d,k}+\alpha}{n_d+k\alpha} * \frac{n_{k,w}+\beta}{n_k+V\beta}$$

$$= 0.0000014$$

$P(\text{Gazzle} \mid \text{Topic1}) = 0.91$

$P(\text{lion} \mid \text{topic2}) = 0.09$

Elephant in topic 1:

$$\frac{n_{d,k}+\alpha}{n_d+k\alpha} * \frac{n_{k,w}+\beta}{n_k+V\beta}$$

$$= \frac{1+0.1}{1+2(0.1)} * \frac{0+0.01}{0+6(0.01)}$$

$$= 0.000015$$

Elephant in topic 2:

$$\frac{n_{d,k}+\alpha}{n_d+k\alpha} * \frac{n_{k,w}+\beta}{n_k+V\beta}$$

$$= \frac{0+0.1}{1+2(0.1)} * \frac{0+0.01}{0+6(0.01)}$$

$$= 0.0000014$$

normalize $= 0.000015 + 0.0000014$

$= 0.0000164$

$P(\text{elephant} \mid \text{topic1}) = \frac{0.000015}{0.0000164} = 0.91$

$P(\text{elephant} \mid \text{topic2}) = \frac{0.0000014}{0.0000164} = 0.09$

giraffes: Same to the elephant

$P(\text{giraffes} \mid \text{topic1}) = \frac{0.000015}{0.0000164} = 0.91$

$P(\text{giraffes} \mid \text{topic2}) = \frac{0.0000014}{0.0000164} = 0.09$

Soccer in Topic 1:

$$\frac{n_{d,k}+\alpha}{n_d+k\alpha} * \frac{n_{k,w}+\beta}{n_k+V\beta}$$

$$= \frac{0+0.1}{1+2(0.1)} * \frac{0+0.01}{0+6(0.01)} = 0.0000014$$

Soccer in Topic 2:

$$= \frac{1+0.1}{1+2(0.1)} * \frac{0.01}{0+6(0.01)} = 0.000015$$

normalize $= 0.0000014 + 0.000015 = 0.0000164$

$P(\text{soccer} \mid \text{topic1}) = \frac{0.0000014}{0.0000164} = 0.09$

$P(\text{soccer} \mid \text{topic2}) = \frac{0.000015}{0.0000164} = 0.91$

Stadium in topic 1:

$$\frac{n_{d,k}+\alpha}{n_d+k\alpha} * \frac{n_{k,w}+\beta}{n_k+V\beta}$$

$$= \frac{0+0.1}{1+2(0.1)} * \frac{0+0.1}{0+6(0.01)} = 0.0000014$$

Stadium in topic 2:

$$\frac{n_{d,k}+\alpha}{n_d+k\alpha} * \frac{n_{k,w}+\beta}{n_k+V\beta}$$

$$= \frac{1+0.1}{1+2(0.1)} * \frac{0+0.01}{0+6(0.01)} = 0.000015$$

normalize $= 0.0000014 + 0.000015 = 0.0000164$

$P(\text{stadium} \mid \text{topic1}) = \frac{0.0000014}{0.0000164} = 0.09$

$P(\text{stadium} \mid \text{topic2}) = \frac{0.000015}{0.0000164} = 0.91$