

1. Soru

True Positive \Rightarrow A iken A olarak sınıflandırılması

True Negative \Rightarrow A değilken A değil olarak sınıflandırılması

False Positive \Rightarrow A değilken A " "

False Negative \Rightarrow A iken A değil " "

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		A	B	C
Gerçek Sınıf	A	10	1	5
	B	3	6	1
	C	0	2	8

A için	TP=10	B için	TP=6	C için	TP=8
	TN=17		TN=23		TN=20
	FP=3		FP=3		FP=6
	FN=6		FN=4		FN=2

$$f \text{ Recall}(A) = \frac{10}{6+10} = \frac{10}{16} = \underline{\underline{0.625}}$$

$$\text{Recall} = \frac{TP}{FN+TP}$$

$$\text{Precision}(B) = \frac{6}{3+6} = \frac{6}{9} = \underline{\underline{0.666}}$$

$$\text{Precision} = \frac{TP}{FP+TP}$$

$$\text{Precision}(C) = \frac{8}{6+8} = \frac{8}{14} = 0.571$$

$$\text{Recall}(C) = \frac{8}{2+8} = \underline{\underline{0.8}}$$

$$f_{\text{score}} = 2 \cdot \frac{(\text{Precision} \cdot \text{Recall})}{(\text{Precision} + \text{Recall})}$$

$$f_{\text{Score}}(C) = \frac{2 \times (0.571 \times 0.8)}{0.571 + 0.8} = \underline{\underline{0.666}}$$

$$\text{MicroAverage}(\text{Precision}(A, B, C)) = \frac{TP(A) + TP(B) + TP(C)}{FP(A) + FP(B) + FP(C) + TP(A) + TP(B) + TP(C)}$$

$$= \frac{10+6+8}{3+3+6+10+6+8} = \frac{24}{36} = \underline{\underline{0.666}}$$

2. Soru

	spor	Siyaset	ekonomi
başarı gecer	8	4	6
başarı geemeye	12	30	40

$$\text{count}(D) = 100$$

$$\begin{aligned} \text{Mutual Information} = & \frac{8}{100} \cdot \log_2 \left(\frac{800}{(20 \cdot 18)} \right) + \frac{4}{100} \cdot \log_2 \left(\frac{400}{(36 \cdot 18)} \right) + \\ & \frac{6}{100} \cdot \log_2 \left(\frac{600}{(46 \cdot 18)} \right) + \frac{12}{100} \cdot \log_2 \left(\frac{1200}{(20 \cdot 82)} \right) + \\ & \frac{30}{100} \cdot \log_2 \left(\frac{3000}{(36 \cdot 82)} \right) + \frac{40}{100} \cdot \log_2 \left(\frac{4000}{(46 \cdot 82)} \right) \end{aligned}$$

$$= \underline{\underline{0.051}}$$

$$P(\text{kar} \setminus \text{kar}) = 0$$

$$P(\text{ve} \setminus \text{kar}) = 2/12 = 0.16$$

$$P(\text{zarar} \setminus \text{kar}) = 2/12 = 0.16$$

$$P(\text{büyük} \setminus \text{kar}) = 1/12 = 0.083$$

$$P(\text{sorun} \setminus \text{kar}) = 0$$

$$P(\text{çok} \setminus \text{kar}) = 1/12 = 0.083$$

$$P(\text{yok} \setminus \text{kar}) = 2/12 = 0.16$$

$$P(\text{ve} \setminus \text{ve}) = 0$$

$$P(\text{kar} \setminus \text{ve}) = 1/28 = 0.035$$

$$P(\text{zarar} \setminus \text{ve}) = 3/28 = 0.107 \approx 0.11$$

$$P(\text{büyük} \setminus \text{ve}) = 2/28 = 0.714$$

$$P(\text{sorun} \setminus \text{ve}) = 0$$

$$P(\text{çok} \setminus \text{ve}) = 1/28 = 0.035$$

$$P(\text{yok} \setminus \text{ve}) = 0$$

$$P(\text{kar} \setminus \text{zarar}) = 0$$

$$P(\text{ve} \setminus \text{zarar}) = 0$$

$$P(\text{zarar} \setminus \text{zarar}) = 0$$

$$P(\text{büyük} \setminus \text{zarar}) = 2/20 = 0.1$$

$$P(\text{sorun} \setminus \text{zarar}) = 1/20 = 0.05$$

$$P(\text{çok} \setminus \text{zarar}) = 2/20 = 0.1$$

$$P(\text{yok} \setminus \text{zarar}) = 1/20 = 0.05$$

$$P(\text{kar} \setminus \text{büyük}) = 1/30 = 0.033$$

$$P(\text{ve} \setminus \text{büyük}) = 1/30 = 0.033$$

$$P(\text{zarar} \setminus \text{büyük}) = 2/30 = 0.066 \approx 0.07$$

$$P(\text{büyük} \setminus \text{büyük}) = 0$$

$$P(\text{sorun} \setminus \text{büyük}) = 3/30 = 0.1$$

$$P(\text{çok} \setminus \text{büyük}) = 0$$

$$P(\text{yok} \setminus \text{büyük}) = 0$$

$$P(\text{kar} \setminus \text{sorun}) = 0$$

$$P(\text{ve} \setminus \text{sorun}) = 1/16 = 0.062$$

$$P(\text{zarar} \setminus \text{sorun}) = 0$$

$$P(\text{büyük} \setminus \text{sorun}) = 1/16 = 0.062$$

$$P(\text{sorun} \setminus \text{sorun}) = 1/16 = 0.062$$

$$P(\text{çok} \setminus \text{sorun}) = 1/16 = 0.062$$

$$P(\text{yok} \setminus \text{sorun}) = 3/16 = 0.187 \approx 0.19$$

$$P(\text{kar} \setminus \text{çok}) = 0$$

$$P(\text{ve} \setminus \text{çok}) = 1/32 = 0.031$$

$$P(\text{zarar} \setminus \text{çok}) = 2/32 = 0.062$$

$$P(\text{büyük} \setminus \text{çok}) = 2/32 = 0.062$$

$$P(\text{sorun} \setminus \text{çok}) = 1/32 = 0.031$$

$$P(\text{çok} \setminus \text{çok}) = 2/32 = 0.062$$

$$P(\text{yok} \setminus \text{çok}) = 1/32 = 0.031$$

$$P(\text{kar} \setminus \text{yok}) = 0$$

$$P(\text{ve} \setminus \text{yok}) = 1/12 = 0.083$$

$$P(\text{zarar} \setminus \text{yok}) = 0$$

$$P(\text{büyük} \setminus \text{yok}) = 0$$

$$P(\text{sorun} \setminus \text{yok}) = 0$$

$$P(\text{çok} \setminus \text{yok}) = 2/12 = 0.16$$

$$P(\text{yok} \setminus \text{yok}) = 0$$

$$P(w_i | w_{i-1}) = \frac{\text{count}(w_{i-1}, w_i)}{\text{count}(w_{i-1})}$$

kelime bir önceki kelime w_i

MLE estimate

	kar	ve	zarar	büyük	sorun	gök	yok
kar	0	0.16	0.16	0.083	0	0.083	0.16
ve	0.035	0	0.11	0.714	0	0.035	0
zarar	0	0	0	0.1	0.05	0.1	0.05
büyük	0.033	0.033	0.07	0	0.1	0	0
sorun	0	0.062	0	0.062	0.062	0.062	0.19
gök	0	0.031	0.062	0.062	0.031	0.062	0.031
yok	0	0.083	0	0	0	0.16	0

$$P(\text{büyük} | \text{gök}) = \frac{2}{32} = 0.062$$

$$P(\text{zarar} | \text{büyük}) = \frac{2}{30} = 0.07$$

$$P(\text{yok} | \text{zarar}) = \frac{1}{20} = 0.05$$

elimizde training corpus olmadığı için hesaplanamaz

$$P(\langle s \rangle \text{gök büyük zarar yok} \langle /s \rangle) = P(\text{gök} | \langle s \rangle) P(\text{büyük} | \text{gök}) P(\text{zarar} | \text{büyük}) P(\text{yok} | \text{zarar}) P(\langle /s \rangle | \text{yok})$$

$$= 0.062 \times 0.07 \times 0.05 = 0.000217$$

Add-1 estimate $V=100$

	kar	ve	zarar	büyük	sorun	gök	yok
kar	0.009	0.026	0.026	0.018	0.009	0.018	0.026
ve	0.008	0.016	0.031	0.023	0.008	0.016	0.008
zarar	0.008	0.008	0.008	0.025	0.016	0.025	0.016
büyük	0.015	0.015	0.023	0.007	0.030	0.007	0.007
sorun	0.008	0.017	0.008	0.017	0.017	0.017	0.034
gök	0.007	0.015	0.022	0.022	0.015	0.022	0.015
yok	0.009	0.018	0.009	0.009	0.009	0.026	0.009

$$P(\text{kar} | \text{sorun}) = 1/116 = 0.008$$

$$P(\text{ve} | \text{sorun}) = 2/116 = 0.017$$

$$P(\text{zarar} | \text{sorun}) = 1/116 = 0.008$$

$$P(\text{büyük} | \text{sorun}) = 2/116 = 0.017$$

$$P(\text{sorun} | \text{sorun}) = 2/116 = 0.017$$

$$P(\text{gök} | \text{sorun}) = 2/116 = 0.017$$

$$P(\text{yok} | \text{sorun}) = 4/116 = 0.034$$

$$P(\text{kar} | \text{gök}) = 1/132 = 0.007$$

$$P(\text{ve} | \text{gök}) = 2/132 = 0.015$$

$$P(\text{zarar} | \text{gök}) = 3/132 = 0.022$$

$$P(\text{büyük} | \text{gök}) = 3/132 = 0.022$$

$$P(\text{sorun} | \text{gök}) = 2/132 = 0.015$$

$$P(\text{gök} | \text{gök}) = 3/132 = 0.022$$

$$P(\text{yok} | \text{gök}) = 2/132 = 0.015$$

$$P(\text{kar} | \text{yok}) = 1/112 = 0.009$$

$$P(\text{ve} | \text{yok}) = 2/112 = 0.018$$

$$P(\text{zarar} | \text{yok}) = 1/112 = 0.009$$

$$P(\text{büyük} | \text{yok}) = 1/112 = 0.009$$

$$P(\text{sorun} | \text{yok}) = 1/112 = 0.009$$

$$P(\text{gök} | \text{yok}) = 3/112 = 0.026$$

$$P(\text{yok} | \text{yok}) = 1/112 = 0.009$$

$$P_{\text{Add-1}}(\text{gök büyük zarar yok})$$

$$= 0.022 \times 0.023 \times 0.016$$

$$= 0.000008096$$

Add-1

$$P(\text{kar} | \text{kar}) = (0+1)/(12+100) = 0.009$$

$$P(\text{ve} | \text{kar}) = (2+1)/(12+100) = 0.026$$

$$P(\text{zarar} | \text{kar}) = (2+1)/(12+100) = 0.026$$

$$P(\text{büyük} | \text{kar}) = (1+1)/(12+100) = 0.018$$

$$P(\text{sorun} | \text{kar}) = (0+1)/(12+100) = 0.009$$

$$P(\text{gök} | \text{kar}) = (1+1)/(12+100) = 0.018$$

$$P(\text{yok} | \text{kar}) = (2+1)/(12+100) = 0.026$$

$$P(\text{kar} | \text{ve}) = (0+1)/(28+100) = 0.008$$

$$P(\text{ve} | \text{ve}) = (1+1)/128 = 0.016$$

$$P(\text{zarar} | \text{ve}) = (3+1)/128 = 0.031$$

$$P(\text{büyük} | \text{ve}) = (2+1)/128 = 0.023$$

$$P(\text{sorun} | \text{ve}) = (0+1)/128 = 0.008$$

$$P(\text{gök} | \text{ve}) = (1+1)/128 = 0.016$$

$$P(\text{yok} | \text{ve}) = (0+1)/128 = 0.008$$

$$P(\text{kar} | \text{zarar}) = 1/120 = 0.008$$

$$P(\text{ve} | \text{zarar}) = 1/120 = 0.008$$

$$P(\text{zarar} | \text{zarar}) = 1/120 = 0.008$$

$$P(\text{büyük} | \text{zarar}) = 3/120 = 0.025$$

$$P(\text{sorun} | \text{zarar}) = 2/120 = 0.016$$

$$P(\text{gök} | \text{zarar}) = 3/120 = 0.025$$

$$P(\text{yok} | \text{zarar}) = 2/120 = 0.016$$

$$P(\text{kar} | \text{büyük}) = (1+1)/130 = 0.015$$

$$P(\text{ve} | \text{büyük}) = 2/130 = 0.015$$

$$P(\text{zarar} | \text{büyük}) = 3/130 = 0.023$$

$$P(\text{büyük} | \text{büyük}) = 1/130 = 0.007$$

$$P(\text{sorun} | \text{büyük}) = 4/130 = 0.030$$

$$P(\text{gök} | \text{büyük}) = 1/130 = 0.007$$

$$P(\text{yok} | \text{büyük}) = 1/130 = 0.007$$