

情報検索システム特論

Advanced Information Retrieval Systems

第5Topic回 Lecture #5Topic

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湯川 高志 Takashi Yukawa

[TOPIC]

Performance Evaluation of Recognition/Classification Systems

Recognition System = Classification System

- ▶ A recognition system for handwritten numbers



- ▶ classifies an image into one of ten or eleven classes
 - ▶ classes: 0,1,2,3,4,5,6,7,8,9
 - ▶ or classes: 0,1,2,3,4,5,6,7,8,9,not a digit

- ▶ A dog and cat recognition system



- ▶ classifies an image into one of two or three classes
 - ▶ classes: dog, cat
 - ▶ or classes: dog, cat, else

Diagnose System = Classification System

- ▶ PCR test



- ▶ classifies a specimen into one of two classes
 - ▶ classes: Positive, Negative

Performance Evaluation of Classification Systems

- ▶ Accuracy (精度) ?
 - ▶ How is "accuracy" defined ?

- ▶ Confusion Matrix

		Actual		
		POS	NEG	
Predicted	POS	85	5	90
	NEG	15	95	110
		100	100	

True Positive (TP) points to the cell containing 85.

False Positive (FP) points to the cell containing 5.

False Negative (FN) points to the cell containing 15.

True Negative (TN) points to the cell containing 95.

Performance Evaluation of Classification Systems (cont'd)

► Confusion Matrix

True Positive (TP)		Actual		False Positive (FP)
		POS	NEG	
Predicted	POS	85	5	90
	NEG	15	95	110
False Negative (FN)		100	100	200
		True Negative (TN)		

- True positive rate = Sensitivity (感度) = $\frac{TP}{TP+FN}$
- True negative rate = Specificity (特異率) = $\frac{TN}{FP+TN}$
- Precision (適合率) = $\frac{TP}{TP+FP}$
- Recall (再現率) = True positive rate
- Accuracy (正解率) = $\frac{TP+TN}{TP+FP+TN+TN}$

Confusion Matrix for Multi-Class Classifier

		Actual			
		A	B	C	
Predicted	A	True A	False A(B)	False A(C)	PredA
	B	False B(A)	True B	False B(C)	PredB
	C	False C(A)	False C(B)	Ture C	PredC
		ActA	ActB	ActC	Total

► $\text{Precision(A)} = \frac{\text{TrueA}}{\text{TrueA} + \text{FalseA(B)} + \text{FalseA(C)}}$

► $\text{Recall(A)} = \frac{\text{TrueA}}{\text{TrueA} + \text{FalseB(A)} + \text{FalseC(A)}}$

Confusion Matrix for Multi-Class Classifier (cont'd)

		Actual			
		A	B	C	
Predicted	A	True A	False A(B)	False A(C)	PredA
	B	False B(A)	True B	False B(C)	PredB
	C	False C(A)	False C(B)	Ture C	PredC
		ActA	ActB	ActC	Total

- ▶ Cohen's Kappa = $(\text{Agree} - \text{ChanceAgree}) / (1 - \text{ChanceAgree})$
 - ▶ $\text{Agree} = (\text{TrueA} + \text{TrueB} + \text{TrueC}) / \text{Total}$
 - ▶ $\text{ChanceAgree} = (\text{ActA} \times \text{PredA}) / \text{Total} + (\text{ActB} \times \text{PredB}) / \text{Total} + (\text{ActC} \times \text{PredC}) / \text{Total}$