Digital Transformation of Healthcare

Evaluating Predictions

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Objectives

After this lecture students will be able to

- Distinguish between classification and regression metrics
- Compare and contrast the use of different metrics to evaluate predictions
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Metrics for Evaluation of Classification Models

Confusion Matrix

predicted outcome	actual outcome: p	actual outcome: n	
p′	TP	FP	$\text{PPV} = \frac{TP}{TP + FP}$
n′	FN	TN	$\text{NPV} = \frac{TN}{FN + TN}$
	$\text{Sens} = \frac{TP}{TP + FN}$	$\text{Spec} = \frac{TN}{FP + TN}$	$\text{Acc} = \frac{TP+TN}{TP+TN+FP+FN}$

Confusion Matrix

predicted outcome	actual outcome: **p**	actual outcome: **n**	
p′	TP	FP	$\text{PPV} = p(\mathbf{p} \mid \mathbf{p}')$
n′	FN	TN	$\text{NPV} = p(\mathbf{n} \mid \mathbf{n}')$
	$\text{Sens} = p(\mathbf{p}' \mid \mathbf{p})$	$\text{Spec} = p(\mathbf{n}' \mid \mathbf{n})$	$\text{Acc} = p(TP + TN)$

		actual outcome: **p**	actual outcome: **n**	
predicted outcome	$\mathbf{p}'$	TP	FP	$\text{PPV} = p(\mathbf{p} \mid \mathbf{p}')$
	$\mathbf{n}'$	FN	TN	$\text{NPV} = p(\mathbf{n} \mid \mathbf{n}')$
		$\text{Sens} = p(\mathbf{p}' \mid \mathbf{p})$	$\text{Spec} = p(\mathbf{n}' \mid \mathbf{n})$	$\text{Acc} = p(TP + TN)$

Condition	Stats	Example
High Sensitivity, Low Specificity	$\mathbf{p}' >> \mathbf{n}'$	test is always positive
Low Sensitivity, High Specificity	$\mathbf{n}' >> \mathbf{p}'$	test is always negative
High PPV, Low NPV	$\mathbf{p} >> \mathbf{n}$	high disease prevalence
Low PPV, High NPV	$\mathbf{n} >> \mathbf{p}$	low disease prevalence
High PPV, Low Sensitivity	FN >> FP	say they are negative most of the time for a high preva
High Sensitivity, Low NPV		
High Specificity, Low NPV		
High PPV, Low Specificity		

Mean rates (events per 1000 patient days) of incidents in Phase 1 and Phase 2.

Paired comparisons were made using t-tests

Confusion Matrix

		actual outcome: **p**	actual outcome: **n**	
predicted outcome	$\mathbf{p}'$	TP	FP	$\text{PPV} = p(\mathbf{p} \mid \mathbf{p}')$
	$\mathbf{n}'$	FN	TN	$\text{NPV} = p(\mathbf{n} \mid \mathbf{n}')$
		$\text{Sens} = p(\mathbf{p}' \mid \mathbf{p})$	$\text{Spec} = p(\mathbf{n}' \mid \mathbf{n})$	$\text{Acc} = p(TP + TN)$

- Sensitivity and 1 - Specificity
- PPV and 1 - NPV
- Sensitivity and PPV
- Sensitivity and 1 - NPV
- Specificity and 1 - PPV
- Specificity and NPV

- Sensitivity = TP:FN (say everyone is positive)
- Specificity = TN:FP (say everyone is negative)
- PPV = TP:FP (high prevalence disease)
- NPV = TN:FN (low prevalence disease)
- Accuracy = (TP + TN):(FP + FN)