

Homework 1: Signal Detection Theory

20 Points: Due at the beginning of class, Thursday, 11 September 2003

There are two parts to this homework assignment. Each part counts 10 points. Late homework will receive a grade of zero.

Part 1:

Two radiologists were tested on their ability to detect cancer from x-ray photographs. They were shown 150 x-rays without cancer and 150 with cancer and were asked to say whether or not cancer was present. The resulting 2x2 contingency tables for each are presented below:

		Radiologist A Response		Radiologist B Response	
		“yes”	“no”	“yes”	“no”
Cancer present in x-rays		143	7	100	50
Cancer absent in x-rays		101	49	32	118

Using the **equal-variance** signal detection theory model determine the sensitivity (d' , using Equation 9c in the handout) and response bias (c , using Equation 12 in the handout) of the radiologists for the detection of cancer. Present your calculations in an orderly fashion. Which radiologist would you want to evaluate your x-rays? Why?

Part 2:

Below is a set of **hit rates** and **false alarm rates** computed from the confidence judgments of a one subject in a signal detection experiment.

	1	2	3	4	5
Hit Rate	0.2898	0.5477	0.7169	0.8275	0.9229
False Alarm Rate	0.0135	0.0829	0.2386	0.4146	0.7056

Plot two ROC graphs from these data: one graph in linear probability coordinates (ranging between 0.0 and 1.0), the other in Gaussian z-score coordinates (ranging from -2.5 to +2.5). Make the x- and y-axes of your graph equal in length so that each graph forms a square. Take care to properly label your graphs and to make them neat. What is your opinion about how well the Gaussian signal detection model describes these data? In four sentences or less explain your answer.