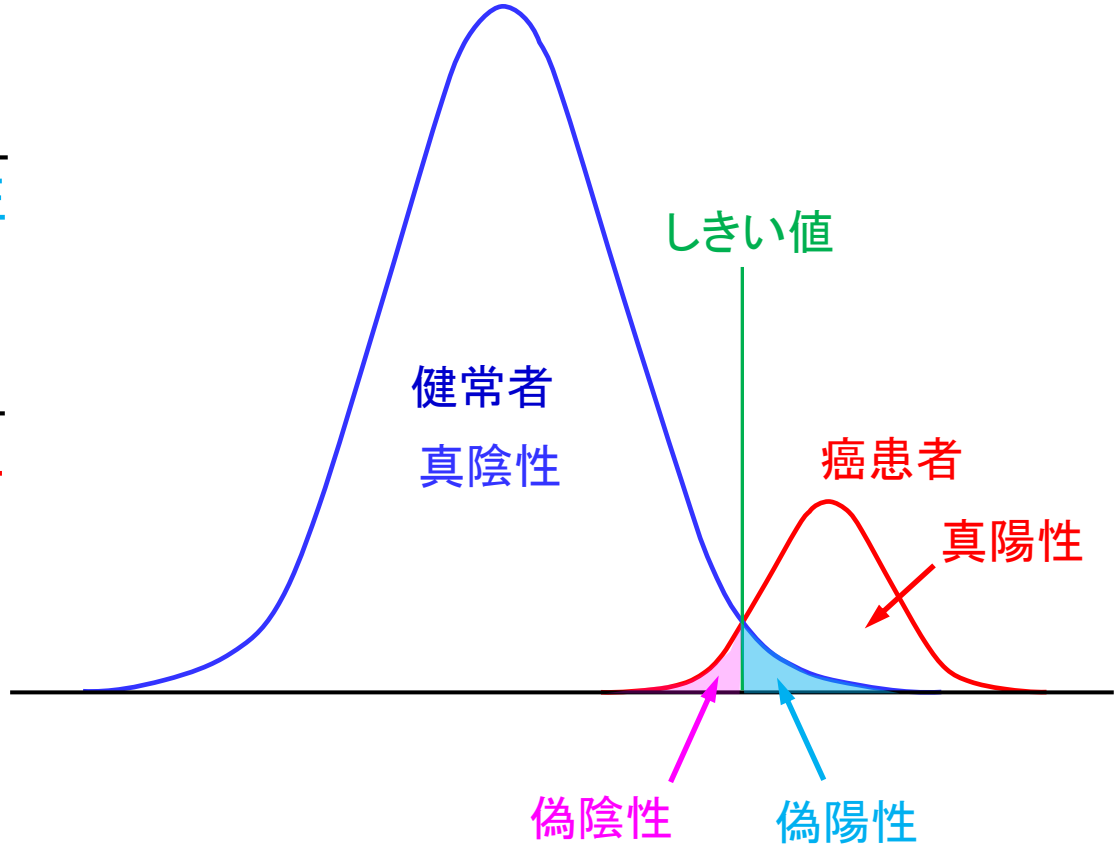
		診断 → 予測	
		陰性	陽性
実際	陰性（健常者の集団）	真陰性	偽陽性
	陽性（癌患者の集団）	偽陰性	真陽性

$$\text{偽陽性率} = \frac{\text{偽陽性}}{\text{真陰性}+\text{偽陽性}}$$

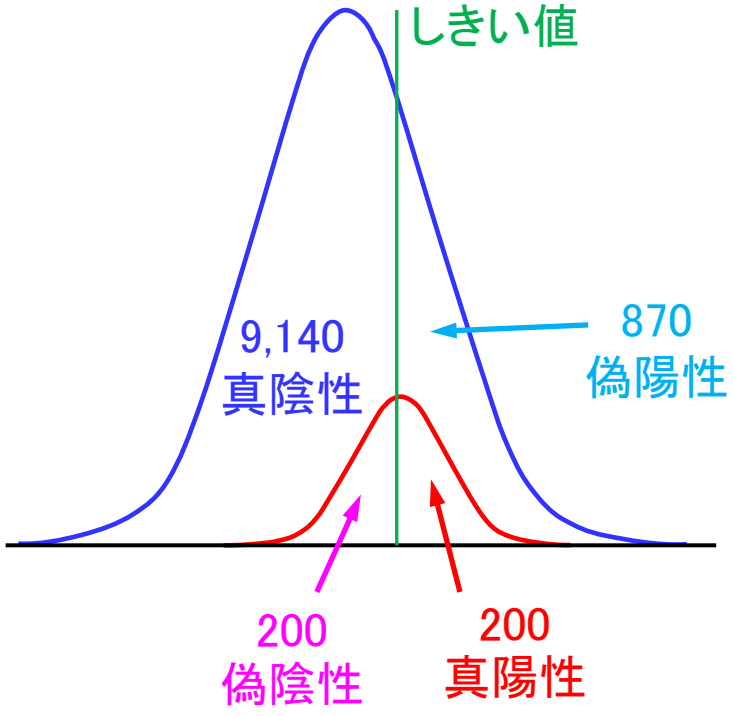
$$\text{真陽性率} = \frac{\text{真陽性}}{\text{偽陰性}+\text{真陽性}}$$



		診断	
		陰性	陽性
実際	陰性	9,140 真陰性	870 偽陽性
	陽性	200 偽陰性	200 真陽性

$$偽陽性率 = \frac{偽陽性}{真陰性+偽陽性} = \frac{870}{9{,}140+870} = 0.087$$

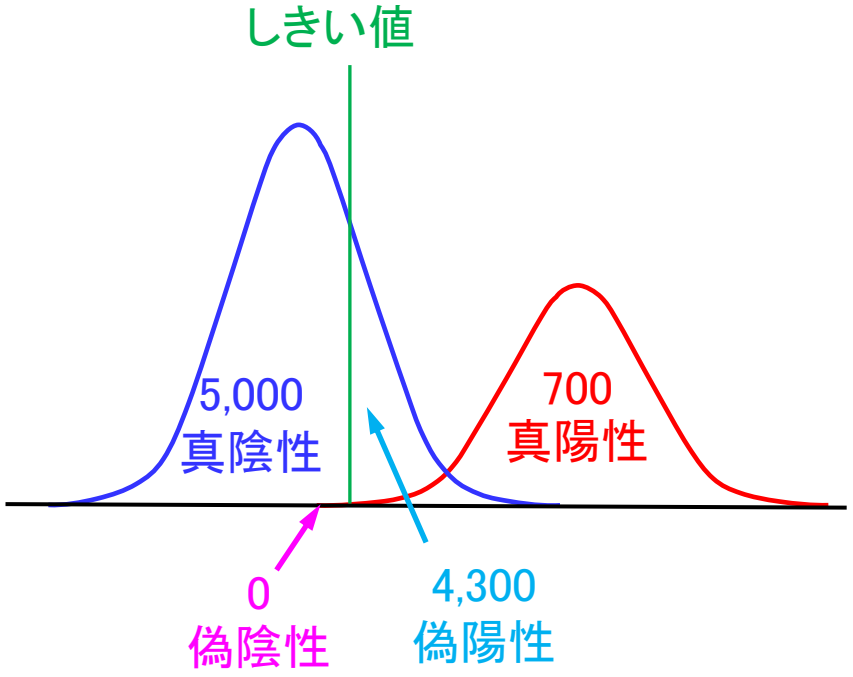
$$真陽性率 = \frac{真陽性}{偽陰性+真陽性} = \frac{200}{200+200} = 0.5$$



		診断	
		陰性	陽性
実際	陰性	5,000 真陰性	4,300 偽陽性
	陽性	0 偽陰性	700 真陽性

$$偽陽性率 = \frac{4{,}300}{5{,}000+4{,}300} = 0.46$$

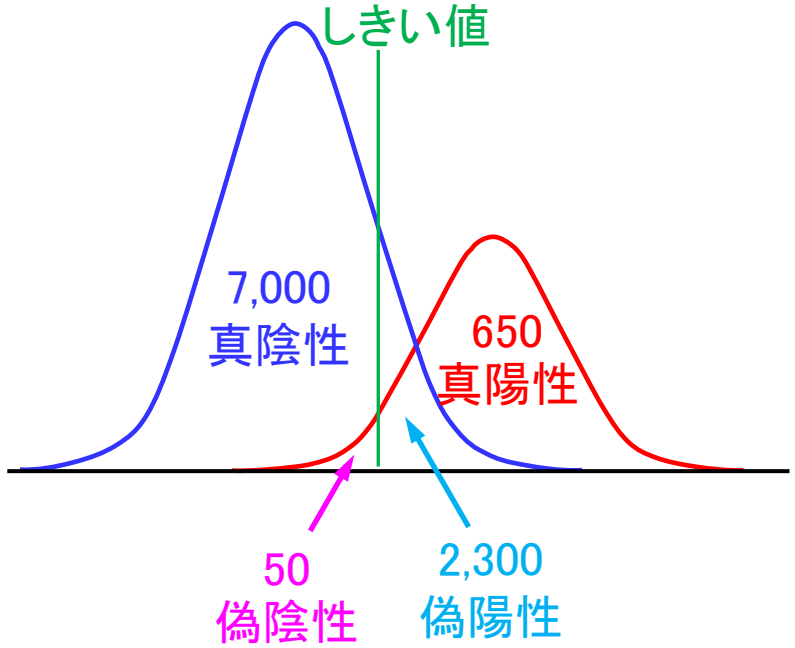
$$真陽性率 = \frac{700}{0+700} = 1$$



		診断	
		陰性	陽性
実際	陰性	7,000 真陰性	2,300 偽陽性
	陽性	50 偽陰性	650 真陽性

$$偽陽性率 = \frac{2{,}300}{7{,}000+2{,}300} = 0.24$$

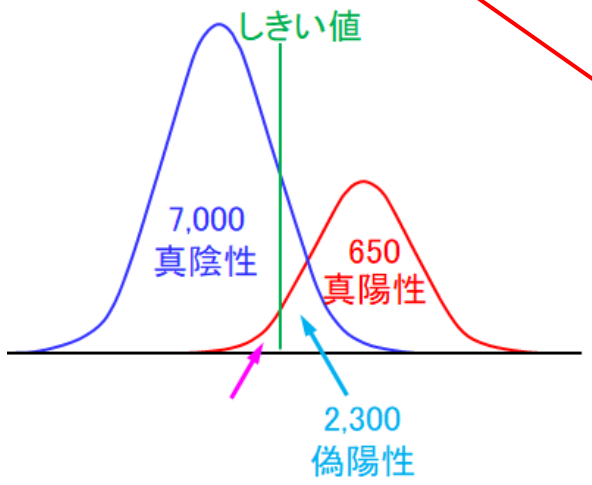
$$真陽性率 = \frac{650}{50+650} = 0.93$$



ROC曲線（Receiver Operatorating Characteristic）
受信者動作特性曲線

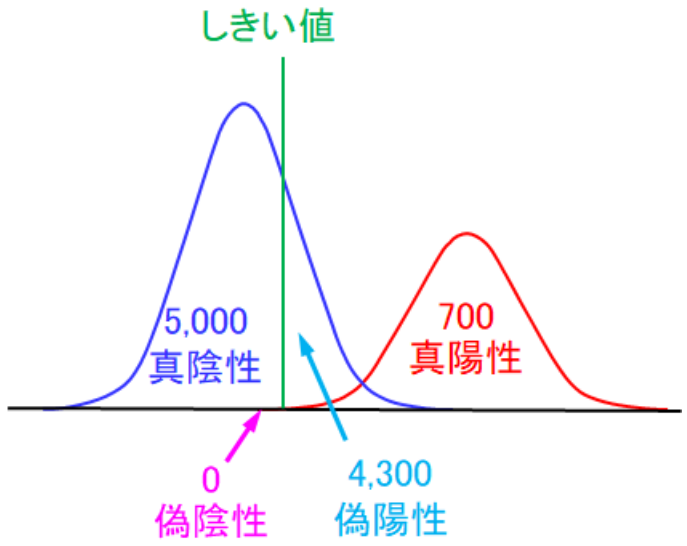
$$偽陽性率 = \frac{2,300}{7,000 + 2,300} = 0.24$$

$$真陽性率 = \frac{650}{50 + 650} = \mathbf{0.93}$$



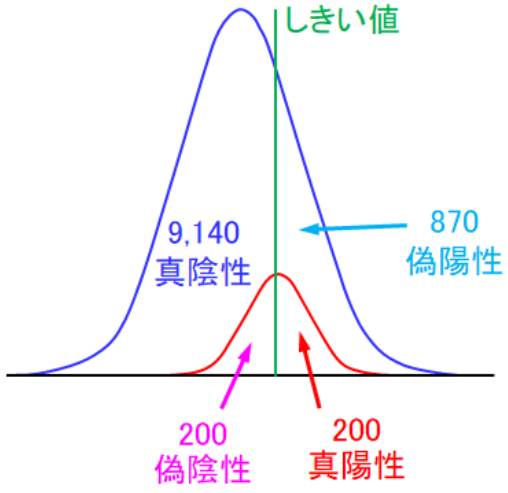
$$偽陽性率 = \frac{4,300}{5,000 + 4,300} = 0.46$$

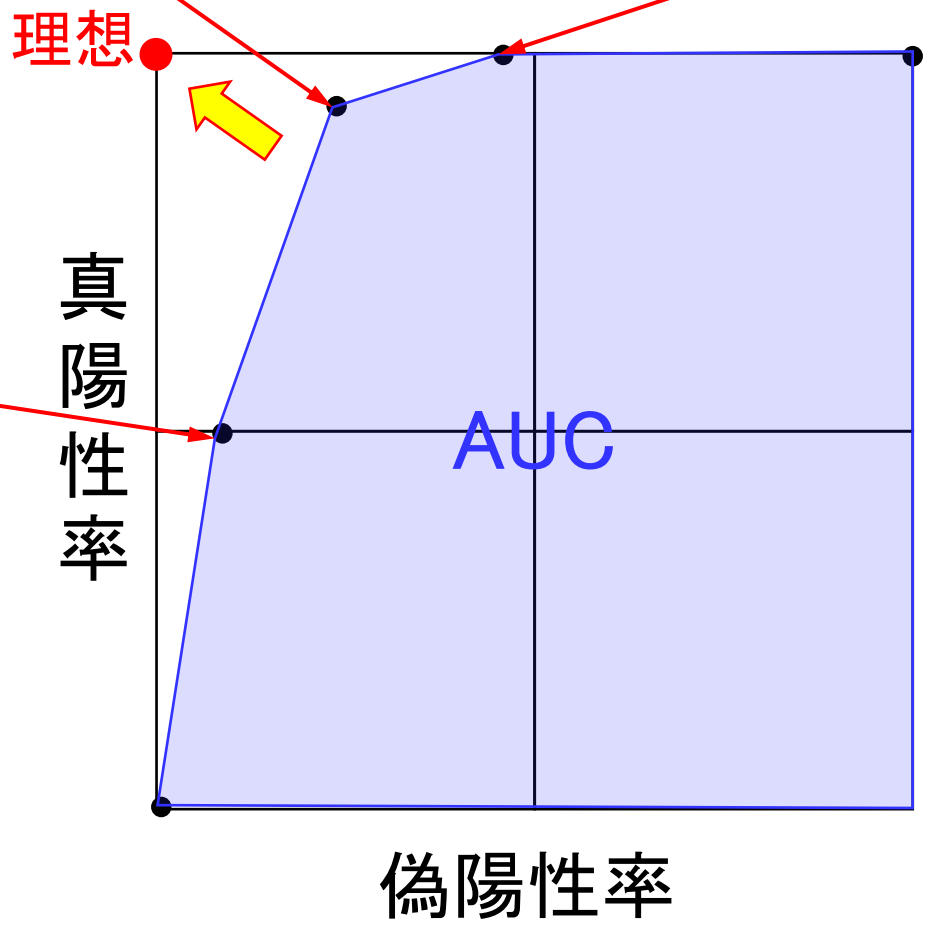
$$真陽性率 = \frac{700}{0 + 700} = \mathbf{1}$$



$$偽陽性率 = \frac{偽陽性}{真陰性+偽陽性} = \frac{870}{9,140+870} = 0.087$$

$$真陽性率 = \frac{真陽性}{偽陰性+真陽性} = \frac{200}{200 + 200} = \mathbf{0.5}$$





AUC

（Area Under the Curve）

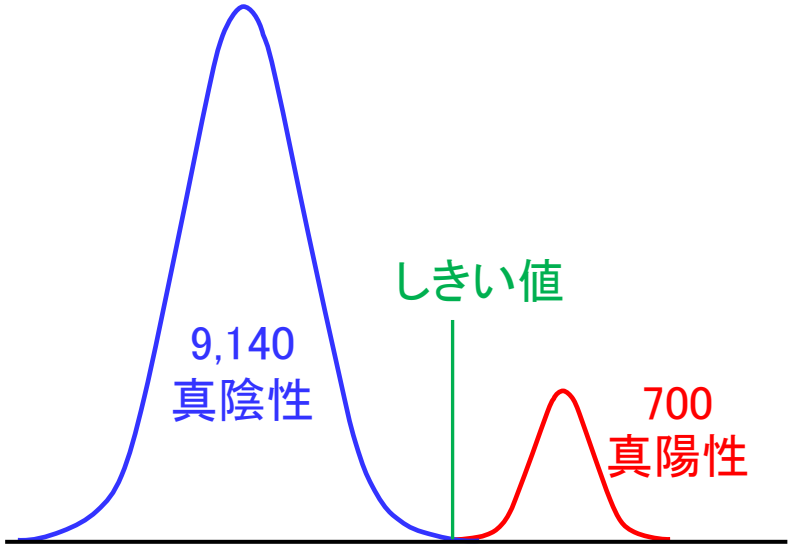
曲線下面積が最大になるのがベスト

陰性と陽性が完全に分離している場合

		診断	
		陰性	陽性
実際	陰性	9,300 真陰性	0 偽陽性
	陽性	0 偽陰性	700 真陽性

$$偽陽性率 = \frac{偽陽性}{真陰性+偽陽性} = \frac{0}{9130+0} = 0$$

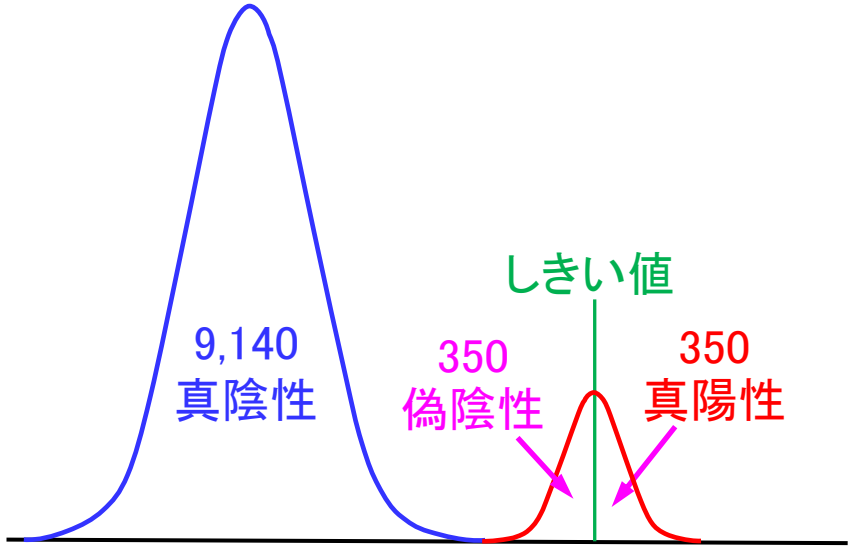
$$真陽性率 = \frac{真陽性}{偽陰性+真陽性} = \frac{700}{0+700} = 1$$



		診断	
		陰性	陽性
実際	陰性	9,300 真陰性	0 偽陽性
	陽性	350 偽陰性	350 真陽性

$$偽陽性率 = \frac{0}{9300+0} = 0$$

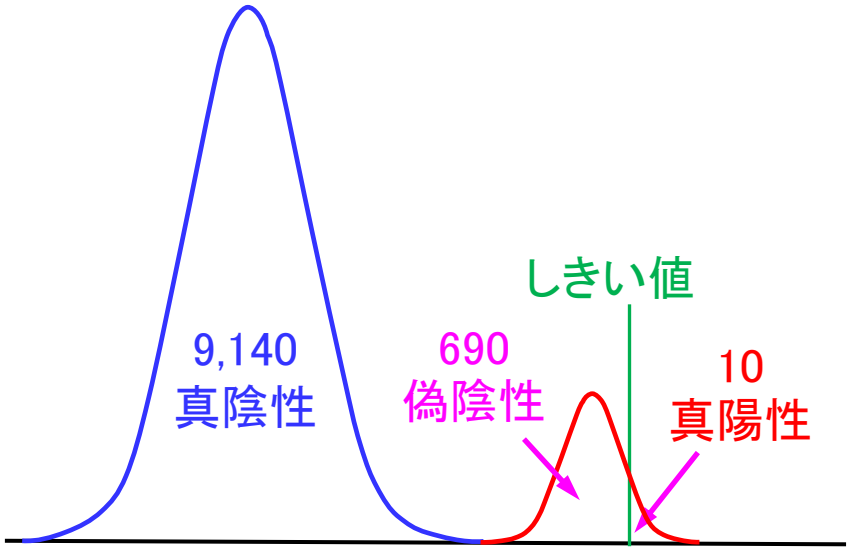
$$真陽性率 = \frac{350}{350+350} = 0.5$$



		診断	
		陰性	陽性
実際	陰性	9300 真陰性	0 偽陽性
	陽性	690 偽陰性	10 真陽性

$$偽陽性率 = \frac{0}{9300+0} = 0$$

$$真陽性率 = \frac{10}{10+690} = 0.01$$

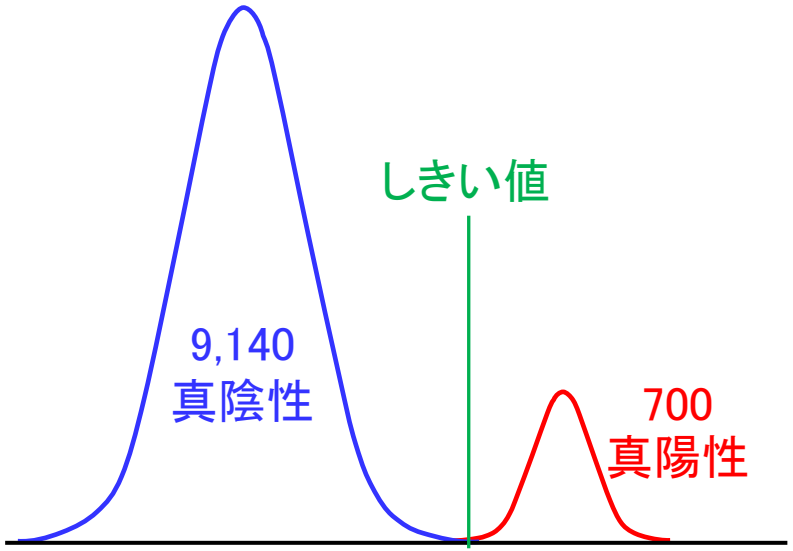


陰性と陽性が完全に分離している場合

		診断	
		陰性	陽性
実際	陰性	9,300 真陰性	0 偽陽性
	陽性	0 偽陰性	700 真陽性

$$偽陽性率 = \frac{偽陽性}{真陰性+偽陽性} = \frac{0}{9130+0} = 0$$

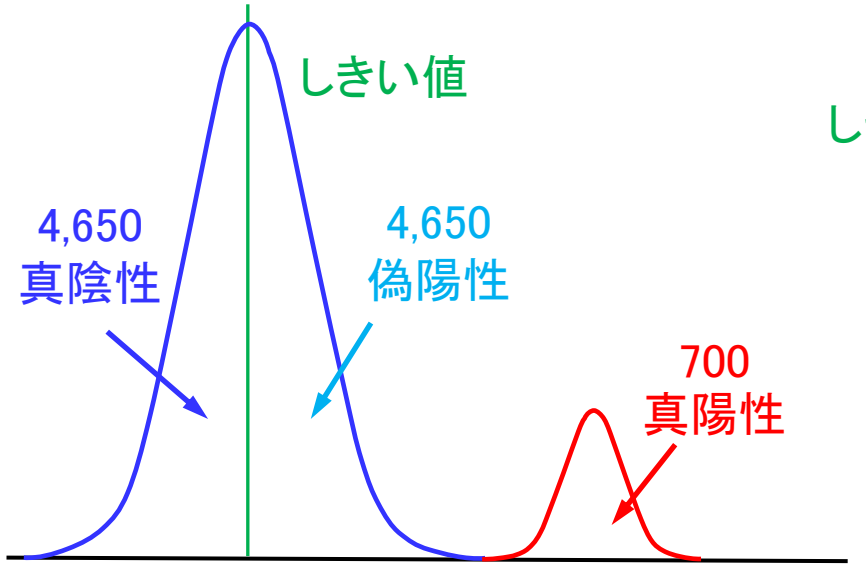
$$真陽性率 = \frac{真陽性}{偽陰性+真陽性} = \frac{700}{0+700} = 1$$



		診断	
		陰性	陽性
実際	陰性	4,650 真陰性	4,650 偽陽性
	陽性	0 偽陰性	700 真陽性

$$偽陽性率 = \frac{4650}{4650+4650} = 0.5$$

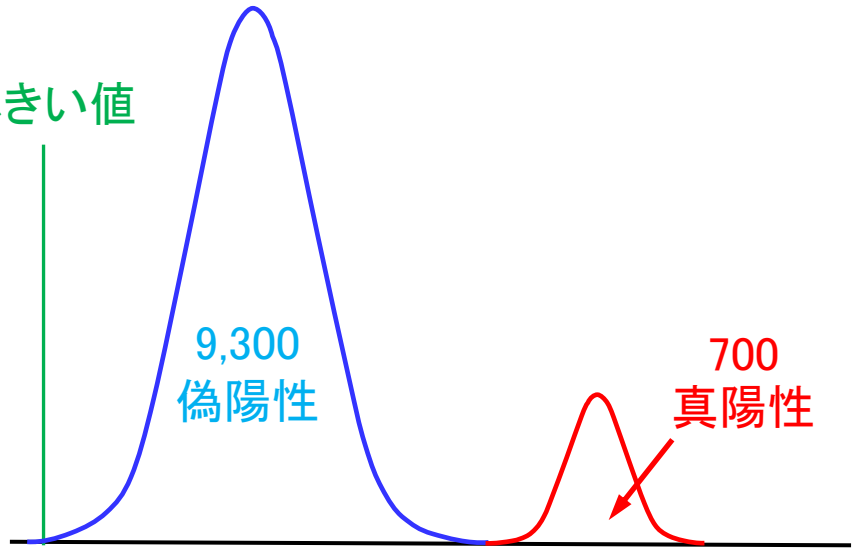
$$真陽性率 == \frac{700}{0+700} = 1$$



		診断	
		陰性	陽性
実際	陰性	0 真陰性	9300 偽陽性
	陽性	0 偽陰性	700 真陽性

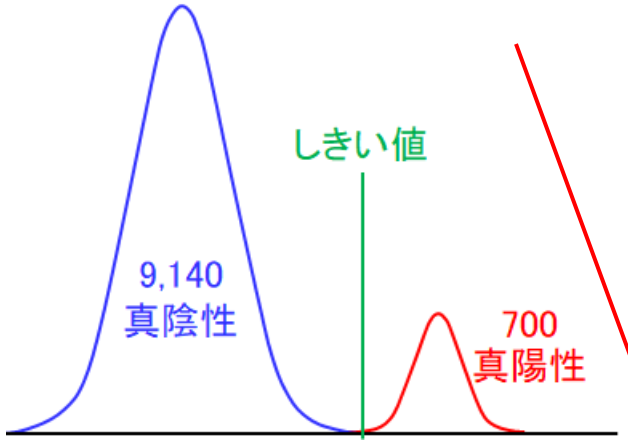
$$偽陽性率 = \frac{9300}{0+9300} = 1$$

$$真陽性率 == \frac{700}{0+700} = 1$$



$$偽陽性率 = \frac{偽陽性}{真陰性+偽陽性} = \frac{0}{9130+0} = 0$$

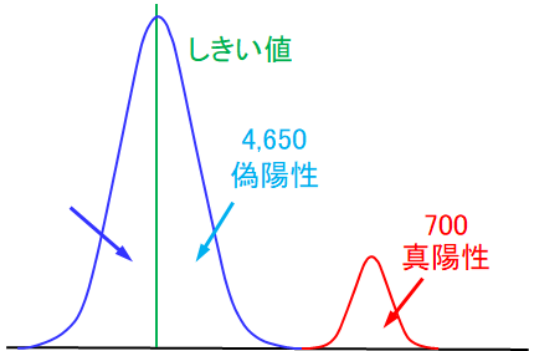
$$真陽性率 = \frac{真陽性}{偽陰性+真陽性} = \frac{700}{0+700} = 1$$



理想

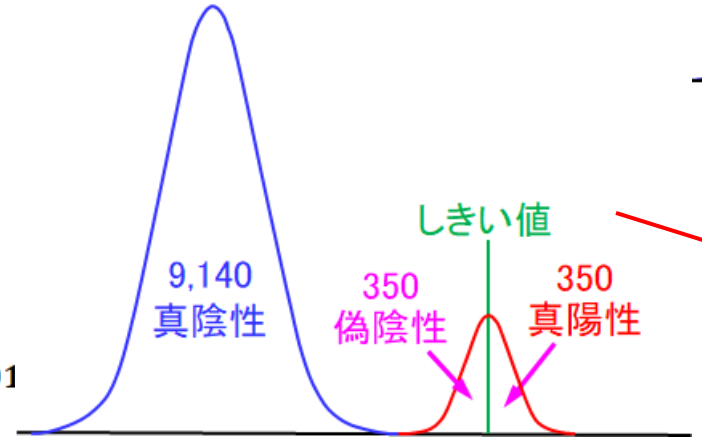
$$偽陽性率 = \frac{4650}{4650+4650} = 0.5$$

$$真陽性率 == \frac{700}{0+700} = 1$$



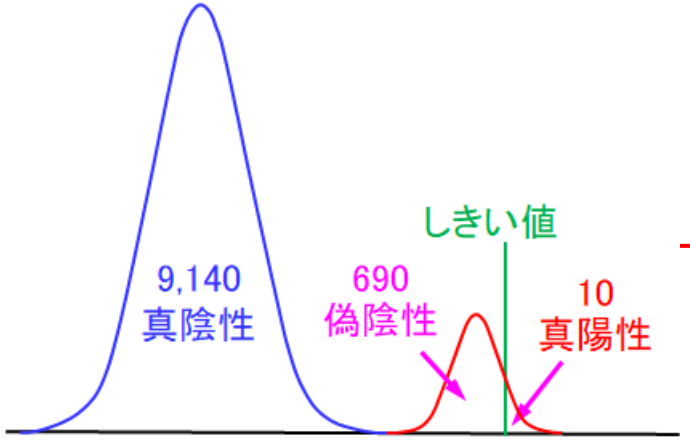
$$偽陽性率 = \frac{0}{9300+0} = 0$$

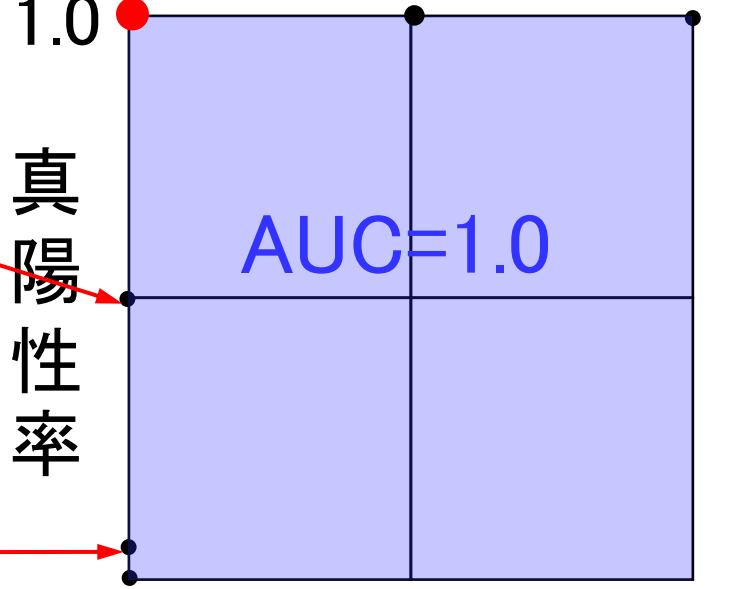
$$真陽性率 = \frac{350}{350+350} = 0.5$$

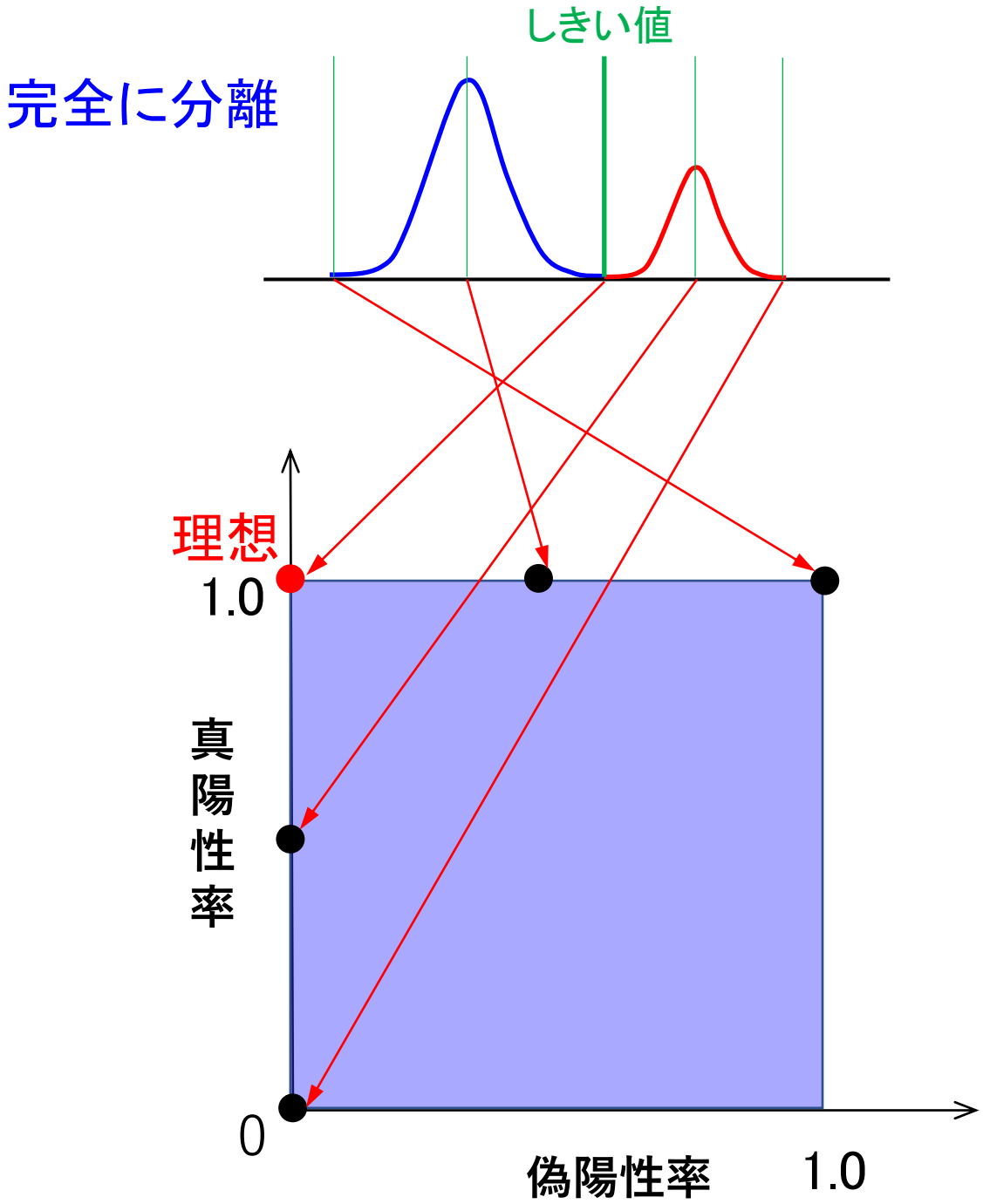


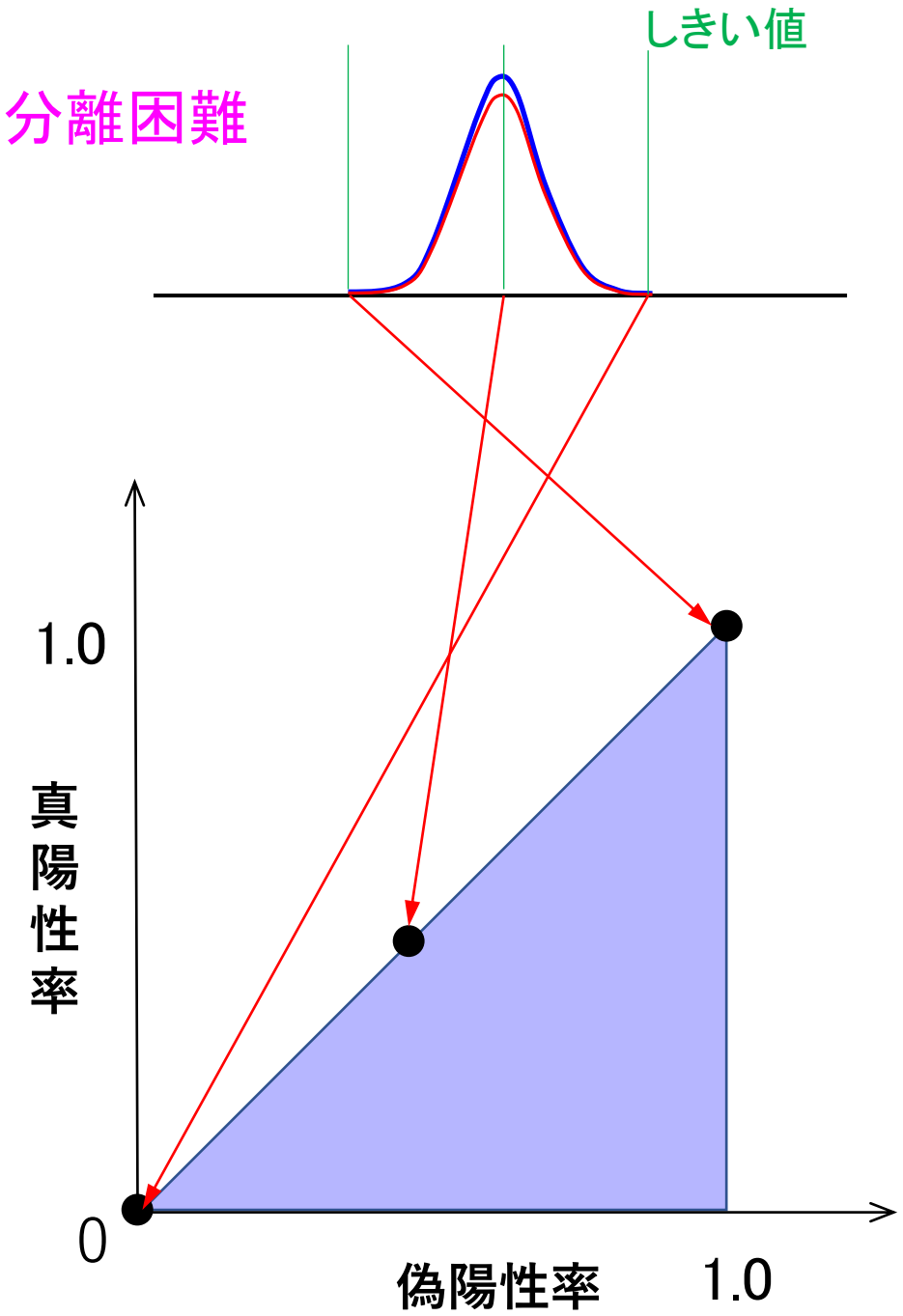
$$偽陽性率 = \frac{0}{9300+0} = 0$$

$$真陽性率 = \frac{10}{10+690} = 0.01$$






完全に分離
しきい値
理想
1.0
真陽性率
0
偽陽性率
1.0


分離困難
しきい値
1.0
真陽性率
0
偽陽性率
1.0