examples

Duke
UNIVERSITY

Dr. Mine Çetinkaya-Rundel
Duke University

American Cancer Society estimates that about 1.7% of women have breast cancer.

http:// www.cancer.org/ cancer/ cancerbasics/ cancer-prevalence

Susan G. Komen For The Cure Foundation states that mammography correctly identifies about 78% of women who truly have breast cancer.

http:// ww5.komen.org/ BreastCancer/ AccuracyofMammograms.html

An article published in 2003 suggests that up to 10% of all mammograms are false positive.

http:// www.ncbi.nlm.nih.gov/ pmc/ articles/ PMC1360940

$P(bc) = 0.017$

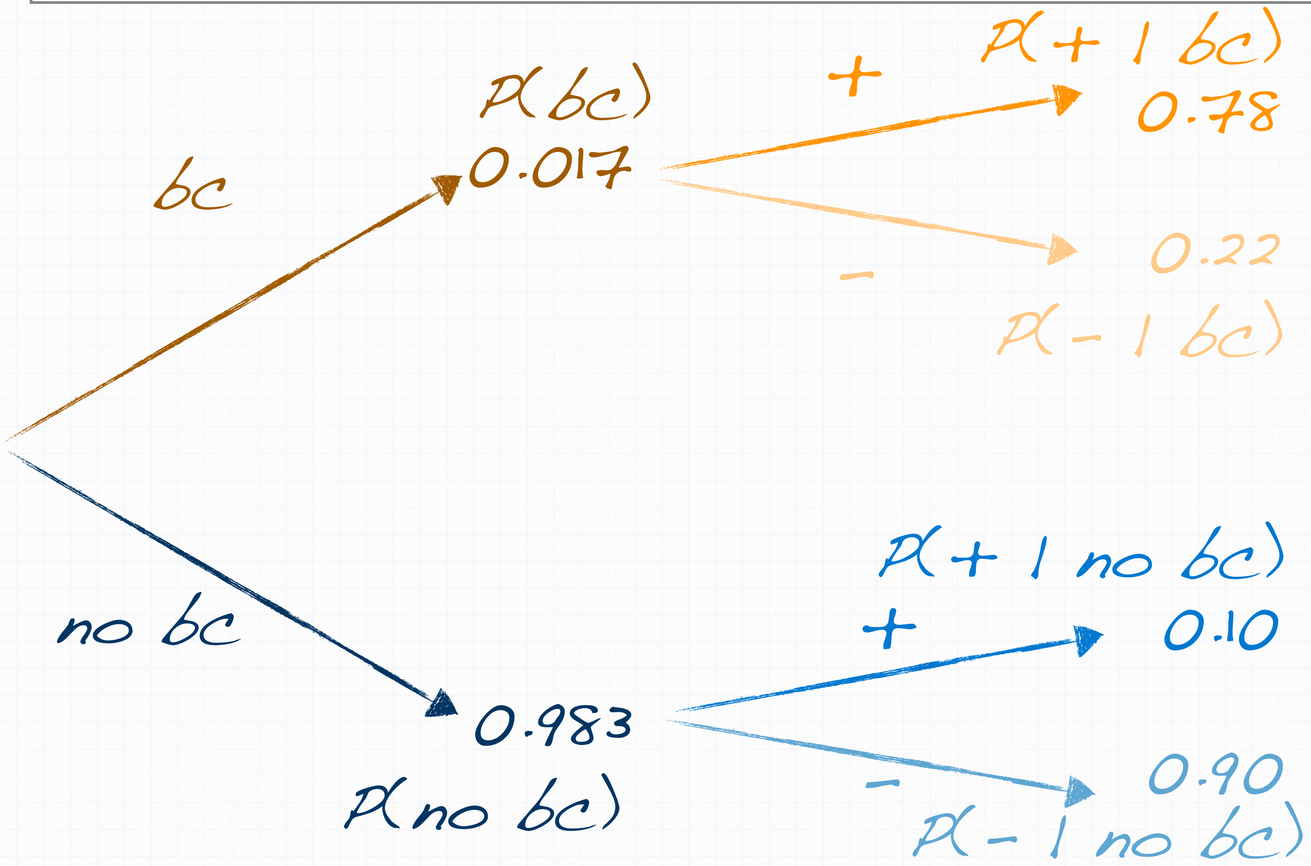
$P(+ \mid bc) = 0.78$

$P(+ \mid no\ bc) = 0.10$

Prior to any testing and any information exchange between the patient and the doctor, what probability should a doctor assign to a female patient having breast cancer?

$P(bc) = 0.017$ ⟶ prior

When a patient goes through breast cancer screening there are two competing claims: patient has cancer and patient doesn't have cancer. If a mammogram yields a positive result, what is the probability that patient has cancer? $P(bc \mid +) = ?$



$P(bc \text{ and } +)$

$0.017 \times 0.78 = 0.01326$

$$P(bc \mid +) = \frac{P(bc \text{ and } +)}{P(+)}$$

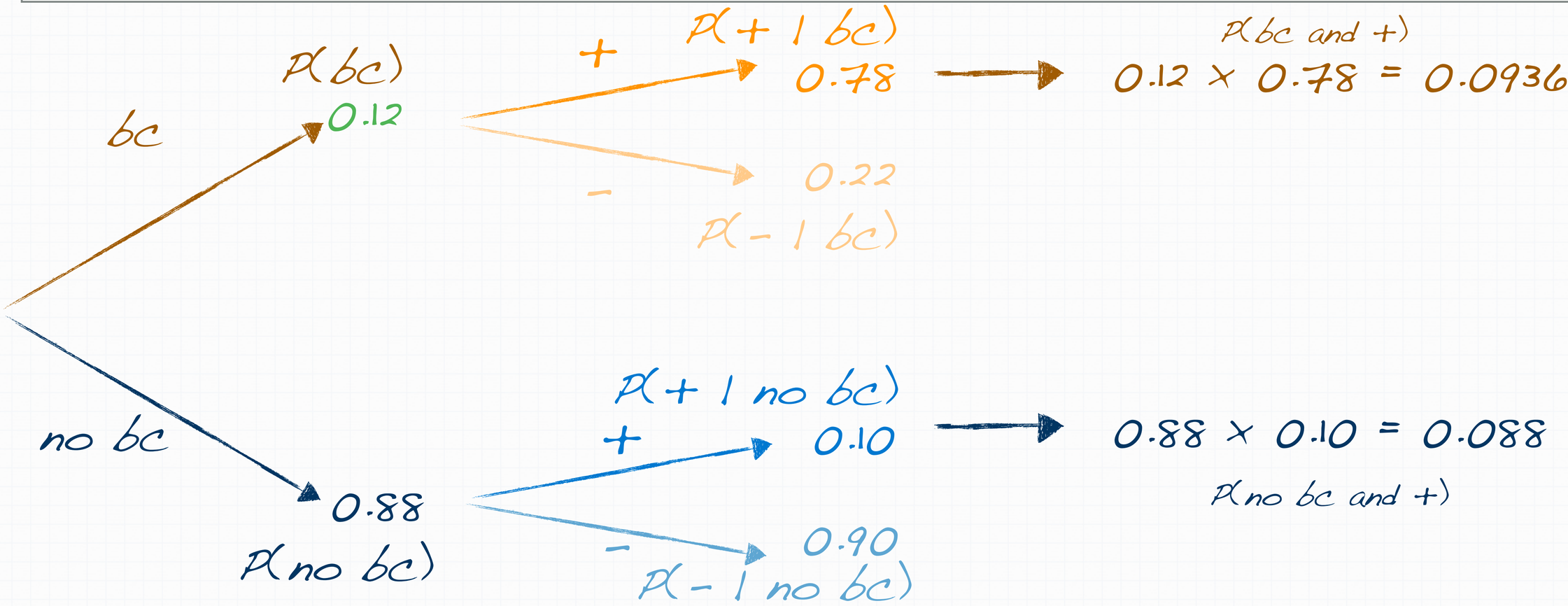
$$= \frac{0.01326}{0.01326 + 0.0983} \approx 0.12$$

posterior

$0.983 \times 0.10 = 0.0983$

$P(\text{no bc and } +)$

Since a positive mammogram doesn't necessarily mean that the patient actually has breast cancer, the doctor might decide to re-test the patient. What is the probability of having breast cancer if this second mammogram also yields a positive result?



- setting a prior
- collecting data
- obtaining a posterior
- updating the prior with the previous posterior