Universität Zürich[UZH]

Introduction to Artificial Intelligence
Exercise Sheet 8

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Exercise 8.1

(a) $\mathbb{P}$(c = fake) = $1 \div n$

(b) We assume that the event is dependent of getting k heads and the fake coin.

$\mathbb{P}$(c = fake | k heads) = $\frac{\mathbb{P}(kheads|c=fake)*\mathbb{P}(c=fake)}{\mathbb{P}(kheads)} = \frac{\frac{1}{n}}{\frac{1}{n}+\frac{n-1}{n}*(\frac{1}{2})^k}$

(c) $\mathbb{P}(c = normal \mid kheads) = \frac{\mathbb{P}(kheads|c=normal)*\mathbb{P}(c=normal)}{\mathbb{P}(kheads)} = \frac{(\frac{1}{2})^k*\frac{n-1}{n}}{\frac{1}{n}*1+\frac{n-1}{n}*(\frac{1}{2})^k} = \frac{(\frac{1}{2})^k*(n-1)}{1+(\frac{1}{2})^k*(n-1)}$
$= \frac{1}{1+\frac{1}{(\frac{1}{2})^k*(n-1)}}$

Exercise 8.2

(a) $\mathbb{P}$(positive result | Test A = positive) = $\frac{\mathbb{P}(TestA=positive|positiveresult)*\mathbb{P}(positiveresult)}{\mathbb{P}(TestA=positive)} = \frac{0.95*0.01}{0.01*0.95+0.99*0.01} = \frac{0.095}{0.095+0.099} = 0.0876$

$\mathbb{P}$(positive result | Test B = positive) = $\frac{\mathbb{P}(TestB=positive|positive)*\mathbb{P}(positive)}{\mathbb{P}(TestB=positive)} = \frac{0.9*0.01}{0.9*0.01+0.99*0.05} = \frac{0.009}{0.009+0.0495} = 0.155$

(b) $\mathbb{P}$(positive result | Test A = positive) = $\frac{\mathbb{P}(TestA=positive|positiveresult)*\mathbb{P}(positiveresult)}{\mathbb{P}(TestA=positive)} = \frac{0.95*0.3}{0.3*0.95+0.7*0.1} = 0.802$

$\mathbb{P}$(positive result | Test B = positive) = $\frac{\mathbb{P}(TestB=positive|positive)*\mathbb{P}(positive)}{\mathbb{P}(TestB=positive)} = \frac{0.9*0.3}{0.9*0.3+0.7*0.05} = 0.885$

Exercise 8.3

(a)

(b)

(c)