Ling 473 Assignment 3

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1 Unfair Die Probability

Since 1 and 6 are twice as likely to occur as all others the p(1) = 1/4, p(2) = 1/8, p(3) = 1/8, p(4) = 1/8, p(5) = 1/8, p(6) = 1/8

1.1 Probability two dice sum to 7

representing each event by outcome white dice and outcome red die so P(4 and 3) means white die shows 4 and red die shows 3

$$P(Sum = 7) = P(4and3)+P(3and4)+P(5and2)+P(2and5)+P(6and1)+P(1and6) \quad (1)$$

$$P(Sum = 7) = 2 * (P(4and3) + P(5and2) + P(2and5) + P(6and1)) \quad (2)$$

$$P(Sum = 7) = 2*((1/8*1/8)+(1/8*1/8)+((1/4*1/4))) = 2*(2/64+4/64) = 3/16 = 0.1875 \quad (3)$$

1.2 Probability two dice sum to 9 or higher

$$P(Sum >= 9) = P(9) + P(10) + P(11) + P(12) \quad (4)$$

$$P(9) = P(4and5)+P(5and4)+P(6and3)+P(3and6) = 1/64+1/64+1/32+1/32 = 6/64 \quad (5)$$

$$P(10) = P(4and6) + P(6and4) + P(5and5) = 1/32 + 1/32 + 1/64 = 5/64 \quad (6)$$

$$P(11) = P(5and6) + P(6and5) = 1/32 + 1/32 = 4/64 \quad (7)$$

$$P(12) = P(6and6) = 1/16 = 4/64 \quad (8)$$

$$P(Sum >= 9) = 6/64 + 5/64 + 4/64 + 4/64 = 19/64 = \ 0.296875 \quad (9)$$

1.3 Probability probability red higher than white

Since both die have the same probability the P(Red ¿ White) = P(White ¿ Red).

$$P(S) = P(Red > White)+P(White > Red)+P(White = Red) = 1 \quad (10)$$

$$P(White = Red) = P(1and1)+P(2and2)+p(3and3)+p(4and4)+p(5and5)+p(6and6) = 4/64+1/ \quad (11)$$

$$P(Red > White) = 1 - P(White > Red) - P(White = Red) \quad (12)$$

$$2 * P(Red > White) = 1 - P(White = Red) = 13/16 \quad (13)$$

$$P(Red > White) = 13/32 = 0.40625 \quad (14)$$

2 Bi grams

2.1 Count Bi grams

158 words so 157 bi grams

2.2 Probability . give NN

4/24

2.3 Probability DT JJ

6/157

2.4 Probability NN giveb DT JJ

5/6

2.5 Probability DT JJ given NN

Using Bayes

$$P(DTJJ\|NN) = (P(NN\|DTJJ)P(DTJJ))/P(NN) \tag{15}$$

$$P(DTJJ\|NN) = (5/6{*}6/157)/(24/158) = 395/1884 = \ 0.209660297239915 \tag{16}$$

3 Phonetic Elicitation

Only open words in the set are gnat and sand I believe.

$$P(Close) = P(Close\|A)P(A) + P(Close\|B)P(B) + P(Close\|C)P(C) \tag{17}$$

$$P(Close\|A) = 1/2 \tag{18}$$

$$P(Close\|B) = 1 \tag{19}$$

$$P(Close\|C) = 3/4 \tag{20}$$

$$P(Close) = 1/3 * 1/2 + 1/3 * 1 + 1/3 * 3/4 = 1/6 + 1/3 + 1/4 = 9/12 = 0.75 \tag{21}$$

4 Bio Medical Document Classifier

let T stand for document that reference IL-2R and F stand for those that do not. initially our P(TC)=2/6,P(TNotC)=1/2. Then we select something at random from C and move it to NotC.

4.1 Probability True in NotC post shuffle

Let A be the event NotC got another document mentioning IL-2R. Let F be the event that document we select mentions IL-2R P(A) = 1/3 and P(NotA) = 2/3

$$P(F) = P(T\|A)P(A) + P(T\|NotA)P(NotA) \tag{22}$$

$$P(F) = 2/3 * 1/3 + 1/3 * 2/3 = 4/9 = 0.44444 \tag{23}$$

4.2 Probability Document Moved Referenced IL-2R given F

Use Bayes Theorem P(Document Moved Referenced IL-2)=P(B)=1/3)

$$P(B\|F) = (P(F\|B)P(B))/P(F) = (2/3 * 1/3)/0.44444 = 1/2 \tag{24}$$