NOTE

HW 5

Attribute Selection with Information Gain

age	p_i	n_i	$I(p_i, n_i)$
<=30	2	3	0.971
31...40	4	0	0
>40	3	2	0.971

age	income	student	credit_rating	buys_computer
<=30	high	no	fair	no
<=30	high	no	excellent	no
31...40	high	no	fair	yes
>40	medium	no	fair	yes
>40	low	yes	fair	yes
>40	low	yes	excellent	no
31...40	low	yes	excellent	yes
<=30	medium	no	fair	no
<=30	low	yes	fair	yes
>40	medium	yes	fair	yes
<=30	medium	yes	excellent	yes
31...40	medium	no	excellent	yes
31...40	high	yes	fair	yes
>40	medium	no	excellent	no

1. $Info(D) = I(9,5) = -\frac{9}{14}\log_2\left(\frac{9}{14}\right) - \frac{5}{14}\log_2\left(\frac{5}{14}\right) = 0.940$; yes(9), no(5)

$Info_{age}(D) = \frac{5}{14}I(2,3) + \frac{4}{14}I(4,0) + \frac{5}{14}I(3,2) = 0.694$; <=30 (5), 31...40 (4), >40 (5)

↳ $\frac{5}{14}\left(-\frac{2}{5}\log_2\left(\frac{2}{5}\right) - \frac{3}{5}\log\left(\frac{3}{5}\right)\right)$

$Info_{income}(D) = \frac{4}{14}I(2,2) + \frac{6}{14}I(4,2) + \frac{4}{14}I(3,1) = 0.911$; high(4), medium(6), low(4)

$Info_{student}(D) = \frac{7}{14}I(6,1) + \frac{7}{14}I(3,4) = 0.789$; yes(7), no(7)

$Info_{credit}(D) = \frac{8}{14}I(6,2) + \frac{6}{14}I(3,3) = 0.892$; fair(8), excellent(6)

เอา Information gain ที่น้อยที่สุด

$Gain(age) = Info(D) - Info_{age}(D) = 0.940 - 0.694 = 0.246$

$Gain(income) = Info(D) - Info_{income}(D) = 0.940 - 0.911 = 0.029$

$Gain(student) = Info(D) - Info_{student}(D) = 0.940 - 0.789 = 0.151$

$Gain(credit\_rating) = Info(D) - Info_{credit}(D) = 0.940 - 0.892 = 0.048$

NOTE

2.

age	income	student	credit_rating	buys_computer
<=30	high	no	fair	no
<=30	high	no	excellent	no
<=30	medium	no	fair	no
<=30	low	yes	fair	yes
<=30	medium	yes	excellent	yes

$Info(D) = I(2,3) = -\frac{2}{5}\log_2\left(\frac{2}{5}\right) - \frac{3}{5}\log_2\left(\frac{3}{5}\right) = 0.971$, yes(2), no(3)

$Info_{income}(D) = \frac{2}{5}I(0,2) + \frac{2}{5}I(1,1) + \frac{1}{5}I(1,0) = 0.4$; high(2), Medium(1), low(2)

$Info_{student}(D) = \frac{2}{5}I(2,0) + \frac{3}{5}I(0,3) = 0$; yes(2), no(3)

$Info_{credit}(D) = \frac{3}{5}I(1,2) + \frac{2}{5}I(1,1) = 0.951$; fair(3), excellent(2)

เอา Information gain ที่เยอะที่สุด

$Gain(income) = Info(D) - Info_{income}(D) = 0.971 - 0.4 = 0.571$

$Gain(student) = Info(D) - Info_{student}(D) = 0.971 - 0 = 0.971$

$Gain(credit\_rating) = Info(D) - Info_{credit}(D) = 0.971 - 0.951 = 0.02$

3.

age	income	student	credit_rating	buys_computer
31...40	high	no	fair	yes
31...40	low	yes	excellent	yes
31...40	medium	no	excellent	yes
31...40	high	yes	fair	yes

yes : 4 , no (0) คือถ้าเป็นอายุช่วง 31-40 ก็ตอบ yes เลย

4.

age	income	student	credit_rating	buys_computer
>40	medium	no	fair	yes
>40	low	yes	fair	yes
>40	low	yes	excellent	no
>40	medium	yes	fair	yes
>40	medium	no	excellent	no

$Info(D) = I(3,2) = -\frac{3}{5}\log_2\left(\frac{3}{5}\right) - \frac{2}{5}\log_2\left(\frac{2}{5}\right) = 0.971$; yes(3), no(2)

$Info_{income}(D) = \frac{3}{5}I(2,1) + \frac{2}{5}I(1,1) = 0.951$; medium(3), low(2)

$Info_{student}(D) = \frac{3}{5}I(2,1) + \frac{2}{5}I(1,1) = 0.951$; yes(3), no(2)

$Info_{credit}(D) = \frac{3}{5}I(3,0) + \frac{2}{5}I(0,2) = 0$; fair(3), excellent(2)

เอา Information gain ที่เยอะที่สุด

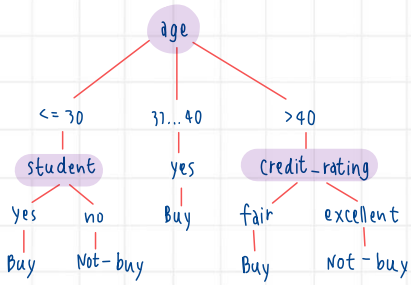
$Gain(income) = Info(D) - Info_{income}(D) = 0.971 - 0.951 = 0.02$

$Gain(student) = Info(D) - Info_{student}(D) = 0.971 - 0.951 = 0.02$

$Gain(credit\_rating) = Info(D) - Info_{credit}(D) = 0.971 - 0 = 0.971$

NOTE

จากการคำนวณ Information gain จะได้ Dicision tree ดังนี้



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