

1. First 18 examples in contact_lenses:

young,myope,no,reduced,none
young,myope,no,normal,soft
young,myope,yes,reduced,none
young,myope,yes,normal,hard
young,hypermetrope,no,reduced,none
young,hypermetrope,no,normal,soft
young,hypermetrope,yes,reduced,none
young,hypermetrope,yes,normal,hard
pre-presbyopic,myope,no,reduced,none
pre-presbyopic,myope,no,normal,soft
pre-presbyopic,myope,yes,reduced,none
pre-presbyopic,myope,yes,normal,hard
pre-presbyopic,hypermetrope,no,reduced,none
pre-presbyopic,hypermetrope,no,normal,soft
pre-presbyopic,hypermetrope,yes,reduced,none
pre-presbyopic,hypermetrope,yes,normal,none
presbyopic,myope,no,reduced,none
presbyopic,myope,no,normal,none

Info_before = entropy(11/18, 4/18, 3/18) = 1.347

Age = 'young': entropy(4/8, 2/8, 2/8) = 1.50
Age = 'presbyopic': entropy(5/8, 2/8, 1/8) = 1.299
Age = 'pre_presbyopic': entropy(2/2, 0/2, 0/2) = 0
Info(Age) = 8/18 * 1.5 + 8/18 * 1.3 + 2/18 * 0 = 1.244
Gain(Age) = Info_Before – Info(Age) = 1.35 – 1.24 = 0.103
Split_info(Age) = entropy(8/18, 8/18, 2/18) = 1.392
Gain_Ratio(Age) = Gain(Age)/Split_Info(Age) = 0.074

Similarly,

Gain_Ratio(Tear-Prod-Rate) = 0.582
Gain_Ratio(Astigmatism) = 0.387
Gain_Ratio(Spectacle-Prescrip) = 0.008

Tear-Prod_Rate is chosen as the root of the decision tree.