

1. ID3 ON Contact-lenses SOFT/HARD/NONE

ATTRIBUTE "AGE"

AGE = YOUNG

0.301

$$\text{info}([2, 2, 4]) = E\left(\frac{2}{8}, \frac{2}{8}, \frac{4}{8}\right) = -\frac{2}{8} \cdot \log\left(\frac{2}{8}\right) - \frac{2}{8} \cdot \log\left(\frac{2}{8}\right) - \frac{4}{8} \cdot \log\left(\frac{4}{8}\right) = 0.451$$

AGE = PRE-PRESBYOPIC

$$\text{info}([2, 1, 5]) = E\left(\frac{2}{8}, \frac{1}{8}, \frac{5}{8}\right) = -\frac{2}{8} \cdot \log\left(\frac{2}{8}\right) - \frac{1}{8} \cdot \log\left(\frac{1}{8}\right) - \frac{5}{8} \cdot \log\left(\frac{5}{8}\right) = 0.391$$

AGE = PRESBYOPIC

$$\text{info}([1, 1, 6]) = E\left(\frac{1}{8}, \frac{1}{8}, \frac{6}{8}\right) = -\frac{1}{8} \cdot \log\left(\frac{1}{8}\right) - \frac{1}{8} \cdot \log\left(\frac{1}{8}\right) - \frac{6}{8} \cdot \log\left(\frac{6}{8}\right) = 0.319$$

$$\text{info}([2, 2, 4], [2, 1, 5], [1, 1, 6]) = .451\left(\frac{8}{24}\right) + .391\left(\frac{9}{24}\right) + .319\left(\frac{9}{24}\right) = \boxed{0.387}$$

ATTRIBUTE "SPECTACLE-PRESCRIP"

= HYPERMETROPE

$$\text{info}([3, 1, 8]) = E\left(\frac{3}{12}, \frac{1}{12}, \frac{8}{12}\right) = -\frac{3}{12} \cdot \log\left(\frac{3}{12}\right) - \frac{1}{12} \cdot \log\left(\frac{1}{12}\right) - \frac{8}{12} \cdot \log\left(\frac{8}{12}\right) = 0.358$$

= MYOPE

$$\text{info}([2, 3, 7]) = E\left(\frac{2}{12}, \frac{3}{12}, \frac{7}{12}\right) = -\frac{2}{12} \cdot \log\left(\frac{2}{12}\right) - \frac{3}{12} \cdot \log\left(\frac{3}{12}\right) - \frac{7}{12} \cdot \log\left(\frac{7}{12}\right) = 0.417$$

$$\text{info}([3, 1, 8], [2, 3, 7]) = .358\left(\frac{12}{24}\right) + .417\left(\frac{12}{24}\right) = \boxed{0.389}$$

ATTRIBUTE "ASTIGMATISM"

= YES

$$\text{info}([0, 4, 8]) = E\left(\frac{0}{12}, \frac{4}{12}, \frac{8}{12}\right) = 0 - \frac{4}{12} \cdot \log\left(\frac{4}{12}\right) - \frac{8}{12} \cdot \log\left(\frac{8}{12}\right) = 0.276$$

= NO

$$\text{info}([5, 0, 7]) = E\left(\frac{5}{12}, \frac{0}{12}, \frac{7}{12}\right) = -\frac{5}{12} \cdot \log\left(\frac{5}{12}\right) - 0 - \frac{7}{12} \cdot \log\left(\frac{7}{12}\right) = 0.295$$

$$\text{info}([0, 4, 8], [5, 0, 7]) = .276\left(\frac{12}{24}\right) + .295\left(\frac{12}{24}\right) = \boxed{0.286}$$

ATTRIBUTE "TEAR-PROD-RATE"

= NORMAL

$$\text{info}([5, 4, 3]) = E\left(\frac{5}{12}, \frac{4}{12}, \frac{3}{12}\right) = -\frac{5}{12} \cdot \log\left(\frac{5}{12}\right) - \frac{4}{12} \cdot \log\left(\frac{4}{12}\right) - \frac{3}{12} \cdot \log\left(\frac{3}{12}\right) = 0.468$$

= REDUCED

$$\text{info}([0, 0, 12]) = E\left(\frac{0}{12}, \frac{0}{12}, \frac{12}{12}\right) = 0 - 0 - 0 = 0$$

$$\text{info}([5, 4, 3], [0, 0, 12]) = .468\left(\frac{12}{24}\right) + 0\left(\frac{12}{24}\right) = \boxed{0.234} \quad * \text{ ROOT NODE}$$

TEAR-PROD-RATE = "NORMAL"

SPECTACLE-PRESCRIP

= HYPERMETROPE

$$\text{info}([3, 1, 2]) = E\left(\frac{3}{6}, \frac{1}{6}, \frac{2}{6}\right) = -\frac{3}{6} \cdot \log\left(\frac{3}{6}\right) - \frac{1}{6} \cdot \log\left(\frac{1}{6}\right) - \frac{2}{6} \cdot \log\left(\frac{2}{6}\right) = 0.439$$

= MYOPE

$$\text{info}([2, 3, 1]) = E\left(\frac{2}{6}, \frac{3}{6}, \frac{1}{6}\right) = 0.439$$

$$\text{info}([3, 1, 2], [2, 3, 1]) = .439\left(\frac{6}{12}\right) + .439\left(\frac{6}{12}\right) = \boxed{0.439}$$



ASTIGMATISM

= YES

$$\text{info}([0, 4, 2]) = E\left(0, \frac{4}{6}, \frac{2}{6}\right) = 0 - \frac{4}{6} \cdot \log\left(\frac{4}{6}\right) - \frac{2}{6} \cdot \log\left(\frac{2}{6}\right) = 0.276$$

= NO

$$\text{info}([5, 0, 1]) = E\left(\frac{5}{6}, 0, \frac{1}{6}\right) = -\frac{5}{6} \cdot \log\left(\frac{5}{6}\right) - 0 - \frac{1}{6} \cdot \log\left(\frac{1}{6}\right) = 0.196$$

$$\text{info}([0, 4, 2], [5, 0, 1]) = .276\left(\frac{6}{12}\right) + .196\left(\frac{6}{12}\right) = \boxed{0.236} * 1^{\text{ST}} \text{ LEVEL NODE}$$

AGE

= PRE-PRESBYOIC

$$\text{info}([2, 1, 1]) = E\left(\frac{2}{4}, \frac{1}{4}, \frac{1}{4}\right) = -\frac{2}{4} \cdot \log\left(\frac{2}{4}\right) - \frac{1}{4} \cdot \log\left(\frac{1}{4}\right) - \frac{1}{4} \cdot \log\left(\frac{1}{4}\right) = 0.452$$

= PRESBYOIC

$$\text{info}([1, 1, 2]) = E\left(\frac{1}{4}, \frac{1}{4}, \frac{2}{4}\right) = 0.452$$

= YOUNG

$$\text{info}([2, 2, 0]) = E\left(\frac{2}{4}, \frac{2}{4}, 0\right) = -\frac{2}{4} \cdot \log\left(\frac{2}{4}\right) - \frac{2}{4} \cdot \log\left(\frac{2}{4}\right) - 0 = 0.301$$

$$\text{info}(\text{AGE}) = .452\left(\frac{4}{12}\right) + .452\left(\frac{4}{12}\right) + .301\left(\frac{4}{12}\right) = \boxed{0.402}$$

TEAR-PROD-RATE = "REDUCED"

SPEC-PRESCLAP

= HYPERMETROPE

$$\text{info}([0, 0, 6]) = E\left(0, 0, \frac{6}{6}\right) = -0 - 0 - \frac{6}{6} \log\left(\frac{6}{6}\right) = 0$$

= MYOPE

$$\text{info}([0, 0, 6]) = 0$$

$$\text{info}([0, 0, 6], [0, 0, 6]) = 0$$

ASTIGMATISM

$$\text{info} = 0$$

AGE

$$\text{info} = 0$$

$$\therefore \boxed{\text{REDUCED} = \text{NONE}} \quad 1^{\text{ST}} \text{ LEVEL LEAF}$$