Decision tree: A classifier (Tree Structured) Decision Node Leaf node - (Classification Frate) /featore

Redge - Value

→ Also und in Regnession

(A+Mb4) Byno/ yes (1) (3) Training Octa - Algo - (m/c) Credit Score income Loan or not prediction 7 Fast is performed on the feature / Athrobute Employed Cordit score in come ) D, finter do the Splitting / led node having class or Value.

T.G. BAN

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Information aain: Measure of how much information
the Answer to a specific occustion
provides.

measure of how much uncertainty, in the detaset / information Gain / Information.

· Info grain 1 = entropy L

Information Gain: -

$$I(P,n) = -\frac{P}{s}\log_2\frac{P}{s} - \frac{n}{s}\log_2\frac{n}{s} \qquad -(1)$$

S -> total Sample Space

$$E(A) = \frac{\sqrt[3]{\frac{p_i + n_i}{p_i}}}{\sqrt[3]{\frac{p_i + n_i}{p_i}}} \left( I(p_i, n_i) - (1) \right)$$

Oustion: 1: - For the following Medical diagnosis deta, courte DT-

| So | oc Threat | fever | Swallen alands | congestion | Hudache | Diagnosis       |
|----|-----------|-------|----------------|------------|---------|-----------------|
| _  | Yes       | Yes   | Yes            | 1/23       | Yes     | Stock<br>throat |
| 2  | NO        | No    | No             | Xel        | 4-43    | Allergy         |
| 3  | Yes       | Yes   | No             | Yes        | No      | cord            |
| 4  | Yes       | Ho    | Yes            | Mo         | Ho      | S. T.           |
| 5  | Ho        | Yes   | No             | Yes        | HO      | Cold            |
| 6  | Ho        | No    | No             | res        | Mo      | Altergy         |
| 7. | Mo        | No    | Yes            | No         | NO      | S.T             |
| 8  | Yes       | NO    | No             | Ye         | Key     | Allergy         |
| 9  | HO        | Yes   | . Mo           | , yes      | 1-y     | Coold           |
| 10 | Y-es      | 410 X | Ho Ho          | xes        | yes.    | cold.           |
|    |           |       |                |            |         |                 |

I-( P, 17,

$$I(ST, A11, Gold) = -\left[\left(\frac{3}{10}\right)\log_2\left(\frac{3}{10}\right) + \frac{3}{10}\log_2\left(\frac{3}{10}\right) + \left(\frac{4}{10}\right)\log_2\left(\frac{4}{10}\right)\right]$$

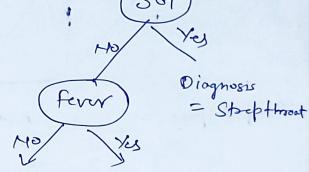
$$= 1.562$$

finding Splitting Attribute: [Salut Attribute with Highest gain]

| STOR Throat: | _   | ST | A   | C  |  |
|--------------|-----|----|-----|----|--|
|              | Yes | 2  | 1   | 2  | _ (Infogain) x 1 7+ FLA                            |
|              | MO  | 1  | 2 1 | 12 | - (Infogain) x P J+ E(A)<br>(Infogain) x P J+ E(A) |

Sore Throat - 0.05 fever - 0.72 Sovollen glands - 0.88]. Congestion - 0.45 Headache - 0.05

Decision Tree



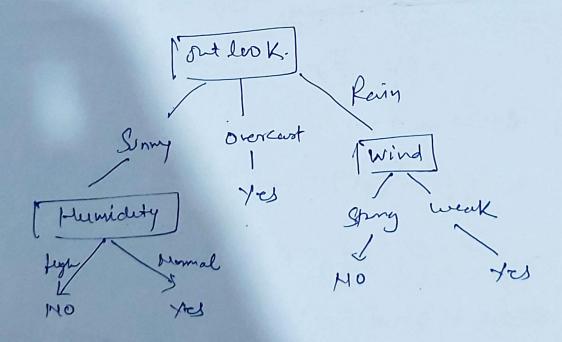
Diagnosis 2 Allergy

Diagnosis = cold.

## Oscate a Decision tree for given feellowing Data! -

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| Day but look tem hurgh week blo  Sonny hurgh week blo  Sonny "  Shong mo  Shong mo  Courant "  Weak Yey  Rain mild "  Frain or cold Hornal "  Rein "  Formy Ho  Formy Mo  Sonny mild tugh week to  Ray mild "  Ray mild "  Sonny mild "  Ray mild "  Ray formy yed  To correct "  Ray mild "  Ray formy yed  Ray mild tugh week "  Ray mild "  Ray formy yed  Ray mild tugh week "  Ray formy yed  Ray mild tugh week "  Ray formy yed  Ray formy yed  Ray formal week "  Ray formy yed  Ray formy yed  Ray formy yed  Ray formal week "  Ray formy yed  Ray formy yed  Ray formy yed  Ray formal week "  Ray formy yed  Ray formy yed  Ray formy yed  Ray formal week "  Ray formy yed  R |      |  | 1    | tunidity [ | wind  | Play. |
|--|------|--|------|------------|-------|-------|
| Sonny 11 Sbong mo  Sonny " " " Sbong mo  Covercent " " " " " " " " " " " " " " " " " " "   | Day  | out look   | Tem  | 1          |       | 610   |
| Sunny " " Spong.  3 Ourcast " " " weak Yey  4 Rain mild " " " "  5 Rain · Cold Hornal " " "  6 Rain " " " " Shry Ho  7 Overcast " " " " " Yes  8 Sunny mild Hugh week Ho  9 " cold hornal " Yes  10 Rain mild " " Yes  11 Sunny " " Shry yes  12 overcast " Heigh " " " " " " " " " " " " " " " " " " "  | 1    | Sonny  | Ged  |            |       |       |
| Journant " " weak Yel  Y Rain mild " " " " " " " " " " " " " " " " " " "   |      | Conwy  | 1)   | 11         | Sporg |       |
| Y Rain mild "" ""  S Rain mild "" ""  S Rain Cold Hornal "" ""  G Rain " " "" Shry Ho  Torcreart "" "" "" Yes  Sonny mild Hugh week Ho  O " cold homal " " Yes  10 Rain mild " " " Yes  11 Sonny " " Shry yes  12 overcant " Heigh " " ""  13 " Hot homal lever "  | 2    |  | 79   | 1)         | Weak  | rey.  |
| Rain Mild  Rain Mild  Rain Cold Hormal  Shring Ho  Rain II II Shring Ho  Rain II II II Shring Ho  Rain III II II II Yes  Rain mild Hugh Week Ho  Rain mild II Yes  II Sonny II II String yes  II overcast II beigh II II  II hot homal break II  | 3    | Orricast   | //   |            | 11    | ,     |
| Rain - Cold Hormal "" ""  6 Rain " " " " Shrry Ho  7 overcent " " " " Yes  8 Sonny mild Hugh week Ho  9 " cold womal " Yes  10 Rain mild " " Yes  11 Sonny " " Stry yes  12 overcent " Heigh " " " " " " " " " " " " " " " " " " "   | 4    | Rain   | mild | 1)         |       |       |
| Rain Cod Shry Ho  Fain "  Frain "  Shry Ho  They have the search of the  |      |  | 1-6  | Hormal     | ",    | 11    |
| Frain "" "" "" Yes  8 Sonny mild trugh week tro  9 " cold womed " Yes  10 Rain mild " " Yes  11 Sonny " " Sonny yes  12 overcast " Heigh " " "  13 " Hot Mornal week "   | - 3  | Konn.  | Cog  |            | Chan  | No    |
| 8 Sunny anild trugh week to 9 " cold womed " Yes 10 Rain mild " " Yes 11 Sunny " Yes 12 overcast " Heigh " " 13 " Hut Mornal week "  | 6    | Rain   | l II | • 1        | Sirie |       |
| 9 " cold womed " Yes  10 Rosn mild " " Yes  11 Sonny " Stry yes  12 overcast " Heigh " "  13 " Hot Mornal week "   | 7    | overcust   | ,,   | 1)         | 1)    | Yes   |
| 10 Rain mild "1 1' Yes  10 Rain mild "1 1' Yes  11 Sonny "1 "1 Strong yes  12 overcast "1 Heigh "1 "  13 "1 Hot. Homal week "1   | 8    | sonny  | mild | tugh       | week  | Mo    |
| 10 Rain mild " " Ves  11 Sonny " " Stry yes  12 overcast " Heigh " "  13 " Hot Momal week "  | 9    | 1)   | cold | Womal      | '1    | Y-es  |
| 12 overcast 11 teigh 11 19 13 11 test. Hermal week 11  | 10   | Rain   | mild | .,         | 11    |       |
| 12 overlast 11 telgh 11 11 11 11 11 11 11 11 11 11 11 11 11  | _ 11 | Sonny  | 3 11 |            | Stone | Yel   |
|  | 12   | ourcast  | ,1   | heigh      | 11    | "     |
| 14 Rain mild teigh Strung HO   | 13   | The second secon | hot. | Hornal     | beck  | . '/  |
|  | 17   | Rain   | mild | Heigh      | Shing | HO    |



CART > CiviCs) = |aini (E) = 1- & P5 2 - fraph/Id Iterative Dichotomiser 3 Classfretion & Regnession tre. arin Index

rad.

CART ( Claimficetion & Regression bees) - Decision tree.

hini Index: - Brobability of each class: 
Sum of squared probability of each

class: we can fermulate it as below: 
hini = 1 - & (Pi)<sup>2</sup> for i=1 to number

of classes.

Sunny oversant sain

| york     | Yes . | No | ho. of instances |
|----------|-------|----|------------------|
| Sunny    | 2     | 3  | 5                |
| Overcast | 4     | 0  | 4                |
| Rain     | 3     | 2  | 5,               |
|          |       |    |                  |

aini(adlook) = 0.342 chini(temp) = 0.439 chini(Humbhy) = 0.367 chini(wind) = 0.428

lowest lost

