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BE IT

8048

MLA Theory Assignment 1

Q.1 Discuss machine learning applications in the following area:

a. Biometrics   b. Medical diagnosis   c. Share Market

d. Speech recognition

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a. Biometrics:-

Machine learning has made the functioning of biometrics identification possible & has also made much advancement in biometric pattern recognition. The unsupervised scientific algorithms are designed for biometric applications which are mainly focused on specific data protection by encrypting biometric information, biometric data extraction, feature level fusion, behavioral pattern detection among others. Besides, biometric systems which have been implementated by using unsupervised learning ensures better learning policies & registration, successively allowing better classification & expect exact proof localization of biometric features.
Supervised learning has been serving for numerous biometric applications by using a large number of algorithms. In contradistinction to unsupervised learning, which only uses mainly k-means algorithm for biometric applications, supervised education offers a variety of approaches for biometric pattern classification principally.

b. Medical diagnosis:-

One of the chief ML applications in healthcare is the identification & diagnosis of diseases & ailments which are otherwise considered hard-to-diagnose. This can include anything from cancers which are tough to catch during the initial stages, to other genetic diseases.

c. Share market:-

ML has the potential to ease the whole process in share marketing by analyzing large chunks of data, spotting significant patterns & generating a single output that navigates traders towards a particular decision based on predicted asset prices.

d. Speech recognition:-

Speech recognition is a process of converting voice instructions into text & it is also known as "speech to text" or "Computer speech recognition". At present, ML algorithms are widely used by various applications of speech recognition. Google assistant, Siri, Cortana & Alexa are using speech recognition technology to follow the voice instructions.

Q.2. Differentiate between supervised & unsupervised learning. Give the examples of each learning type.

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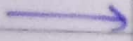
Supervised learning	Unsupervised learning
① Algorithms are trained using labelled data.	① Algorithms are trained using unlabelled data.
② Model takes direct feedback to check if it is predicting correct output or not.	② Model does not take any feedback.
③ Model predicts the output.	③ Model finds the hidden pattern in data.
④ Input data is provided to the model along with the output.	④ Only input data is provided to the model.
⑤ Needs supervision to train the model.	⑤ Does not need any supervision to train the model.
⑥ Example:- Filtering emails as spam or not spam.	⑥ Example:- Finding customer segments.

Q.3. Consider following 3 class confusion matrix.
Calculate Precision & recall per class. Also calculate
weighted average precision & recall for the classifier.

	Predicted		
	15	2	3
Actual	7	15	8
	2	3	45

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① Precision = $\dfrac{\text{True Positive (TP)}}{\text{True Positive (TP)} + \text{False Positive (FP)}}$

Precision of class A = $\dfrac{15}{15 + 2 + 7 + 2}$ $= \dfrac{15}{24} = \dfrac{5}{8} = 0.625$

Precision of class B = $\dfrac{15}{15 + 2 + 3}$ $= \dfrac{15}{20} = \dfrac{3}{4} = 0.75$

Precision of class C = $\dfrac{45}{45 + 3 + 8}$ $= \dfrac{45}{56} = 0.8035$

② Recall = $\dfrac{\text{True Positive (TP)}}{\text{True Positive (TP)} + \text{False Negative (FN)}}$

Recall of class A = $\dfrac{15}{15 + 2 + 3}$ $= \dfrac{15}{20} = \dfrac{3}{4} = 0.75$

Recall of class B = $\dfrac{15}{15+7+8}$ = $\dfrac{15}{30}$ = $\dfrac{1}{2}$ = 0.5

Recall of class C = $\dfrac{45}{45+2+3}$ = $\dfrac{45}{50}$ = $\dfrac{9}{10}$ = 0.9

③ Weighted average precision = $\displaystyle\sum_{i=1}^{j} \dfrac{N_j \times \text{precision of class } C_j}{\text{Total no. of instances}}$

where j is total number of classes,
   N_i is total number of instances in class i

Weighted average precision = $\dfrac{20}{100} \times 0.635 + \dfrac{30}{100} \times 0.75 +$

$\dfrac{50}{100} \times 0.8035$
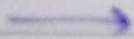
= 0.125 + 0.225 + 0.40175

= 0.75175

Recall = $\dfrac{1}{j} \displaystyle\sum_{i=1}^{j}$ recall of classifier i

where j is total number of classes
Recall of classifier = $\dfrac{1}{3} (0.75 + 0.5 + 0.9)$

= $\dfrac{1}{3} \times$ 2.15

= 0.716

Q.1. Prove That:

   i. FPR = 1 - TNR   ii. FNR = 1 - TPR

$\longrightarrow$

i. RHS = 1 - TNR

$$\text{Using } TNR = \frac{TN}{TN+FP}$$

$$= 1 - \frac{TN}{TN+FP}$$

$$= \frac{FP+TN-TN}{FP+TN}$$

$$= \frac{FP}{FP+TN}$$

$$\text{Using } FPR = \frac{FP}{FP+TN}$$

$$= FPR$$

$$= LHS$$

$$\therefore FPR = 1 - TNR$$

ii.   RHS = 1 - TPR

$$\text{Using } TPR = \frac{TP}{TP+FN}$$

$$= 1 - \frac{TP}{TP+FN}$$

$$= \frac{TP+FN-TP}{TP+FN}$$

$$= \frac{FN}{FN+TP}$$

Using $FNR = \dfrac{FN}{FN+TP}$

$$= FNR$$
$$= LHS$$

$\therefore FNR = 1 - TPR$