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Assignment - 6
Data Mining

Assignment

Each sample has probability of $(1/n)$ of being selected as test data. As the variance in each record is assigned with an equal weight of $1/n$ (1/n of records). Boosting keeps note

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Construction process

Step 1: The dataset will be divided into samples of used sampling and replacement method.

Step 2: A classifier will be designed for each bootstrap samples. A classifier will be trained on the training samples and test the test samples to each and

HW 5Problem 1

Symmetric: Relation R on A is symmetric if for every $(x, y) \in R$ we have $(y, x) \in R$.

Transitive: if whenever xRy and yRz then xRz .

Given $A = \{1, 2, 4, 7\}$

let R be relation on A , where

$$R = \{(1, 1), (1, 2), (1, 4), (2, 7), (2, 4), (4, 7)\}$$

case (i) $(1, 2) \in R$ & $(2, 4) \in R \Rightarrow (1, 4) \in R$

Similarly $(2, 4) \in R$ & $(4, 7) \in R \Rightarrow (2, 7) \in R$.

$\therefore R$ is transitive

Case (ii) $(1, 2) \in R$ but $(2, 1) \notin R$.

$\therefore R$ is not symmetric.

Problem 2:

Given $f: \mathbb{R} \rightarrow [-2, 2]$ & $f(x) = \sin(x) + \cos(x)$

* If f is injective, $f(a) = f(b) \Rightarrow a = b$.

let us consider $0, 2\pi \in \mathbb{R}$.

$$f(0) = \sin(0) + \cos(0) = 0 + 1 = 1$$

$$f(2\pi) = \sin(2\pi) + \cos(2\pi)$$

$$= 0 + 1 = 1$$

$$f(0) = f(2\pi)$$

$$\text{but } 0 \neq 2\pi.$$

\therefore the given function $f(x)$ is not injective — (1)

* $f: A \rightarrow B$ is a surjective if for every $b \in B$ there is some $a \in A$ such that $f(a) = b$

$$\text{Consider } 2, 2 \in [-2, 2]$$

$$\text{Assume } x \in \mathbb{R} \Rightarrow f(x) = 2$$

$$\Rightarrow \sin(x) + \cos(x) = 2 = 1 + 1$$

WKT. Range of $\sin(x), \cos(x)$ is $-1 \leq \sin(x), \cos(x) \leq 1 \forall x \in \mathbb{R}$.

\therefore the maximum value for $\sin(x), \cos(x)$ should be 1 each

$$\Rightarrow \sin(x) = 1, \cos(x) = 1$$

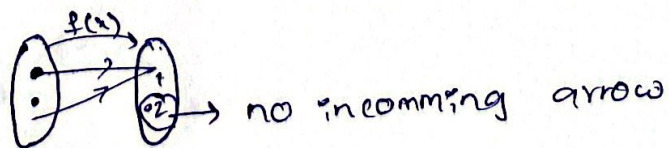
$$\Rightarrow \sin^2(x) + \cos^2(x) = 1^2 + 1^2 = 1 + 1 = 2$$

$$\text{But } \sin^2(x) + \cos^2(x) = 1 \forall x \in \mathbb{R}.$$

$$\Rightarrow 2 = 1$$

This is a contradiction, there is no $x \in \mathbb{R}$ such that

$$f(x) = 2.$$



$\therefore f(x)$ is not surjective — (2)

(3)

* A function is said to be bijjective if it is both injective and Surjective

from (1) & (2) $f(x)$ is not injective neither surjective

$\therefore f(x)$ is not bijective by the definition

\Rightarrow The given function $f(x)$ is not injective, not surjective and not bijective.

Problem 3

$$f: \mathbb{R} \setminus \{1\} \rightarrow \mathbb{R} \setminus \{2\} \quad \& \quad f(x) = \frac{2x-7}{x-1}$$

$$f(x) = \frac{2x-7}{x-1}$$

$$= \frac{2x-2}{x-1} \cdot \frac{-5}{x-1}$$

$$= 2 \left[\frac{x-1}{x-1} \right] - \frac{5}{x-1}$$

$$= 2 - \frac{5}{x-1}$$

* $x \in \mathbb{R} \setminus \{1\}$ there exists $y \in \mathbb{R} \setminus \{2\}$ [injective]
 & * $y \in \mathbb{R} \setminus \{2\}$ there exists $x \in \mathbb{R} \setminus \{1\}$ [surjective]
 where $y = f(x)$

\therefore the function is bijective.

(4)

let $f(x) = y \Rightarrow x = f^{-1}(y)$

$\Rightarrow x = f^{-1}(y) \quad (\rightarrow y)$

$$y = f(x) = \frac{2x-7}{x-1}$$

$$y(x-1) = 2x-7$$

$$yx - y = 2x - 7$$

$$7 - y = 2x - yx$$

$$7 - y = x(2 - y)$$

$$\frac{7-y}{2-y} = x$$

$$\Rightarrow x = \frac{7-y}{2-y}$$

$$f^{-1}(y) = \frac{7-y}{2-y}$$

$$\Rightarrow f^{-1}(x) = \frac{7-x}{2-x}$$

$$\forall x \in \mathbb{R} \setminus \{2\}$$

Problem 4

③

$$f: A \rightarrow B \quad \text{and} \quad g: B \rightarrow C$$

i) Suppose $g \circ f$ is injective.

Let $a, b \in A$.

$$\begin{aligned} \text{Suppose } f(a) = f(b) \quad \text{then } g \circ f(a) &= g(f(a)) \\ &= g(f(b)) \\ &= g \circ f(b) \end{aligned}$$

But since $g \circ f$ is injective $\Rightarrow a = b$

$$\therefore f(a) = f(b) \Rightarrow a = b$$

$\therefore f$ is injective \parallel

ii) Let $z \in C$

Since $g \circ f$ is surjective, there exist $x \in A$,

$$\text{such that } g \circ f(x) = g(f(x)) = z$$

\therefore if we let $y = f(x) \in B$, then.

$$\boxed{g(y) = z.}$$

$\therefore g$ is surjective \parallel