BIOMETRICS ASSIGNMENT-1

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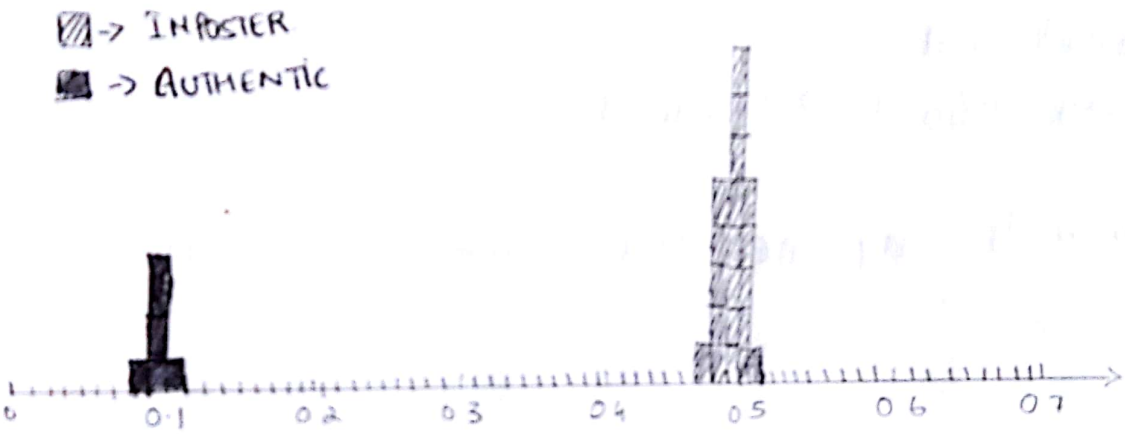
Q1) The genuine and imposter distributions for the five subjects (1) IRIS Match Score :-



Now to plot the ROC curve we vary the threshold and plot the graph between FMR and TMR., where

$$FMR = \frac{\text{No. of false Match Results}}{\text{No. of false identity claims}}$$

$$TNR = 1 - FNMR = 1 - \frac{\text{No. of False Non-Match Results}}{\text{No. of True identity claims}}$$

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Now varying the thresholds,

(1) When threshold is 0.09

FMR = 0

TMR = 1/5 = 0.2

(2) When threshold is 0.1

FMR = 0

$TMR = \frac{4}{5} = 0.8$

(3) When threshold is 0.11

FMR = 0

TMR = 5/5 = 1

(4) When threshold is 0.2

$FMR = \frac{0}{20} = 0$

$TMR = \frac{5}{5} = 1$

(5) When threshold is 0.3

$FMR = \frac{0}{20} = 0$

$TMR = \frac{5}{5} = 1$

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(6) When threshold is 0.4

$$FMR = \frac{0}{20} = 0$$

$$TMR = \frac{5}{5} = 1$$

(7) When threshold is 0.48

$$FMR = \frac{1}{20} = 0.05$$

$$TMR = 1$$

(8) When threshold is 0.49

$$FMR = \frac{6}{20} = 0.3$$

$$TMR = 1$$

(9) When threshold is 0.5

$$FMR = 14/20 = 0.7$$

$$TMR = 5/5 = 1$$

(10) When threshold is 0.51

$$FMR = 19/20 = 0.95$$

$$TMR = 1$$

(11) When threshold is 0.52

$$FMR = 20/20 = 1$$

$$TMR = 5/5 = 1$$

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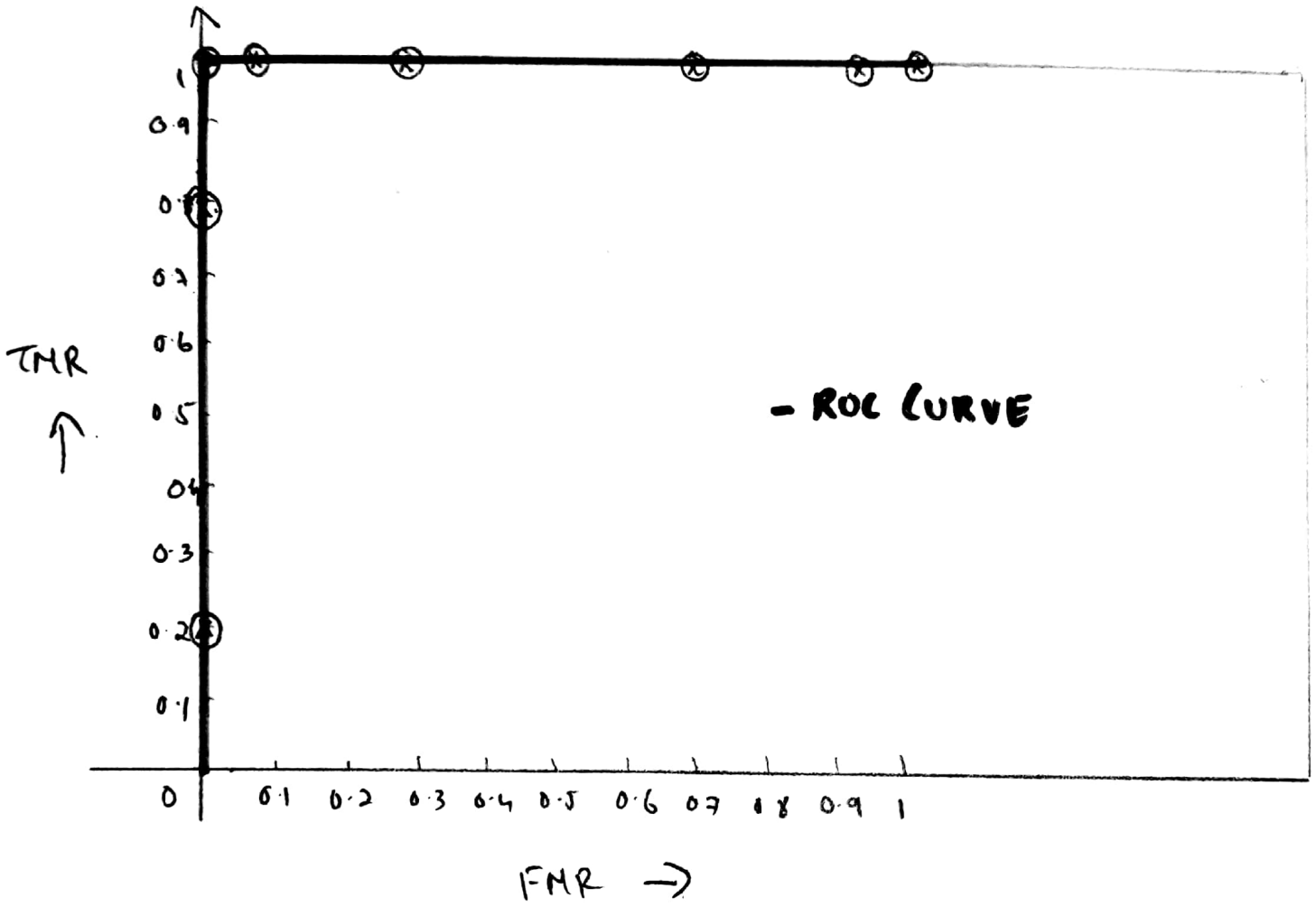

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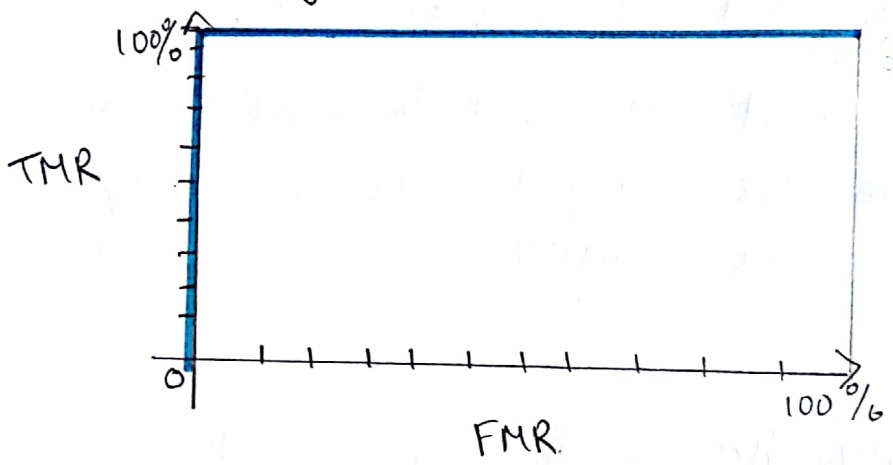
Q2) Perfect Biometrics :-

A perfect Biometrics, is one that shows no errors and matches all the TrueID claims that are present in the system correctly and precisely and rejects any false ID claim that are not in the system.

(i.e) 100% TMR and 0% FMR.

100% TMR is nothing but (1-FNMR) 100%.

ROC Curve for the above :-



Q3) Given

(i) The recognition system returns all the identities whose match score is above threshold.

(ii) The same threshold is used for both verification and recognition.

Yes, we can find the recognition error rates from verification error rates.

P.T.O

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Verification => 1:1

	Accept	Reject
True ID Claim =	True Match +	False non-match
False ID Claims =	False Match +	True non match.

Recognition => 1:N

	No Alarm	Alarm
Not On Watch List	True Negative	False Positive
~~Not~~ On Watch List	False Negative	True Positive

~~FAR~~ => FRR - False Reject Rate describes the proportion of identification in which a genuine subject is incorrectly rejected from a biometric system.

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→ FAR - False Accept Rate that describes the proportion in which an imposter subject was incorrectly matched to a genuine user template stored within a biometric system.

∴ Combining the Verification and Recognition Table.

→	True ID claims/ On Watch List	True Match/ True Positive.	False Non Math/ False Negative.
→	False ID claims / not on watch list	False Positive/ False Match.	True Negative/ True Non match.
		↑ Accept / Alarm	↑ Reject/ No Alarm.

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So to derive FAR, FPR from FAR

Here FNR ⇒ FNMR

FPR = FMR

$\therefore$ FAR = FMR × (1 − FTA)

[FAR = FPR × (1 − FTA)]

$\therefore$ $$FPR = \frac{FAR}{(1 - FTA)}$$

And to derive FNR from FRR

FRR = FTA + FNMR × (1 − FTA)

FRR = FTA + FNR (1 − FTA)

$$\left[\frac{FRR - FTA}{(1 - FTA)} = FNR\right]$$

where FTA - Failure to Acquire Rate (i.e) the proportions of the attempts for which the system fails to produce a sample of quality.

⇒ Recognition is more challenging than verification as

① Recognition might take more time when no: of biometric queries is high (since 1:N)

② Its performance will be less when no: of queries are high and in both case verification is better.

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