Identification Systems: List 1

1. Describe real-life cases when low FNMR (FRR) is significantly more important than low FMR (FAR).

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3. Explain the difference between **authentication** and **authorization**.

4. In a biometric system match distribution of similarity score is given by function $p_m(s)$, while non-match distribution by the function $p_n(s)$. Find FNMR and FMR for $T = 1$ and $T = 3/2$, if

$$p_n(s) = \begin{cases} 0, \text{ for } x < 0 \\ e^{-x}, \text{ for } x \geq 0 \end{cases}$$

$$p_m(s) = \begin{cases} 1/2, \text{for } 1 < x < 3 \\ 0, \text{ otherwise.} \end{cases}$$

5. Let us a biometric system with match and non-match distributions $p_n(s)$ and $p_m(s)$ described below. Find Receiver Operating Characteristic Curve and d-prime measure. What is minimal sum of errors ?

$$p_n(s) = \begin{cases} 1/5, \text{for } 1 < x < 6 \\ 0, \text{ otherwise.} \end{cases}$$

$$p_m(s) = \begin{cases} 1/5, \text{for } 5 < x < 10 \\ 0, \text{ otherwise.} \end{cases}$$

6. We have two (independent) biometrics with match and non-match distributions $p_n^{(1)}(s), p_m^{(1)}(s)$ and $p_n^{(2)}(s), p_m^{(2)}(s)$. Suggest a reasonable policy of accepting / rejecting a given subject. Find FMR, FNMR. What is smallest possible FMR if we demand FNMR $= 0$?

$$p_n^{(1)}(s) = \begin{cases} 1/2, \text{for } 1 < x < 3 \\ 0, \text{ otherwise.} \end{cases}$$

$$p_m^{(1)}(s) = \begin{cases} 1/2, \text{for } 2 < x < 4 \\ 0, \text{ otherwise.} \end{cases}$$

$$p_n^{(2)}(s) = \begin{cases} 1/2, \text{for } 6 < x < 8 \\ 0, \text{ otherwise.} \end{cases}$$

$$p_m^{(2)}(s) = \begin{cases} 1/2, \text{for } 7.5 < x < 9.5 \\ 0, \text{ otherwise.} \end{cases}$$

7. Why it is so difficult in practice to estimate non-match distribution $p_n(s)$?

8. We have a set of observations $\{(1,2),(-1,-2),(3,6.2),(4,7.9),(5,10.7),(0,0.2),(-2.3,-5.1)\}$. Use a gradient descent method to find a linear function of a form $y = \theta_1 x + \theta_2$ (for parameters θ_1, θ_2) for approximating a linear dependence in this set. Use different learning rates e.g $\alpha = 0.1, \alpha = 1, \alpha = 2$ and MSE as a cost function. Hint: use computer !