Genuine and Imposter Scores

Example: 2 users, A & B, each has 5 samples (A_i, B_j are feature vectors)

Genuine Scores: (Similarity measure, S)

User A:

S_A	A_1	A_2	A_3	A_4	A_5
A_1	∞	a_{12}	a_{13}	a_{14}	a_{15}
A_2	a_{21}	∞	a_{23}	a_{24}	a_{25}
A_3	a_{31}	a_{32}	∞	a_{34}	a_{35}
A_4	a_{41}	a_{42}	a_{43}	∞	a_{45}
A_5	a_{51}	a_{52}	a_{53}	a_{54}	∞

User B:

S_B	B_1	B_2	B_3	B_4	B_5
B_1	∞	b_{12}	b_{13}	b_{14}	b_{15}
B_2	b_{21}	∞	b_{23}	b_{24}	b_{25}
B_3	b_{31}	b_{32}	∞	b_{34}	b_{35}
B_4	b_{41}	b_{42}	b_{43}	∞	b_{45}
B_5	b_{51}	b_{52}	b_{53}	b_{54}	∞

Imposter Scores: A & B:

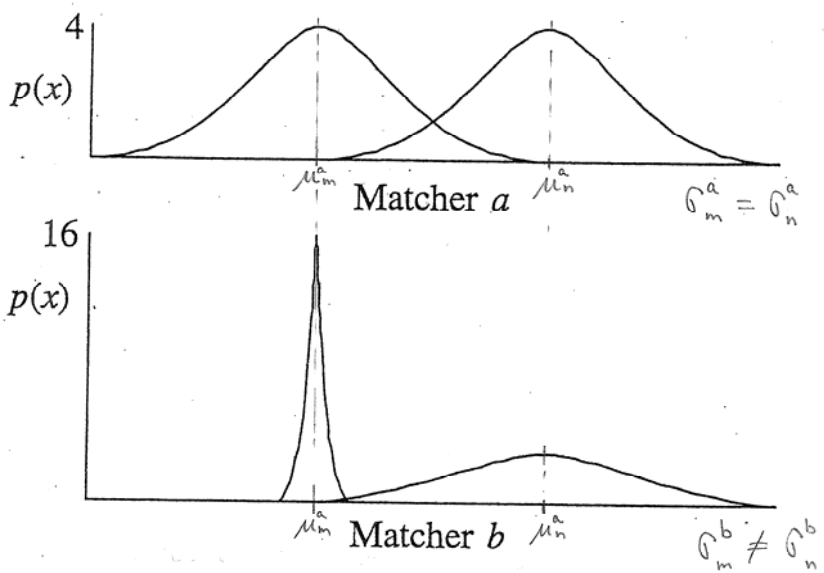
S_{AB}	B_1	B_2	B_3	B_4	B_5
A_1	ab_{11}	ab_{12}	ab_{13}	ab_{14}	ab_{15}
A_2	ab_{21}	ab_{22}	ab_{23}	ab_{24}	ab_{25}
A_3	ab_{31}	ab_{32}	ab_{33}	ab_{34}	ab_{35}
A_4	ab_{41}	ab_{42}	ab_{43}	ab_{44}	ab_{45}
A_5	ab_{51}	ab_{52}	ab_{53}	ab_{54}	ab_{55}

Genuine and Imposter Scores

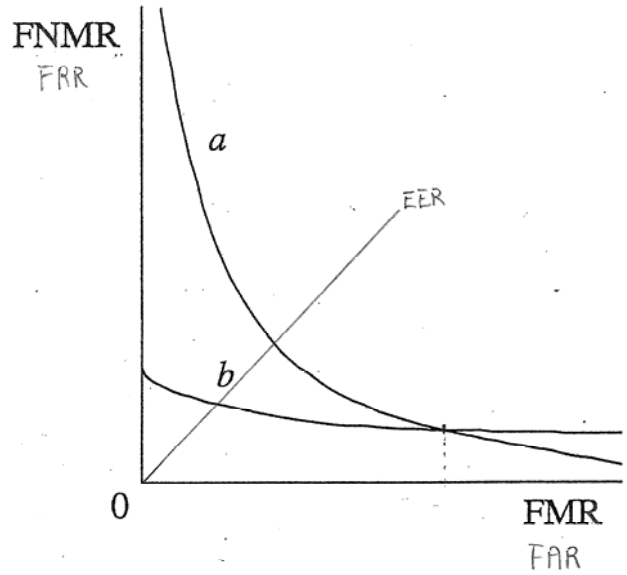
Set X =$\{X_1, \ldots, X_M\}$, is a set of M match (genuine) scores.
Example: $\{a_{12}, a_{13}, \ldots, a_{45}, b_{12}, b_{13}, \ldots, b_{45}\}$, M = 20

Set Y=$\{Y_1, \ldots, Y_N\}$, is a set of N non match (imposter) scores.
Example: $\{ab_{11}, ab_{12}, \ldots, ab_{55}\}$, N = 25

d-prime Value



Ref. [2] p. 76

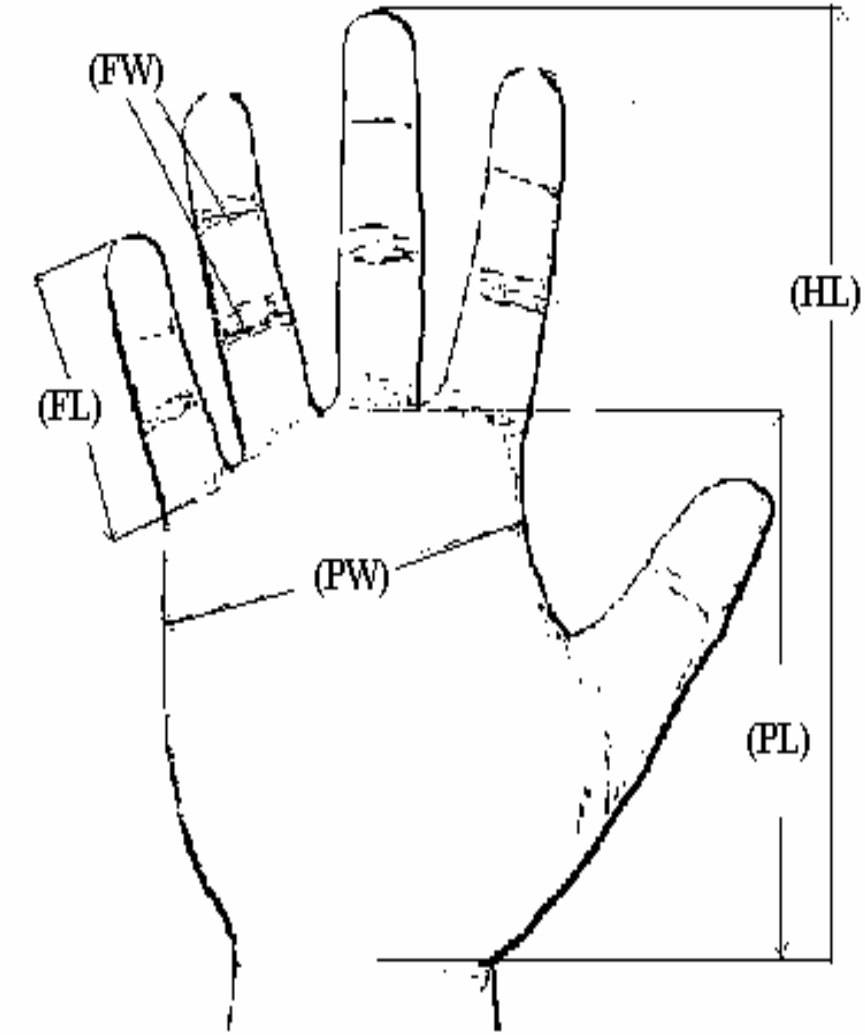


These two systems (matchers) have the same d-prime values
But their ROC are quite different. Which is better?

Representation: Hand Geometry features

Vector of 17 features

- **Finger length (FL) – 4**
- **Finger width (FW) – 8**
- **Palm width (PW)**
- **Palm Length (PL)**
- **Hand Length (HL)**
- **Hand Contour (HC)**
- **Hand Area (HA)**



Examples of Feature Vector – Hand Geometry

User 1:
Sample1:
320,365,354,292,113,89,111,89,112,95,103,91,914,470,584,4275,413574
Sample2:
320,378,361,298,113,89,109,90,113,93,105,90,926,469,590,4478,426774

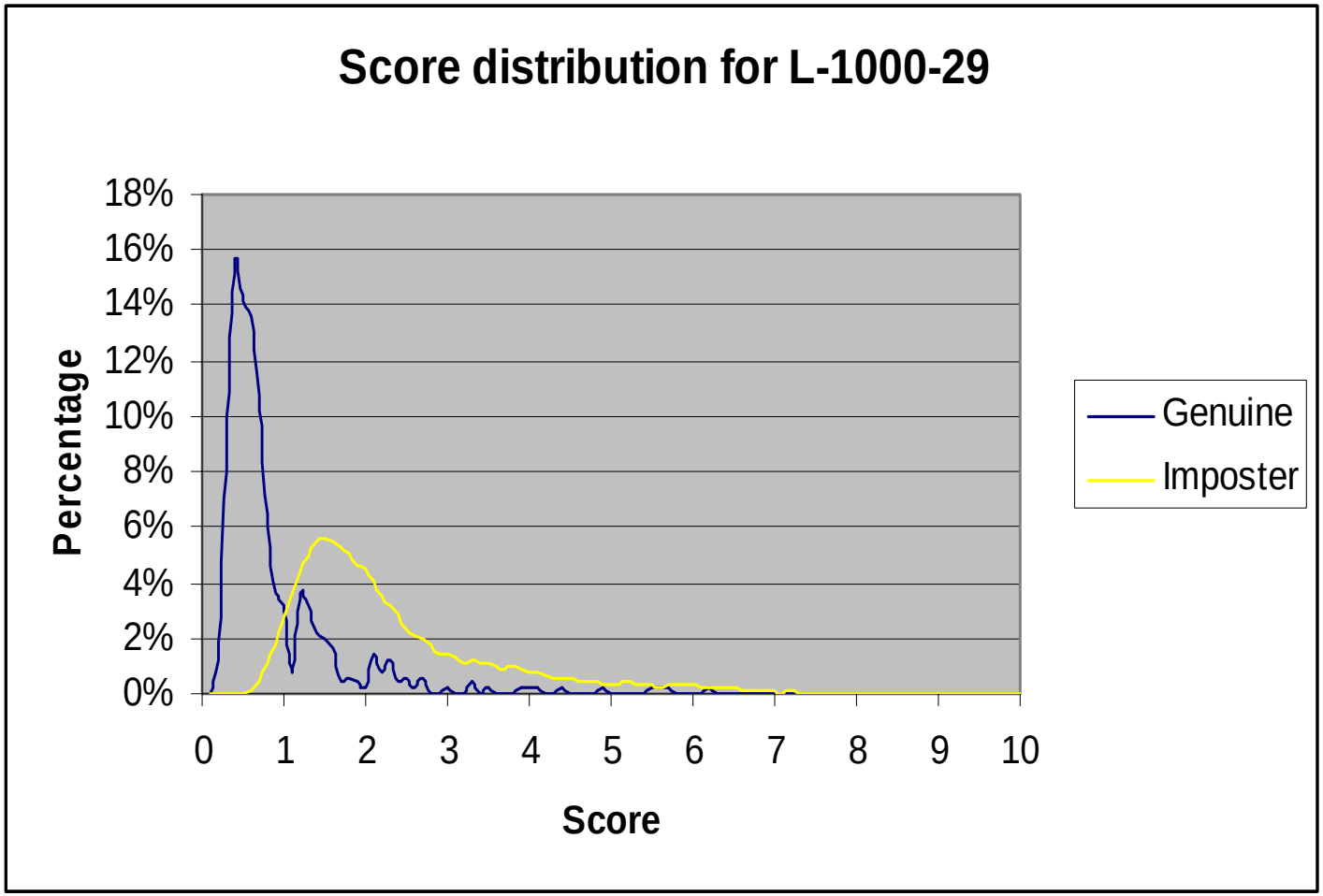
User 2:
Sample1:
346,387,349,278,92,80,95,87,86,78,78,70,868,428,538,4279,365147
Sample2:
335,382,349,277,93,84,93,85,87,78,78,69,871,432,542,4241,367027

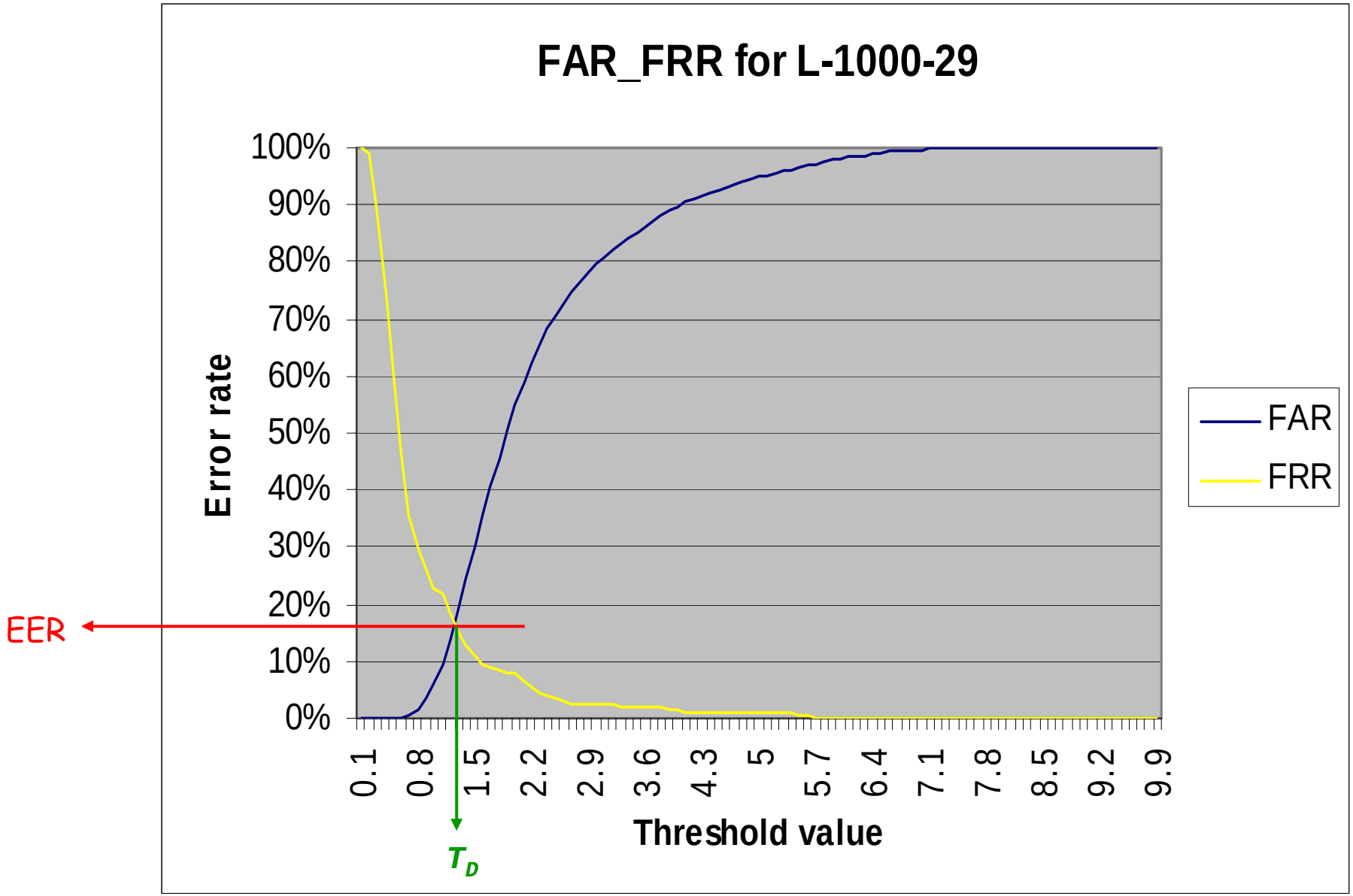
User 3:
Sample1:
315,402,380,294,97,79,94,89,88,82,80,75,911,451,544,4519,396858
Sample2:
334,400,382,298,92,80,95,90,97,87,80,75,884,444,519,4421,383321

User 4:
314,371,359,294,92,77,99,82,107,88,87,73,875,445,544,4175,365795
313,375,361,294,94,79,102,84,104,88,87,72,879,447,545,4187,368345

Matching Score Distribution

Distance Measure – 100 users, 10 samples each,
29 features




FAR_FRR for L-1000-29
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Error rate
0.1
0.8
1.5
2.2
2.9
3.6
4.3
5
5.7
6.4
7.1
7.8
8.5
9.2
9.9
Threshold value
FAR
FRR
EER
T_D

Estimation of the no. of scores from a given set of data

For a given set of feature vector, we have assumed

- set $X = \{X_1, \ldots, X_M\}$, is a set of M match (genuine) scores.

- set $Y = \{Y_1, \ldots, Y_N\}$, is a set of N non match (imposter) scores.

Q: What are the values of M and N, say for a database of 100 users and 10 samples each?

Estimation of the no. of scores from a given set of data

For a given set of feature vector, we have assumed

- set $X = \{X_1, \ldots, X_M\}$, is a set of M match (genuine) scores.
- set $Y = \{Y_1, \ldots, Y_N\}$, is a set of N non match (imposter) scores.

For 100 users, 10 samples each, M :

$$100 \times C_{10}^{2} = 100 \times \frac{(10)!}{(10-2)!\,(2)!} = 4{,}500$$

For Q users, P samples each, M :

$$Q \times C_{P}^{2} = Q \times \frac{(P)!}{(P-2)!\,(2)!}$$

For 100 users, 10 samples each, N:

$$C_{100}^{2} \times 10 \times 10 = \frac{(100)!}{(100-2)!\,(2)!} \times 100 = 495{,}000$$

For Q users, P samples each, N:

$$C_{Q}^{2} \times P \times P = \frac{(Q)!}{(Q-2)!\,(2)!} \times p^{2}$$

For Q users, P samples each, M:

$$C_{Q \times P}^{2} - M$$