

# Writer-dependent off-line signature verification system

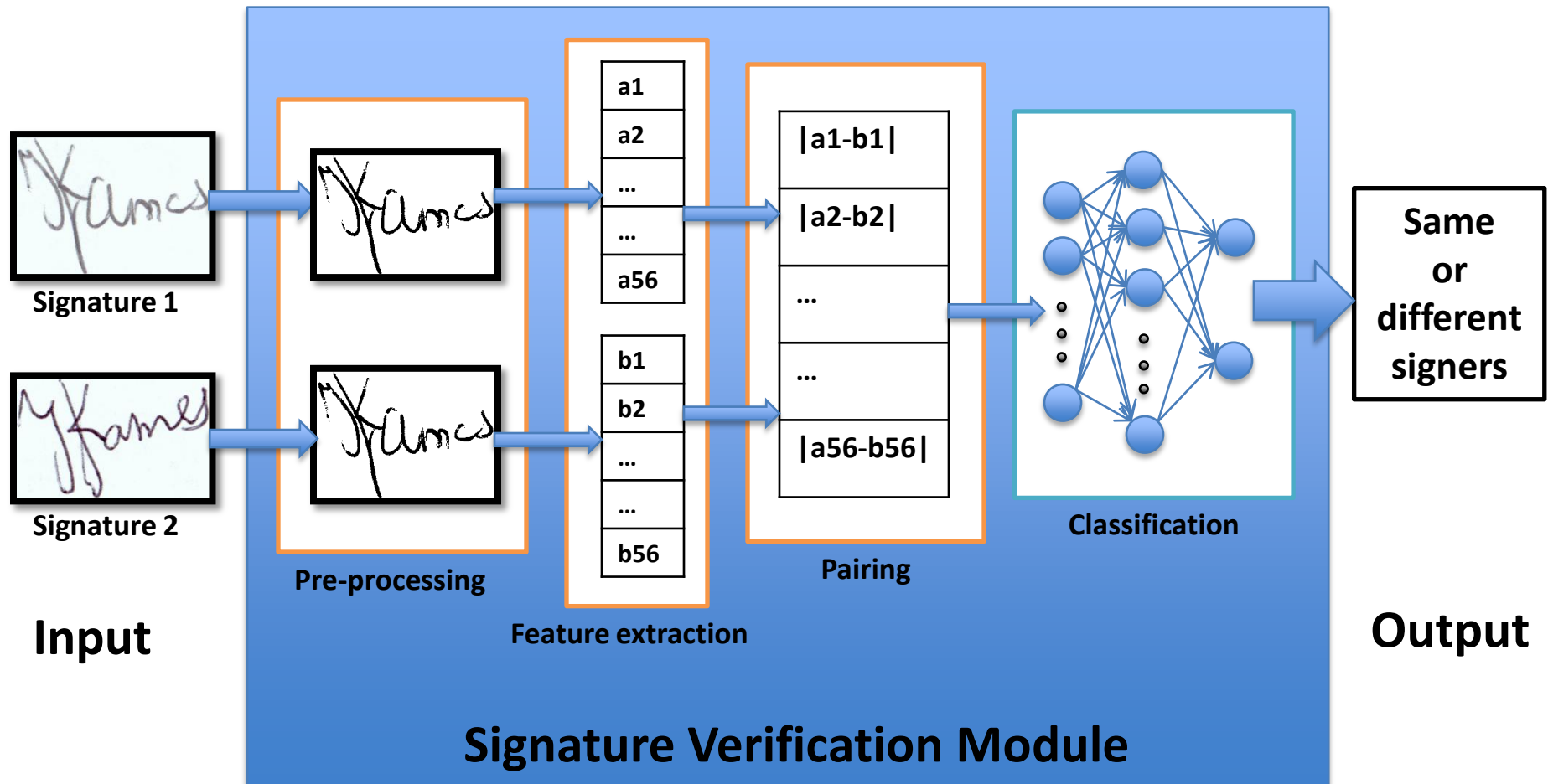
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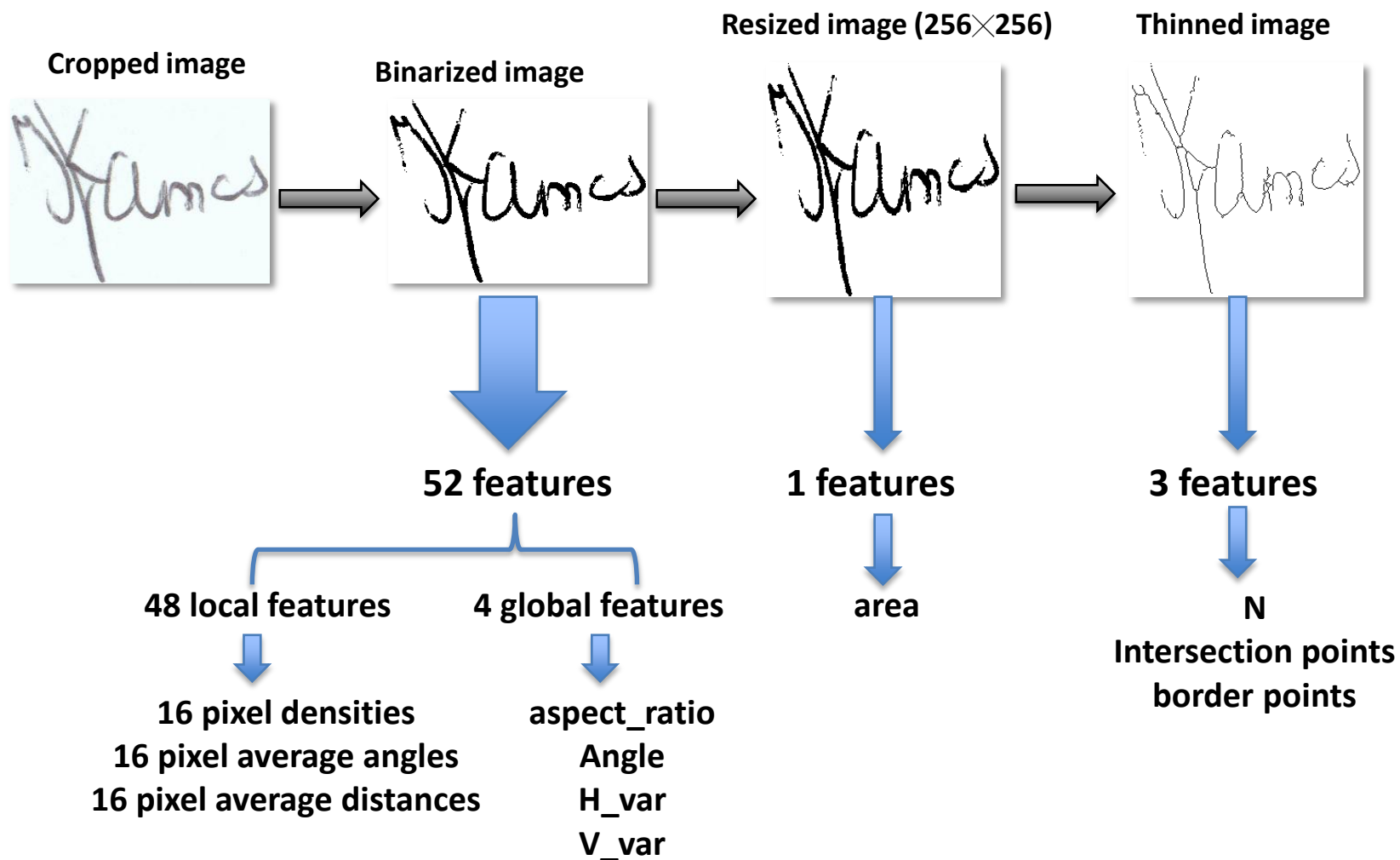
Spring 2018

# Verification System

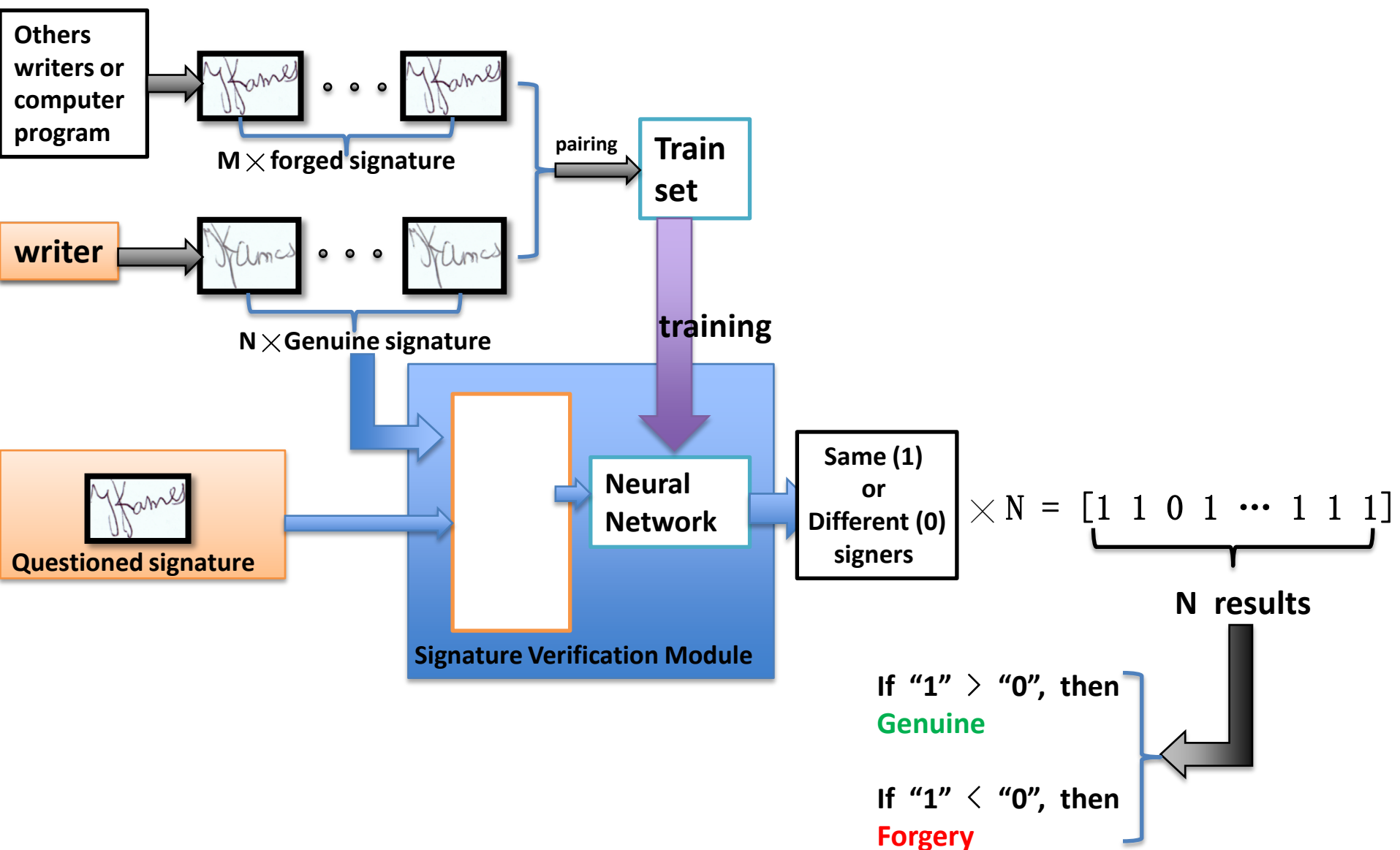


# Feature Extraction

Pre-processing results:



# Verification Process



# Experiment Evaluation Metrics

$$\text{FAR(False Acceptance Rate)} = \frac{\text{Number of forgeries accepted}}{\text{Number of forgeries tested}}$$

$$\text{FRR(False Rejection Rate)} = \frac{\text{Number of genuine signatures rejected}}{\text{Number of genuine signatures tested}}$$

$$\text{Accuracy} = \frac{\text{Number of signatures classified correctly}}{\text{Number of signatures tested}}$$

# Dataset 1

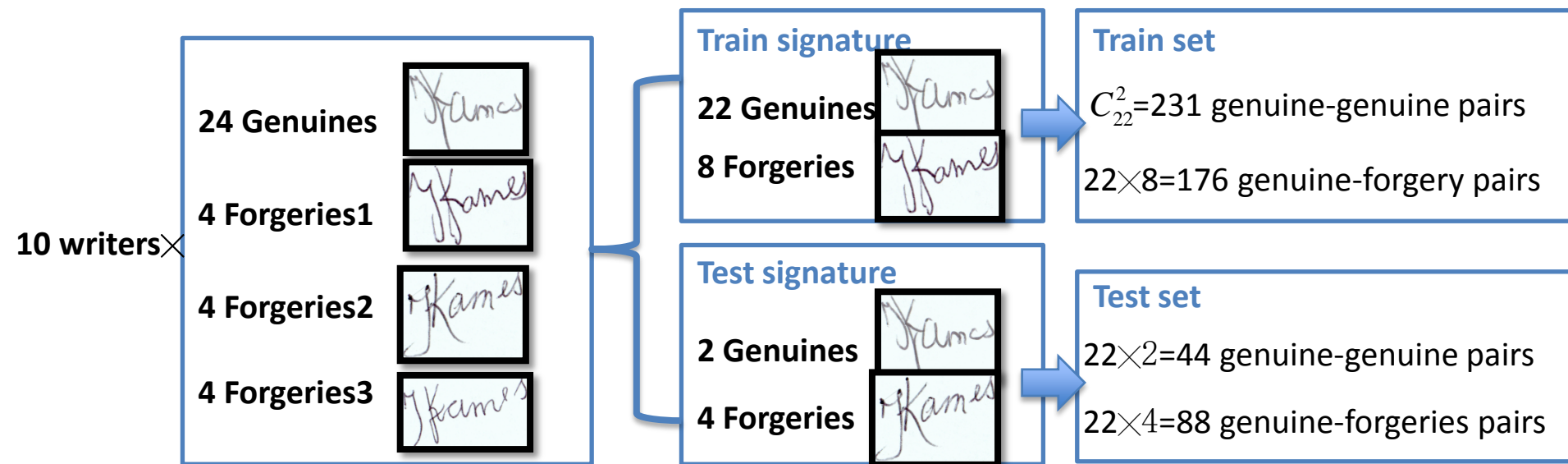
- International Conference on Document Analysis and Recognition (ICDAR) 2011 SigComp international signature verification competition

- The Dutch training set:

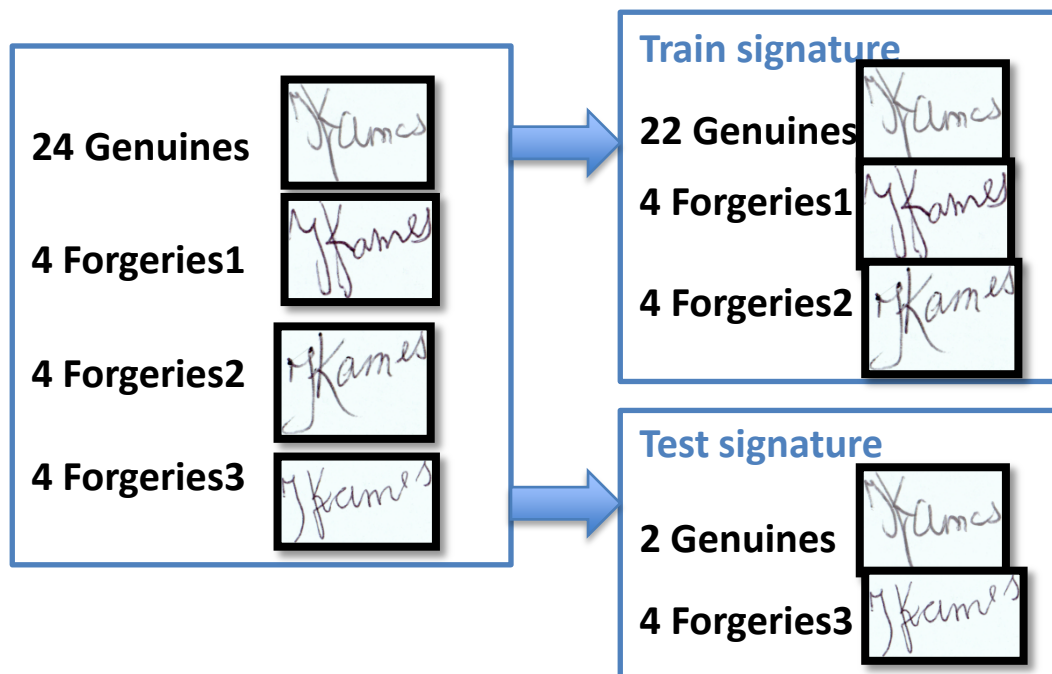
*Total of 361 signature images for 10 individuals*

*About 24 genuine signatures and 12 forged signatures for each individual*

*12 forged signatures come from 3 others forgery-writers, each one writes 4 forged signatures*

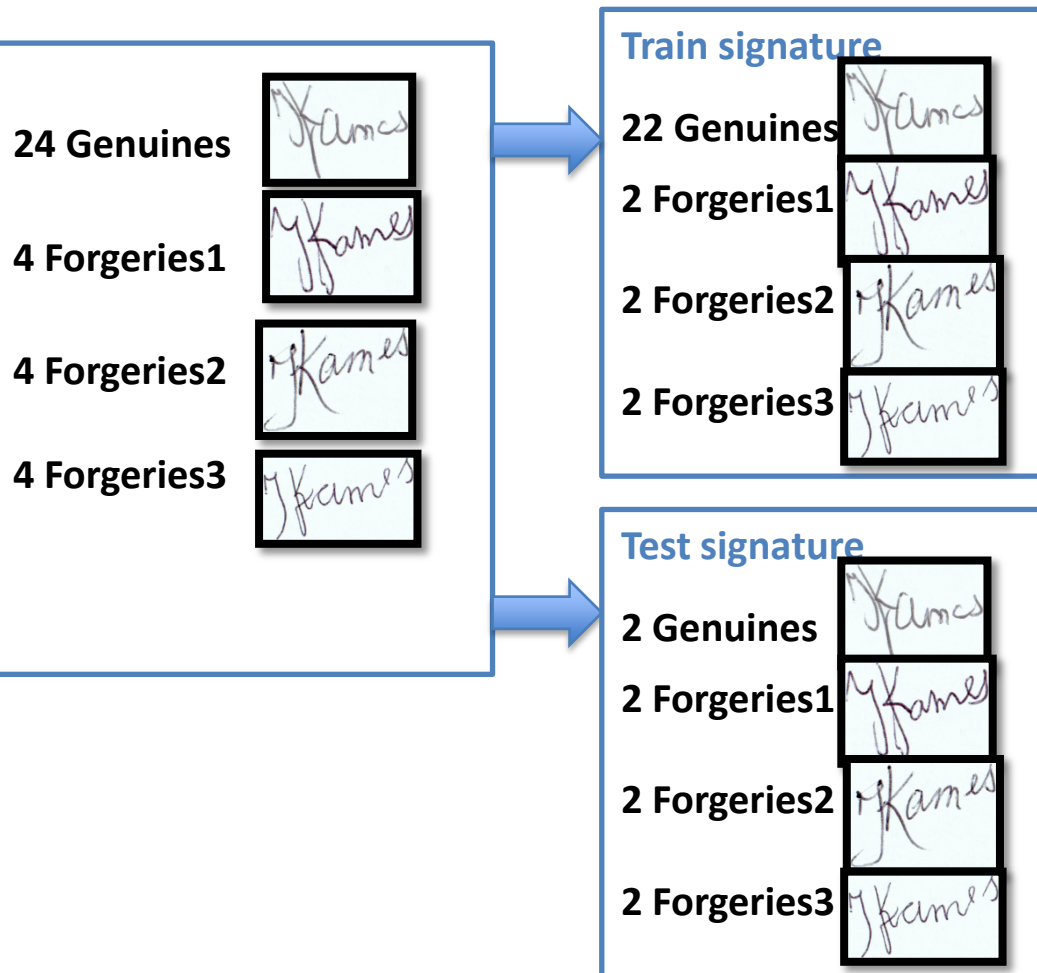


# Unseen forgery-writer test results (dataset 1)



	F_random	F_worst	F_middle	F_best
FAR	<u>10%</u> = 4/40	5% = 2/40	15% = 6/40	22.5% = 9/40
FRR	<u>0%</u> = 0/20	0% = 0/20	0% = 0/20	0% = 0/20
Accuracy	<u>93.3%</u> = 56/60	96.7% = 58/60	90% = 54/60	85% = 51/60

# All forgery-writers test results (dataset 1)



	F_all
FAR	6.6% = 4/60
FRR	0% = 0/20
TA	95% = 76/80

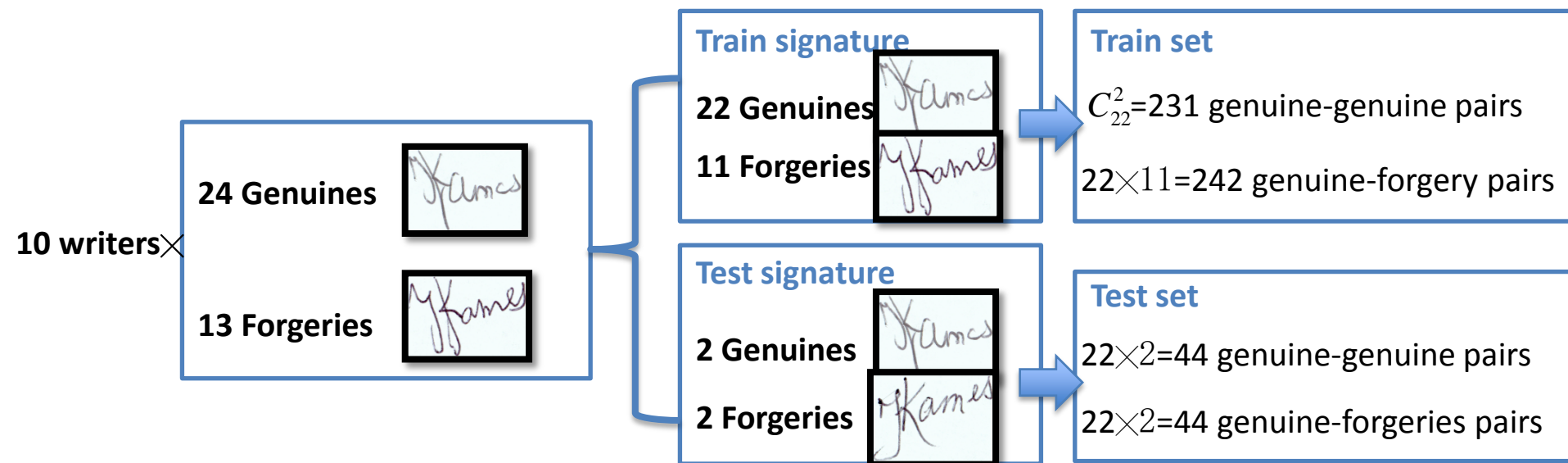


# Dataset 2

- GPDS synthetic Signature Corpus
- The dataset produced from above database contains:

*Total of 3700 signature images for 100 individuals*

*About 24 genuine signatures and 13 forged signatures for each individual*



# GPDS Corpus test results (dataset 2)

	Proposed system
FAR	<b>12% = 24/200</b>
FRR	<b>2% = 4/200</b>
TA	<b>93% = 372/400</b>

# Future works

- Produce more genuine signatures and forged signatures as train set  
More train data, more accurate!
- Design better feature  
More representative features, more accurate!
- Improve structure of Neural Network  
Better classifier, more accurate!

# Open question

## User6

Training accuracy: 100.0000%

TestF1 predictions: [0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0] True

TestF2 predictions: [0 0 0 1 0 0 0 1 1 1 1 1 0 0 0 1 1 0 0 1 1 0] True (12-10)

TestF3 predictions: [0 0 0 0 0 0 0 1 1 1 1 1 0 0 0 1 1 0 0 1 0 1] True (13-9)

TestF4 predictions: [0 0] True

TestG1 predictions: [1 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1] True

TestG2 predictions: [1 1] True

Test overall accuracy: 84.0909%

For second and third forged signature, after comparing with all 22 genuine signatures, produce more negative (0) results than positive (1) results, so system decide they are forged signature, that is true

But the number of negative (0) results and positive (1) results is very close

If for a questioned signature, the number of negative (0) results and positive (1) results is very close, how much can I trust the system's decision ?