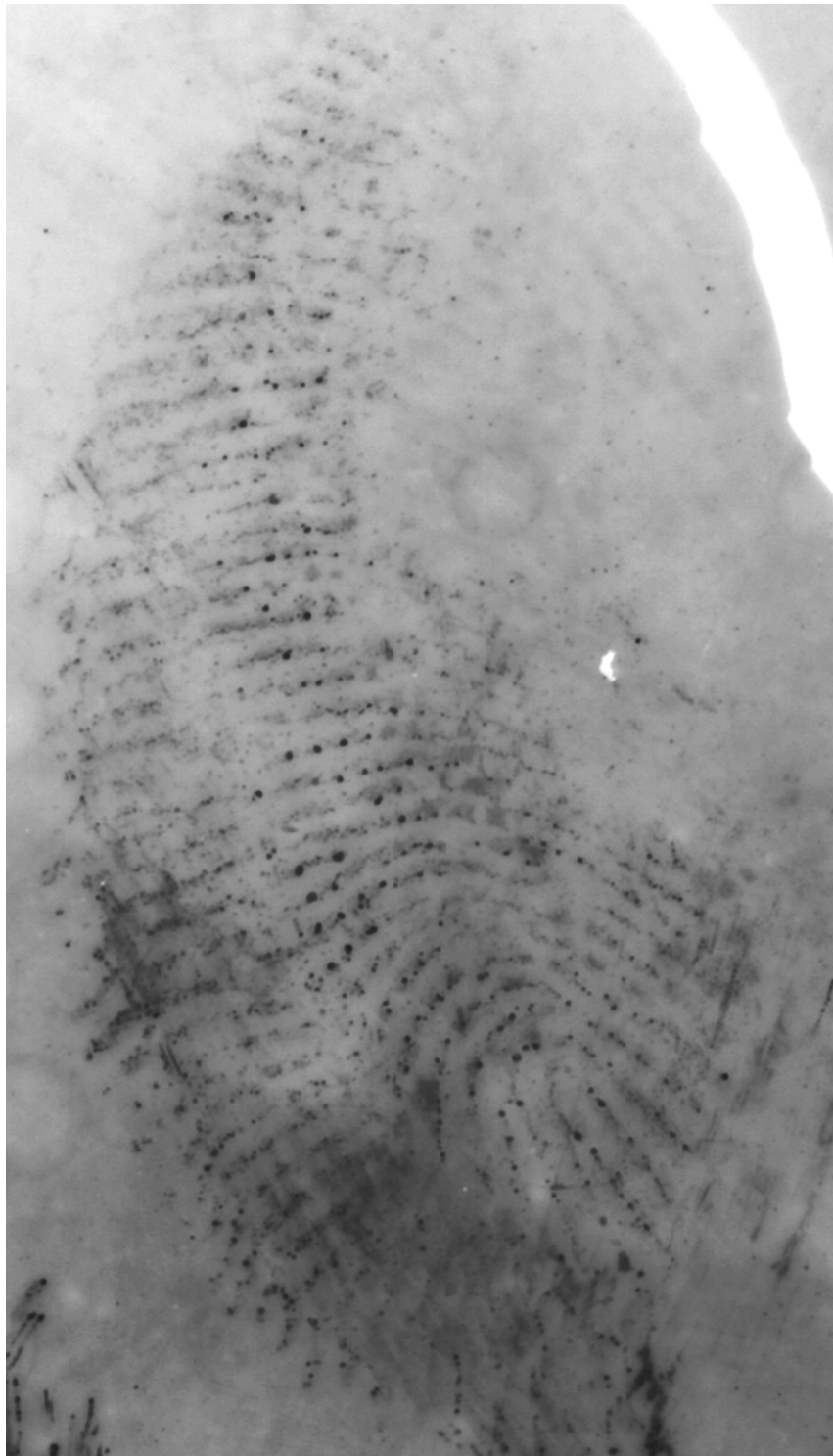


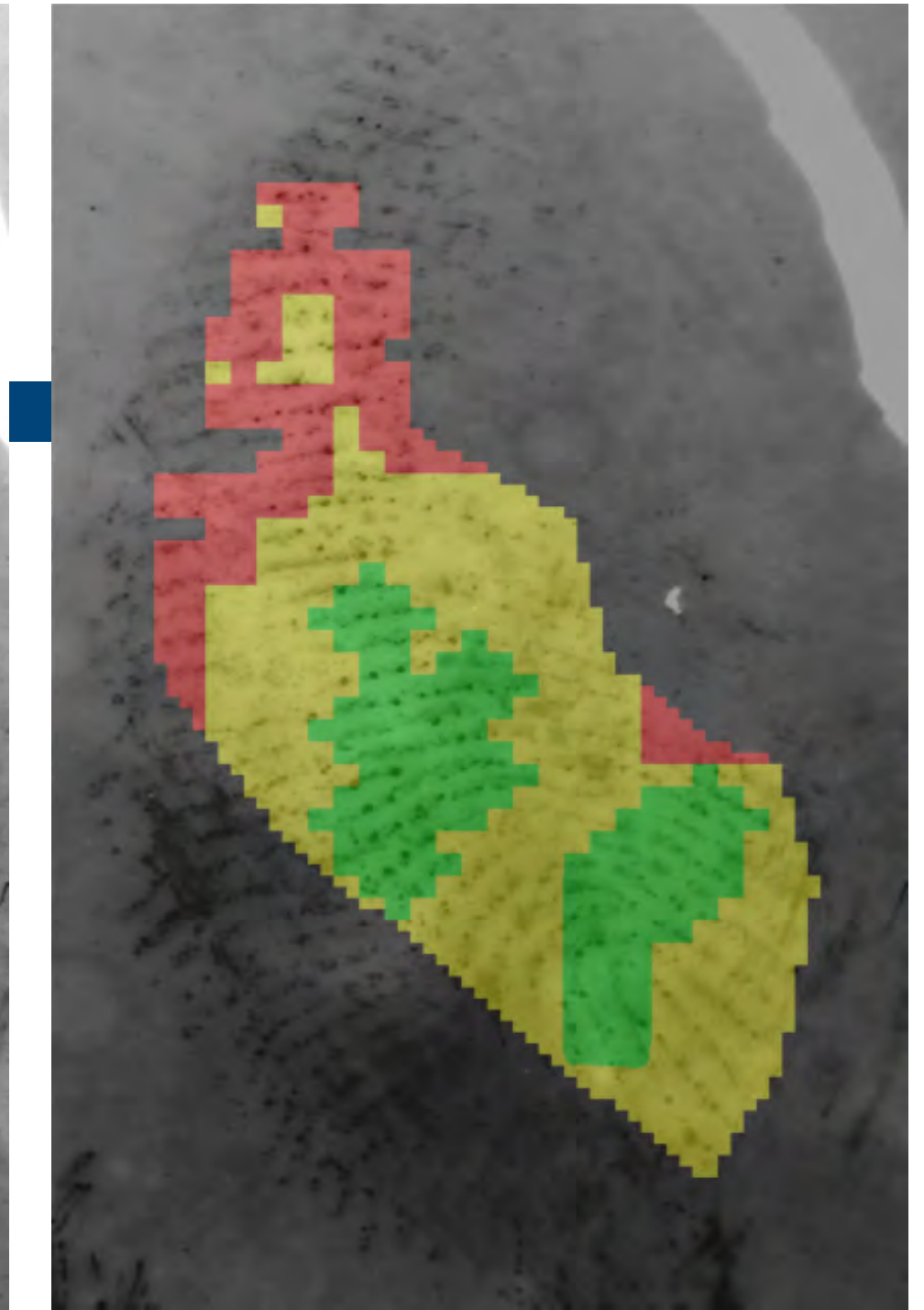
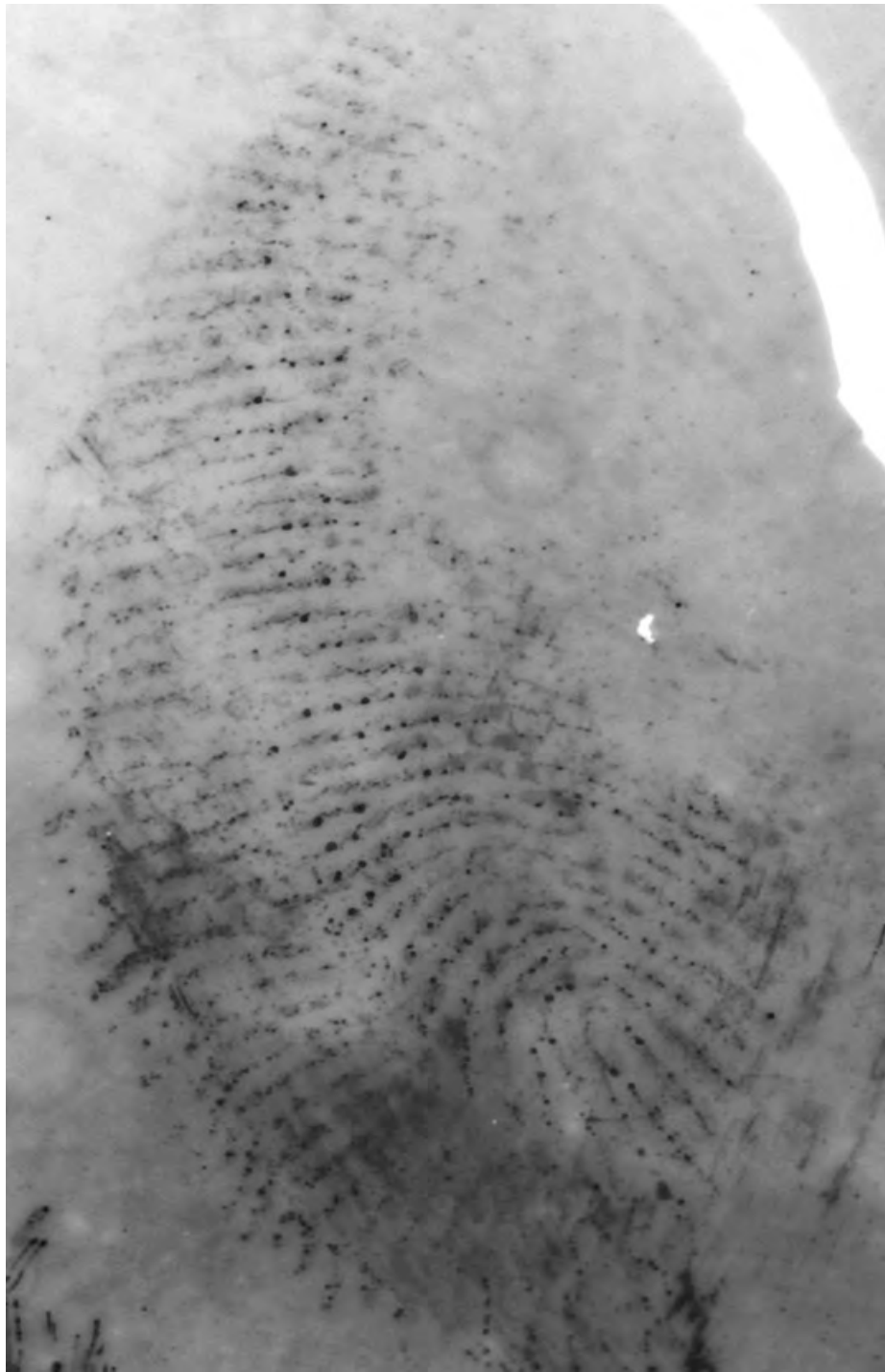
Uncertainty, Probability, and Statistics Workshop

Glenn Langenburg



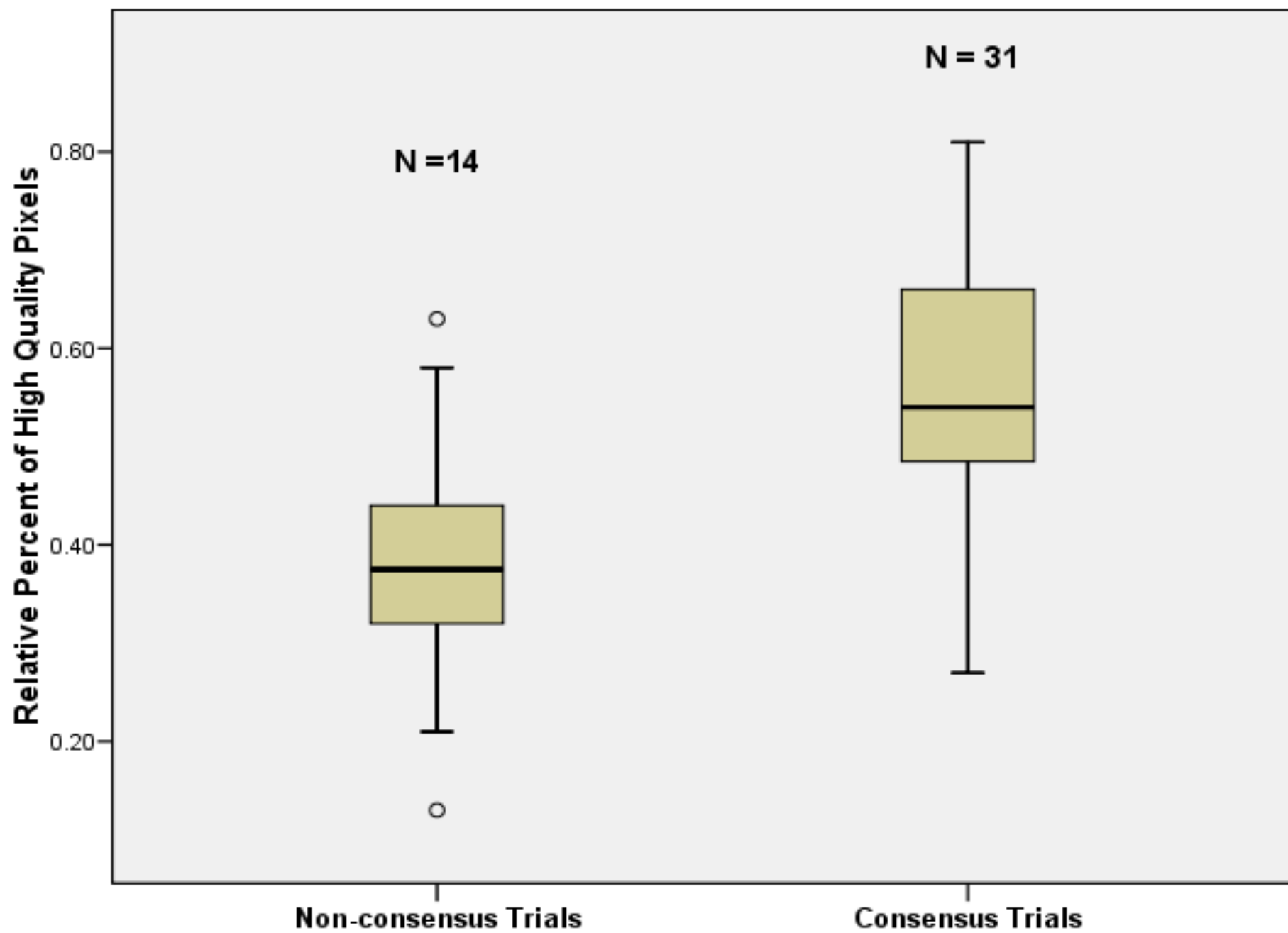


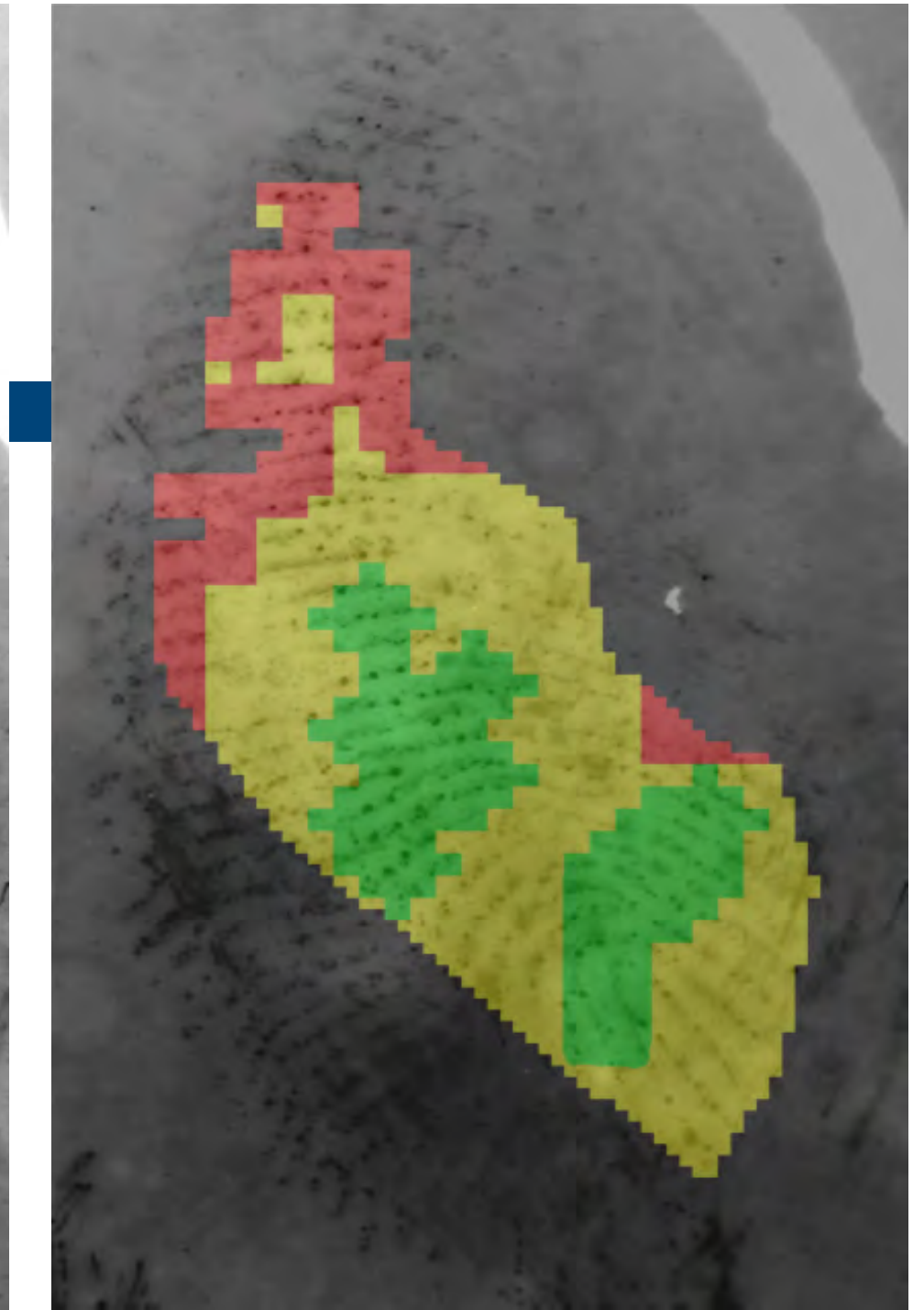
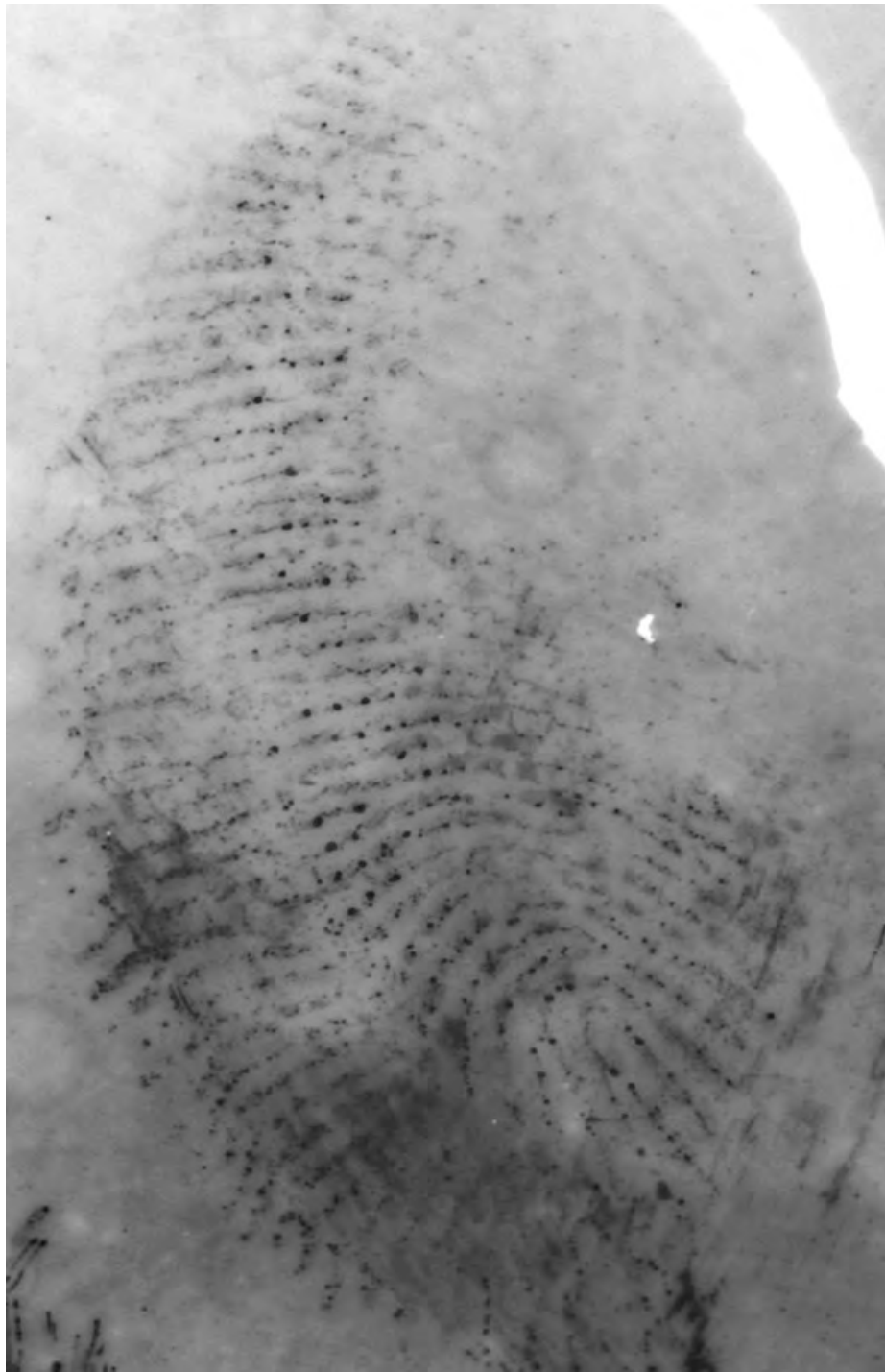
LR 14 Evaluation Exercise 6 14 K 14

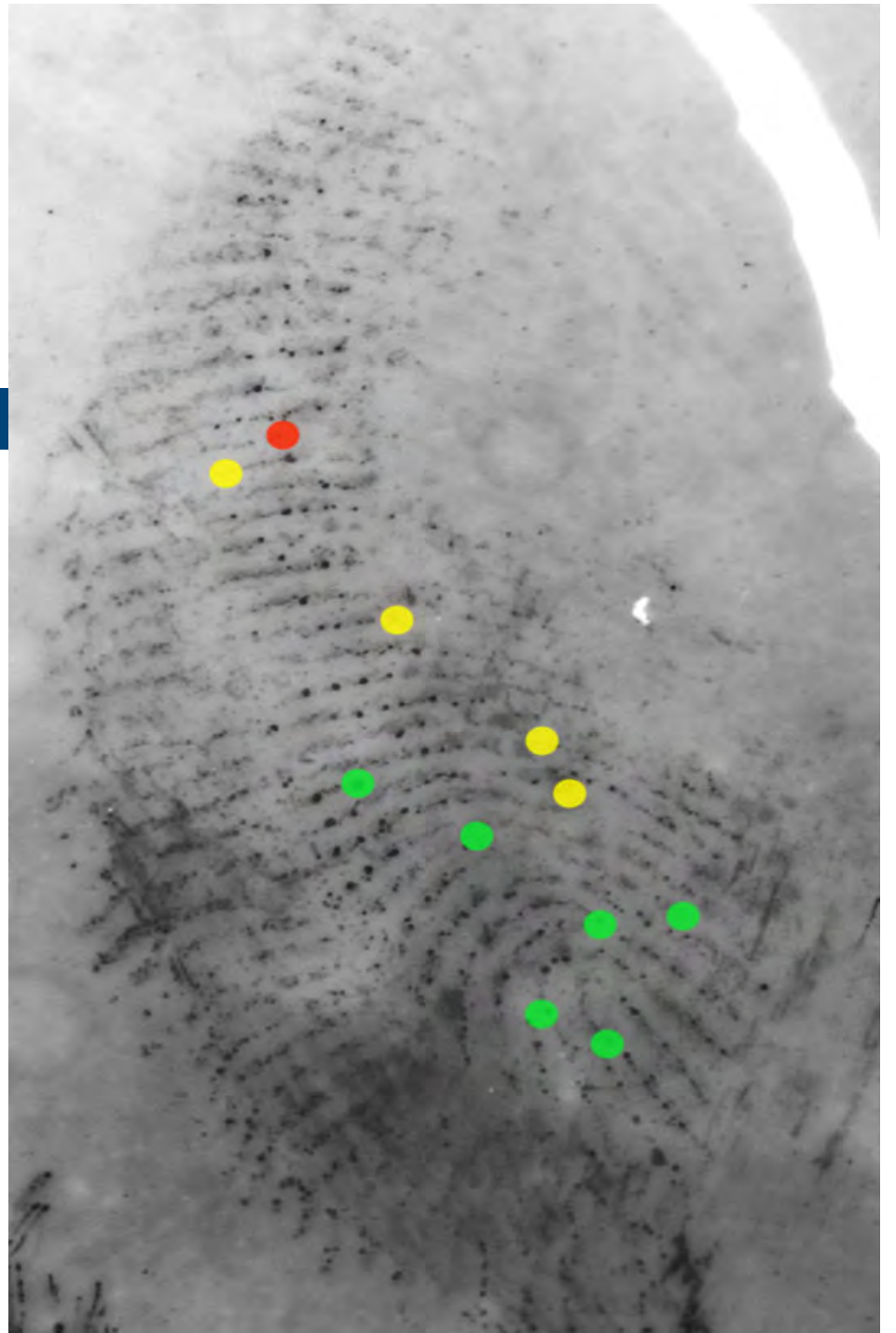
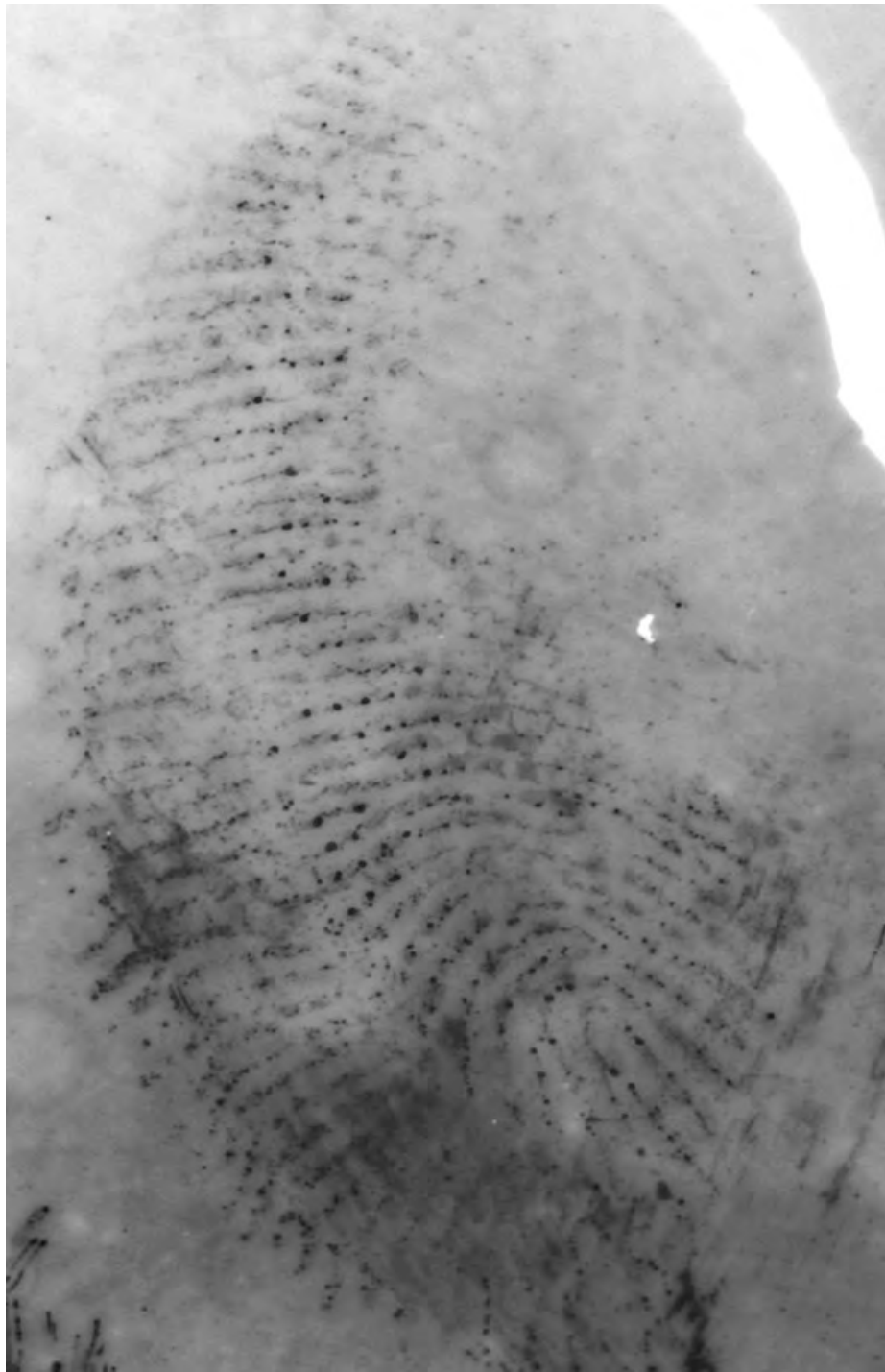


Quality Map

- Green pixels = ~22,000
- Yellow and Red pixel = ~64,500
- 25%

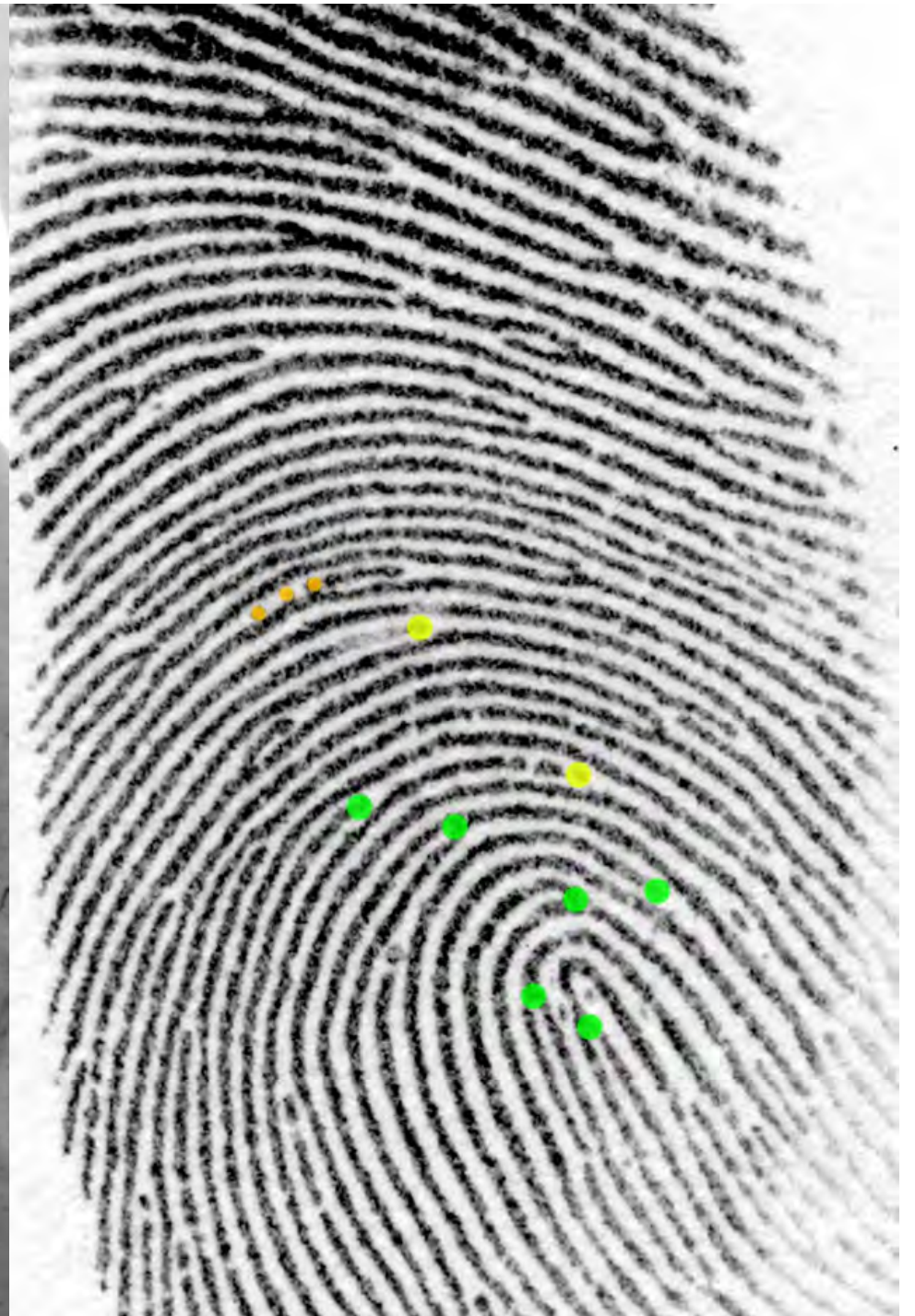
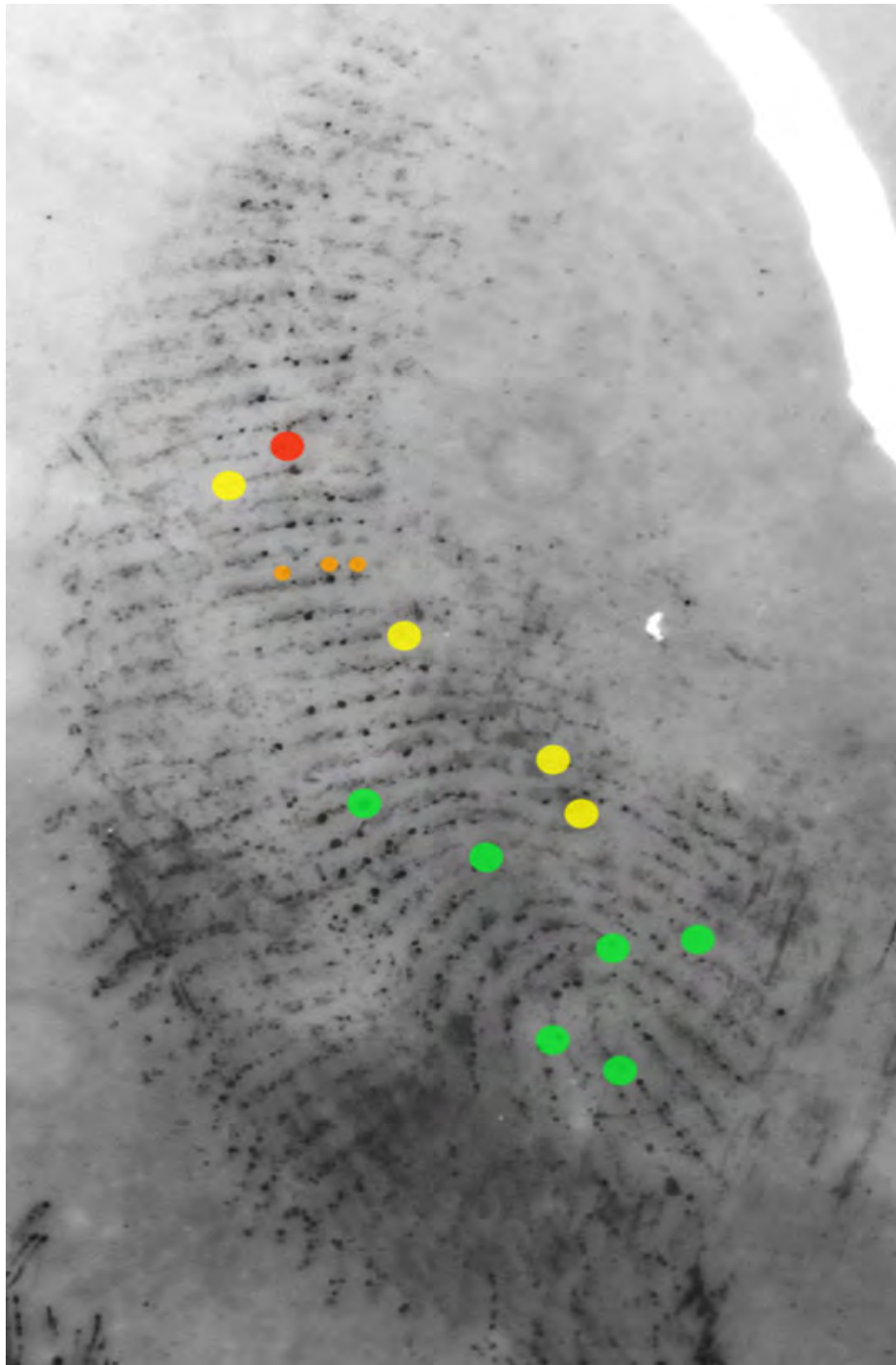






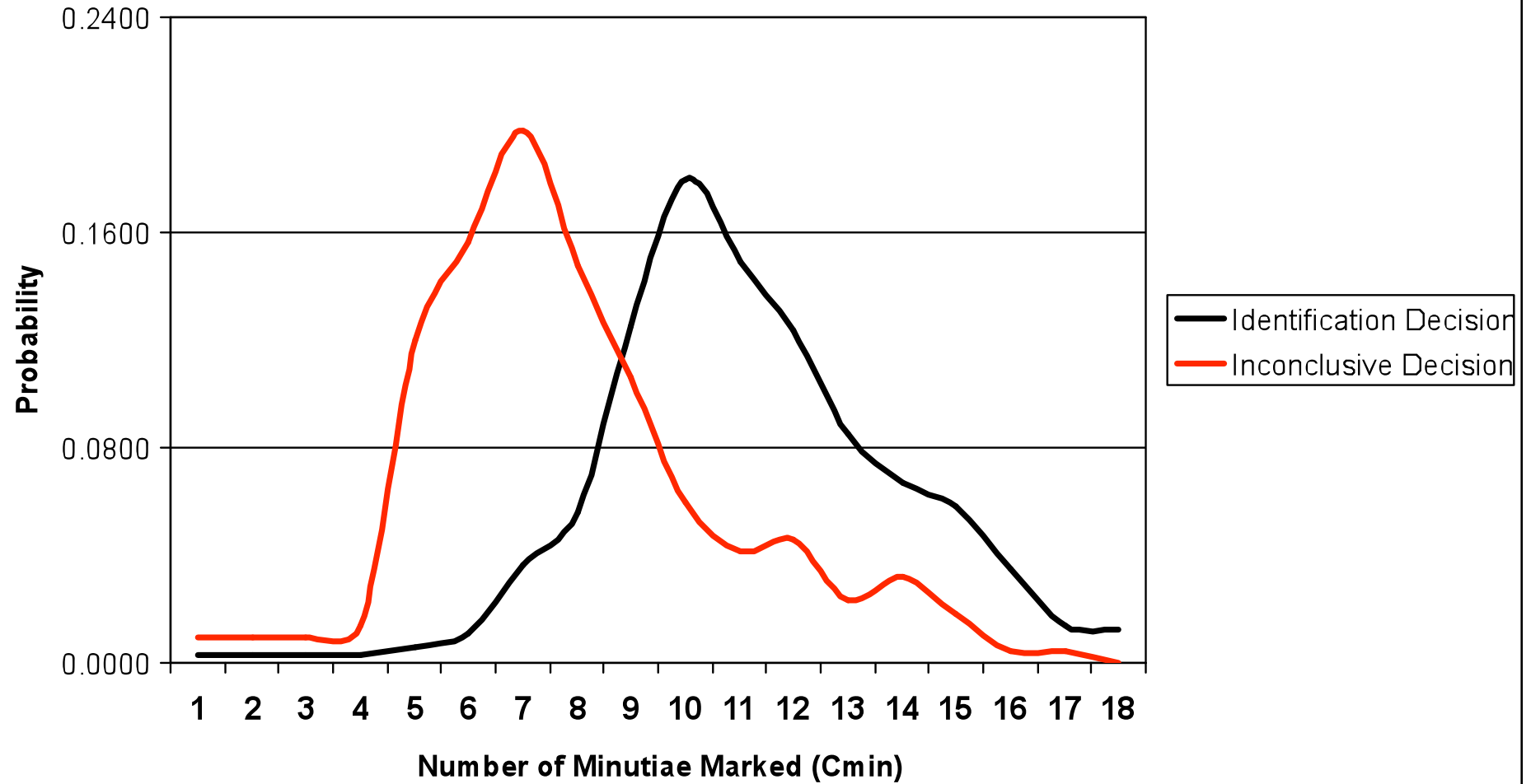
GYRO

- The assignment of uncertainty in the existence of the feature
- Conveys:
 - Uncertainty in the existence of the feature
 - The quality (clarity) of the feature
 - The “tolerance” for that feature
 - The weight to be assigned to that feature (if found in correspondence)



Mark 6-5	Mean Number of Minutiae Marked (Std Dev)	GYRO Colors	Number Minutiae Marked	% of Markings by Color	% Correct	% Indeter	% False
U.S. Mixed Class N = 24	12.4 (5.01)	Green	150	50.3%	87%	2%	11%
		Yellow	96	32.2%	71%	1%	28%
		Red	52	17.5%	58%	2%	40%
		Total	298		75%	2%	23%
U.S. Single Class N = 25	15.0 (4.46)	Green	153	40.8%	92%	1%	7%
		Yellow	127	33.9%	68%	1%	31%
		Red	95	25.3%	53%	9%	38%
		Total	375		74%	3%	23%
U.S. Trainees N = 9	12.4 (2.51)	Green	37	38.5%	89%	0%	11%
		Yellow	40	41.7%	70%	3%	27%
		Red	19	19.8%	53%	0%	47%
		Total	96		74%	1%	25%
Dutch Experts N = 15	9.4 (3.09)	Green	53	37.6%	98%	0%	2%
		Yellow	41	29.1%	95%	0%	5%
		Red	47	33.3%	70%	2%	28%
		Total	141		87%	2%	11%

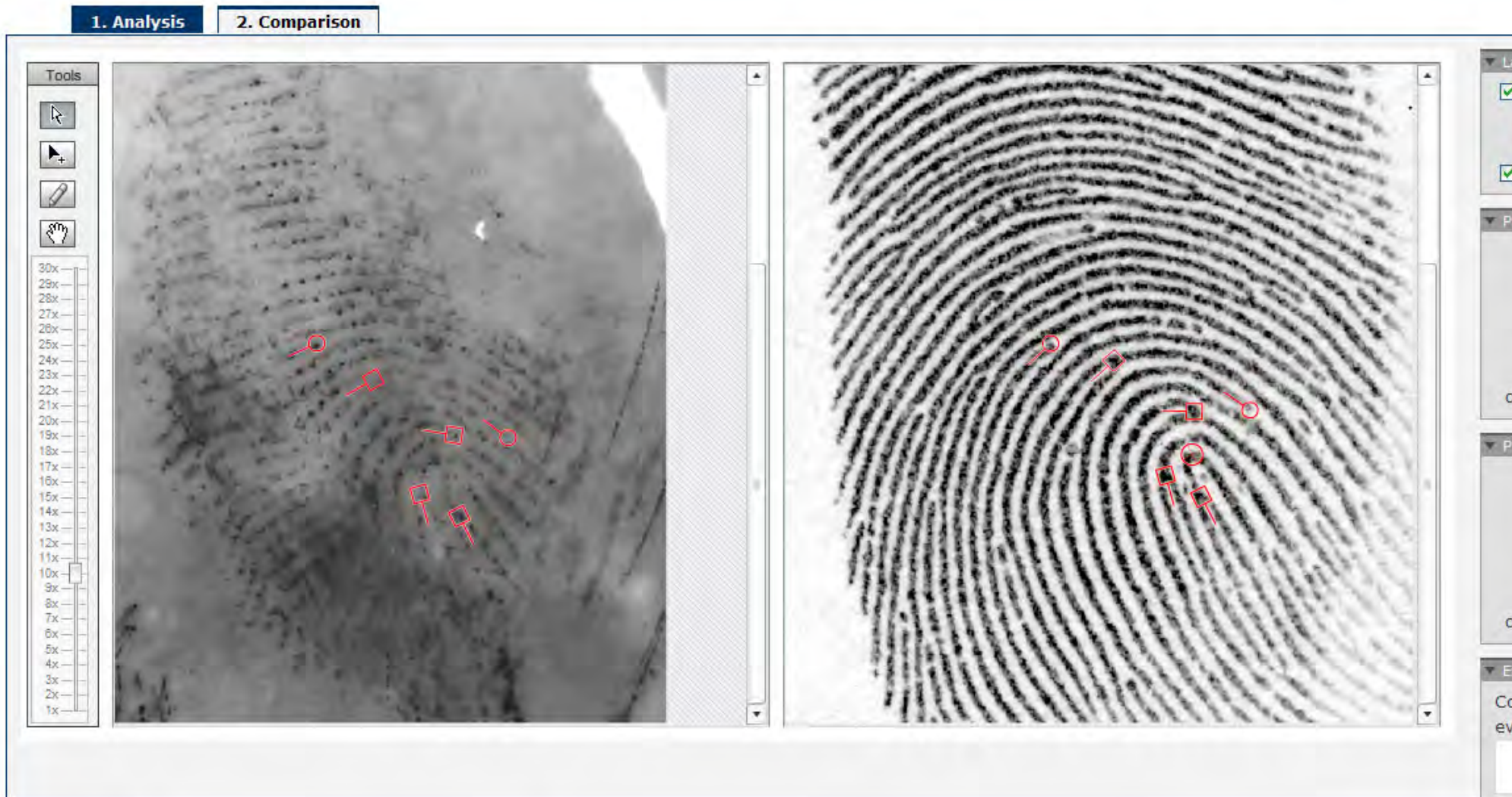
**Probability Density Functions for Number of Minutiae Marked in Comparison
Exemplar and Analyst's Decision**



Actual Data from 7 "Same Source" Trials

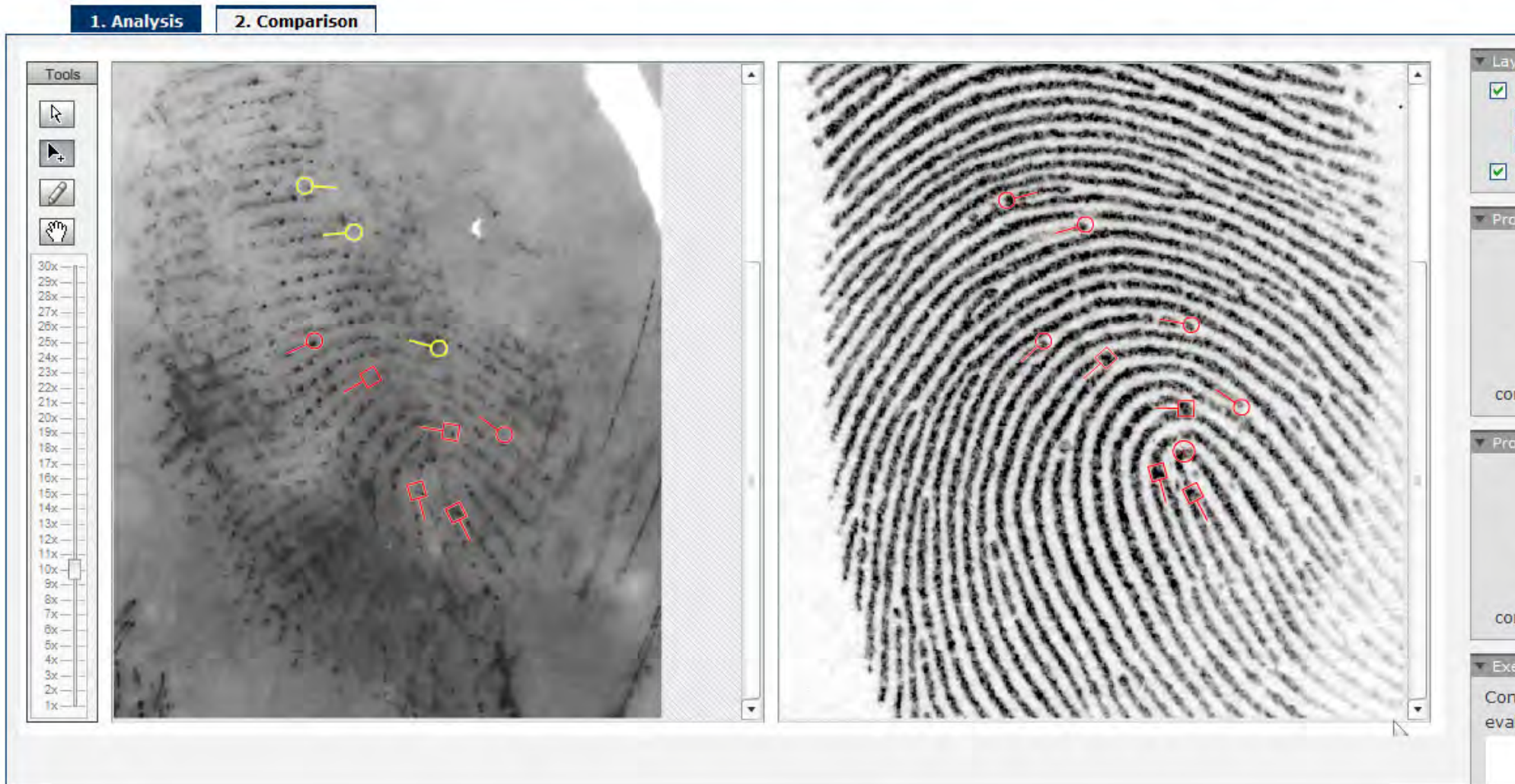
LR = 10^3 to 10^4

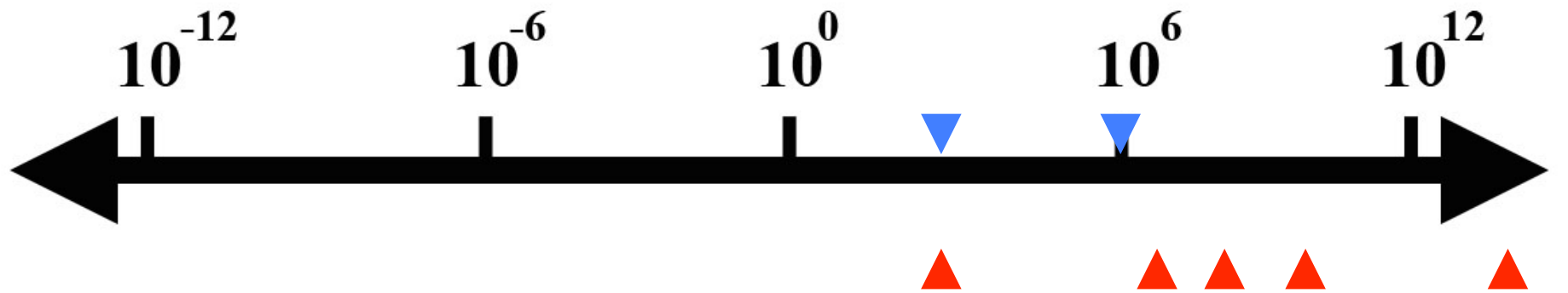
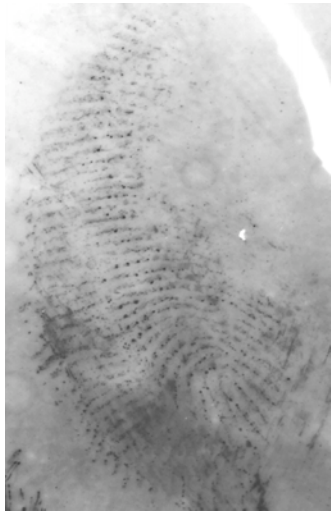
Enter most reliable features in a model



LR = 10^5 to $\sim 10^6$

Enter most reliable features in a model





Apartment
Complex

MPLS IAFIS
Minnesota

Earth

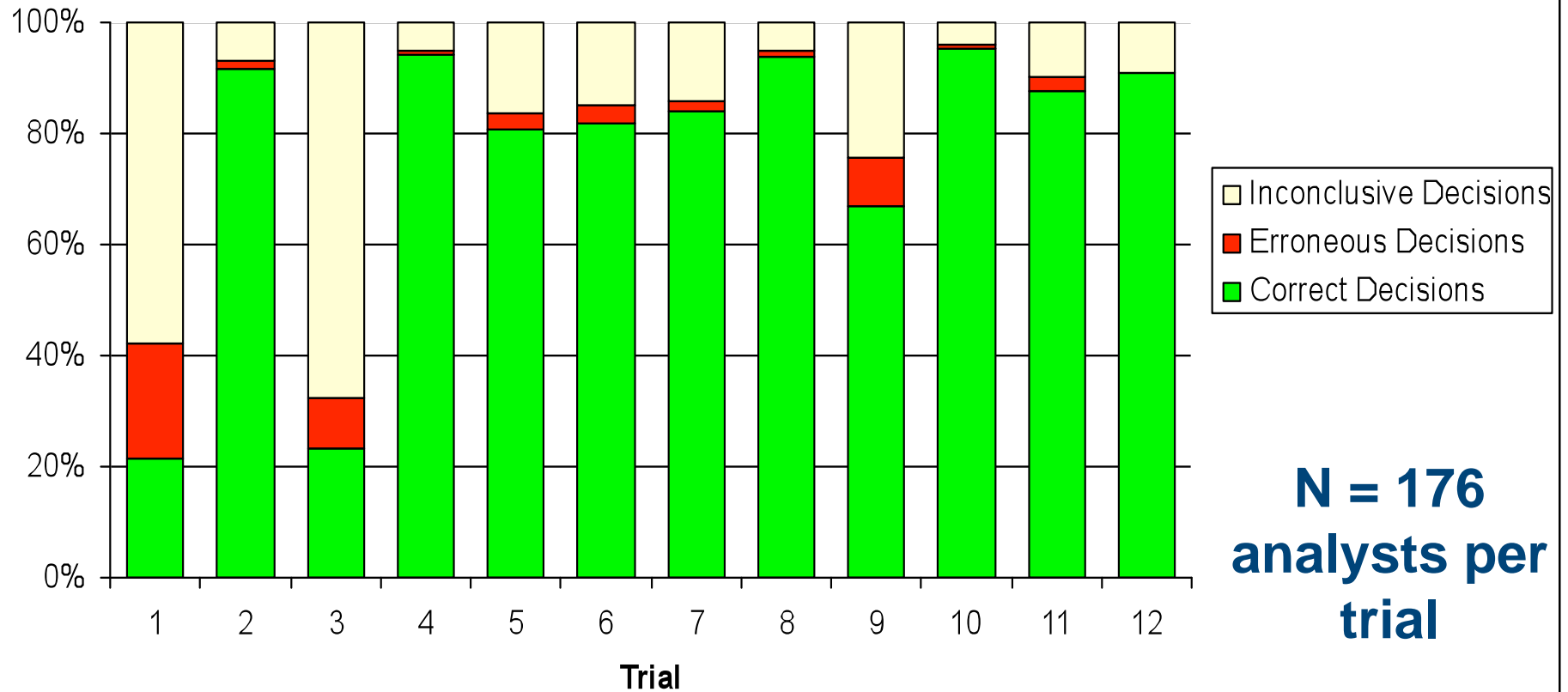
Conflict Resolution

- Reproducibility:
 - When the same sample is given to different instruments, how consistent are the results?
- When the same fingerprint comparison is given to different analysts to work independently, how consistent are the results?

Informing Judgments (2010)

Distribution of Decisions Per Trial

Same Source Trials Different Source Trials



Summary

- There are marginal cases that forensic scientists must provide a decision
- It is unlikely that all scientists will provide the same answer (reproducibility)
- Sometimes that answer does not reflect the actual strength of the evidence (weight of the evidence)

Needed Tools

- Detect reliable features (signal to noise issue)
- Decision model for selecting features (reproducibility of feature selection)
 - Uncertainty is attached to the feature
- Evaluation of correspondence
 - Measure the discriminating value
 - Likelihood ratios
 - Uncertainty can be attached to the value