

Rare threats pose cognitive challenges

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So What? Who Cares?

- Space: *Weapons concealed in cabin baggage.*
- Problem: *False negative errors go up when targets are rare: “low prevalence”*
- Possible Solution: *Artificial Intelligence*
- Results (radiology): *PD > 90%, PFA ~ 10%*
- But: that means that PPV (positive predictive value) is very low

Prevalence matters in search

Let's take 20 bags with guns and knives



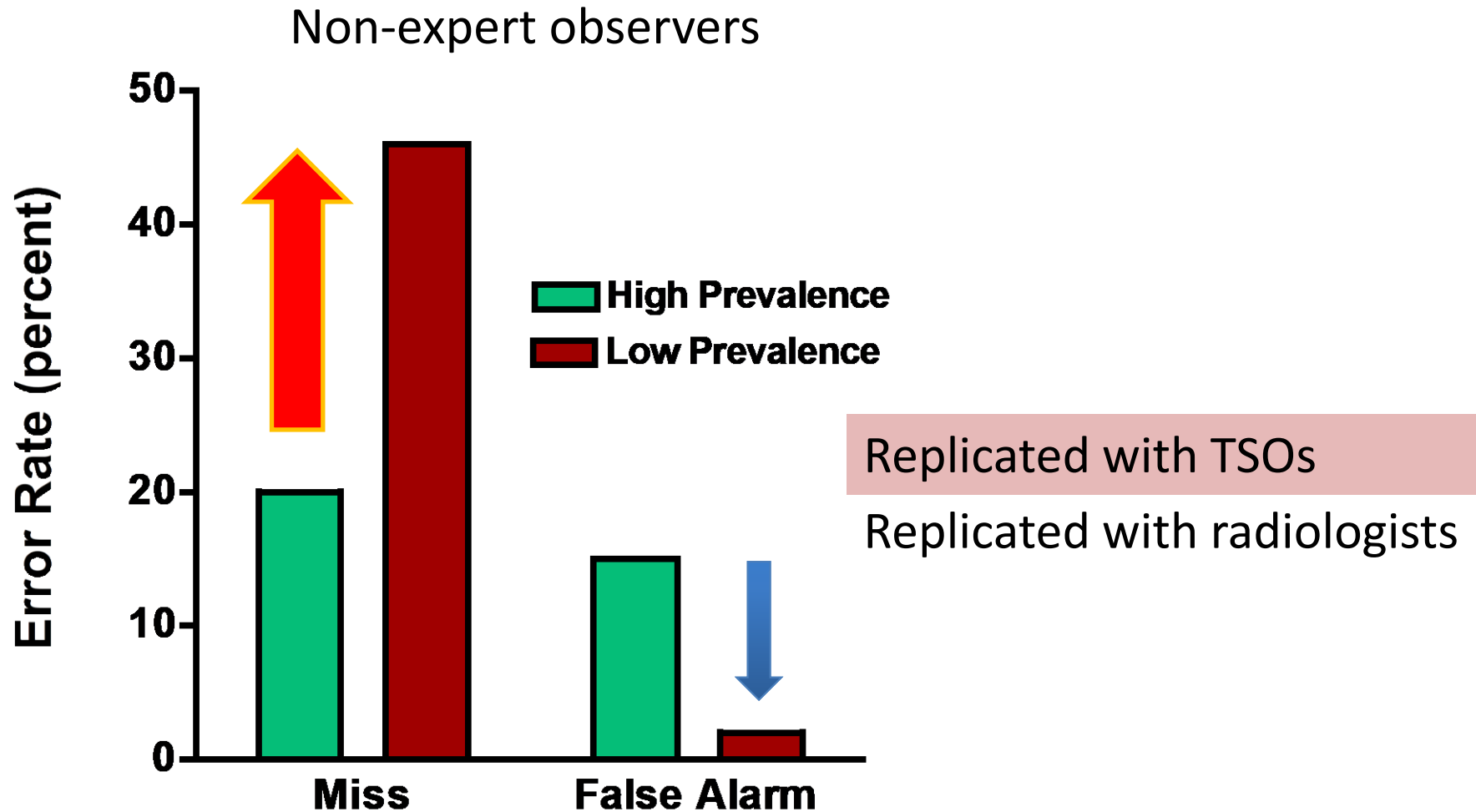
And put them in a stack of 40 bags
50% Prevalence



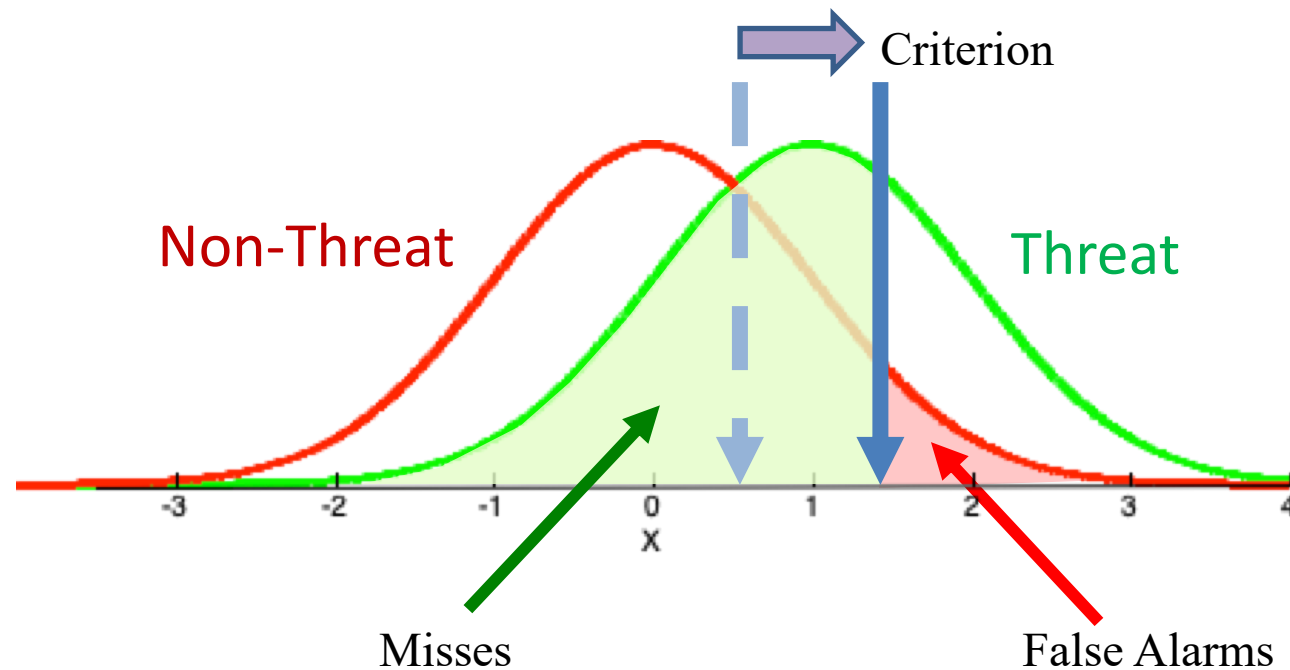
Or 1000
bags
2%
Prevalence



Miss error rates can double at low prevalence



A neutral item is *less likely* to be called a target at low prevalence

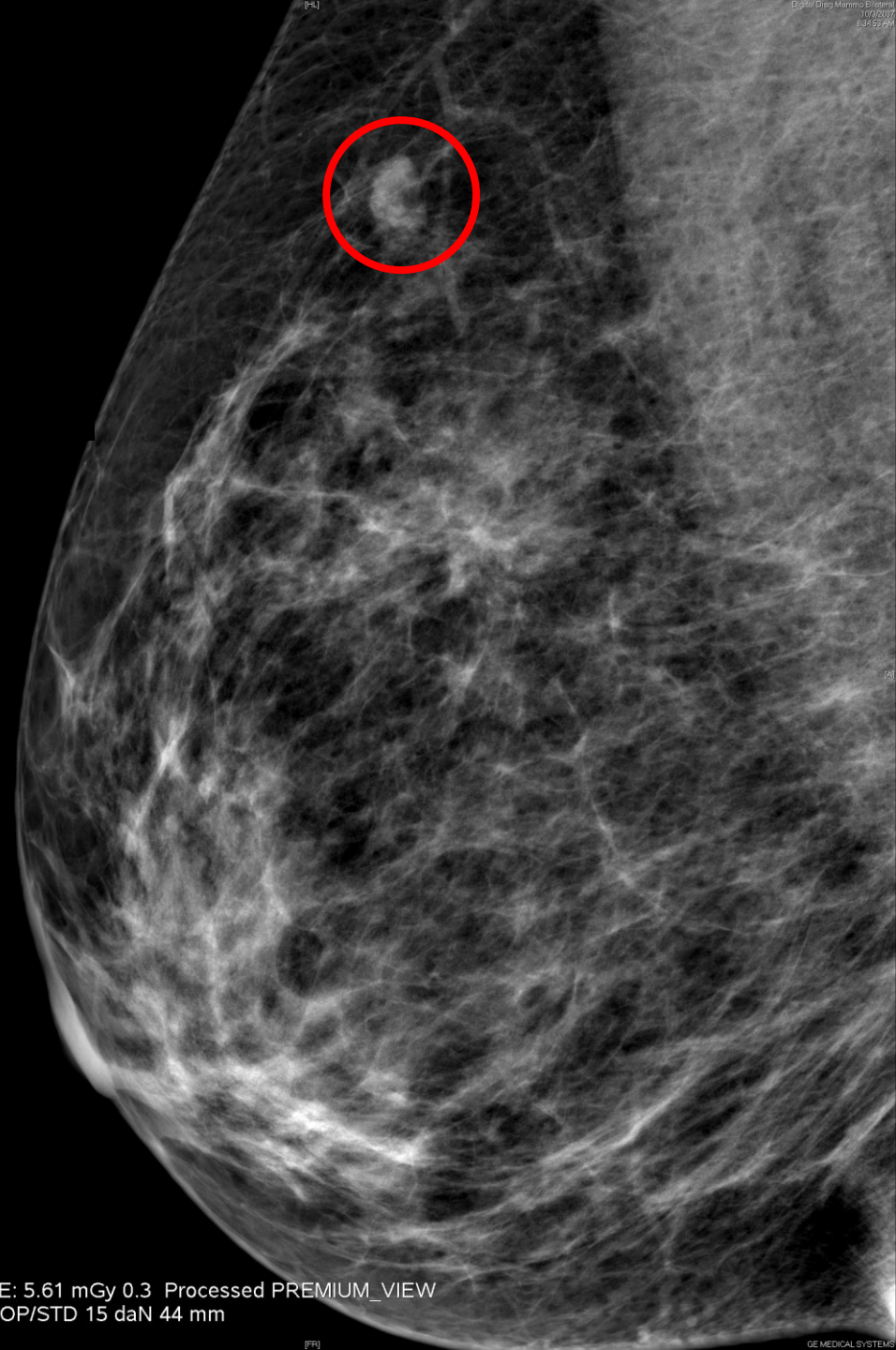


Wolfe, J. M., & Van Wert, M. J. (2010). Varying Target Prevalence Reveals Two Dissociable Decision Criteria in Visual Search. *Curr Biol*, 20(2), 121-124.

Can we fix this
with AI?

Detect 90%

False Alarm
~10%



Zoom = 1.26ROT: FL: L/R
Inc: -45 AGD: 1.38 mGy ESE: 5.61 mGy 0.3 Processed PREMIUM_VIEW
28 kV 62 mAs Mo/Rh Grid AOP/STD 15 daN 44 mm
GE MEDICAL SYSTEMS

The problem
with screening

1000 cases
yield
3-4 cancers

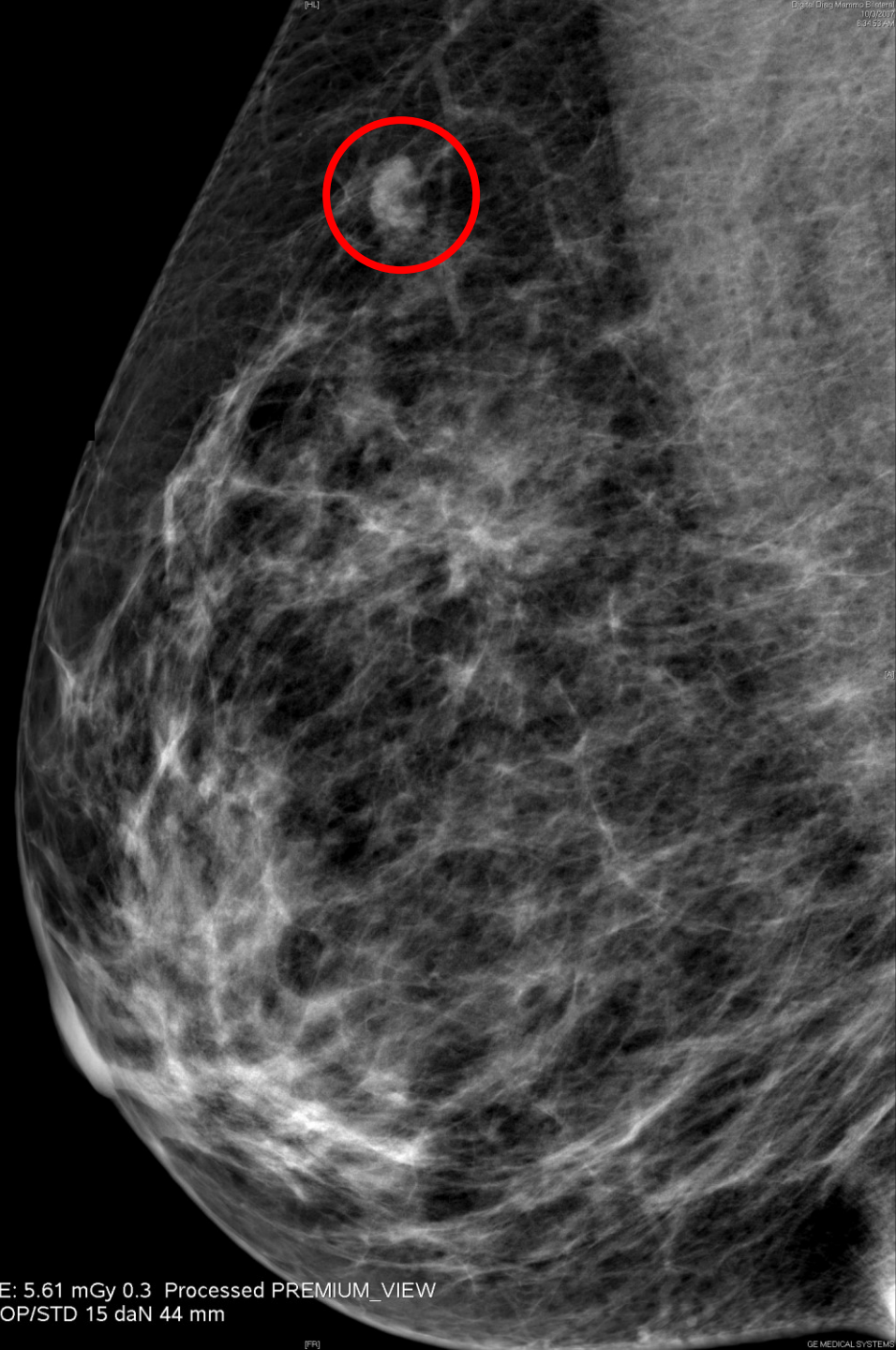


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Inc: -45 AGD: 1.38 mGy ESE: 5.61 mGy 0.3 Processed PREMIUM_VIEW
28 kV 62 mAs Mo/Rh Grid AOP/STD 15 daN 44 mm
GE MEDICAL SYSTEMS

Find 3-4 cancers

Make ~100 false
alarms

PPV = $3/103 = 3\%$
uh oh



Same problem in baggage screening



Or

surveillance for mal-intent
(why profiling is a bad idea)

Or

Any case where the target is rare