Optimizing multi-layered screening

Defence-in-depth or statistical folly?

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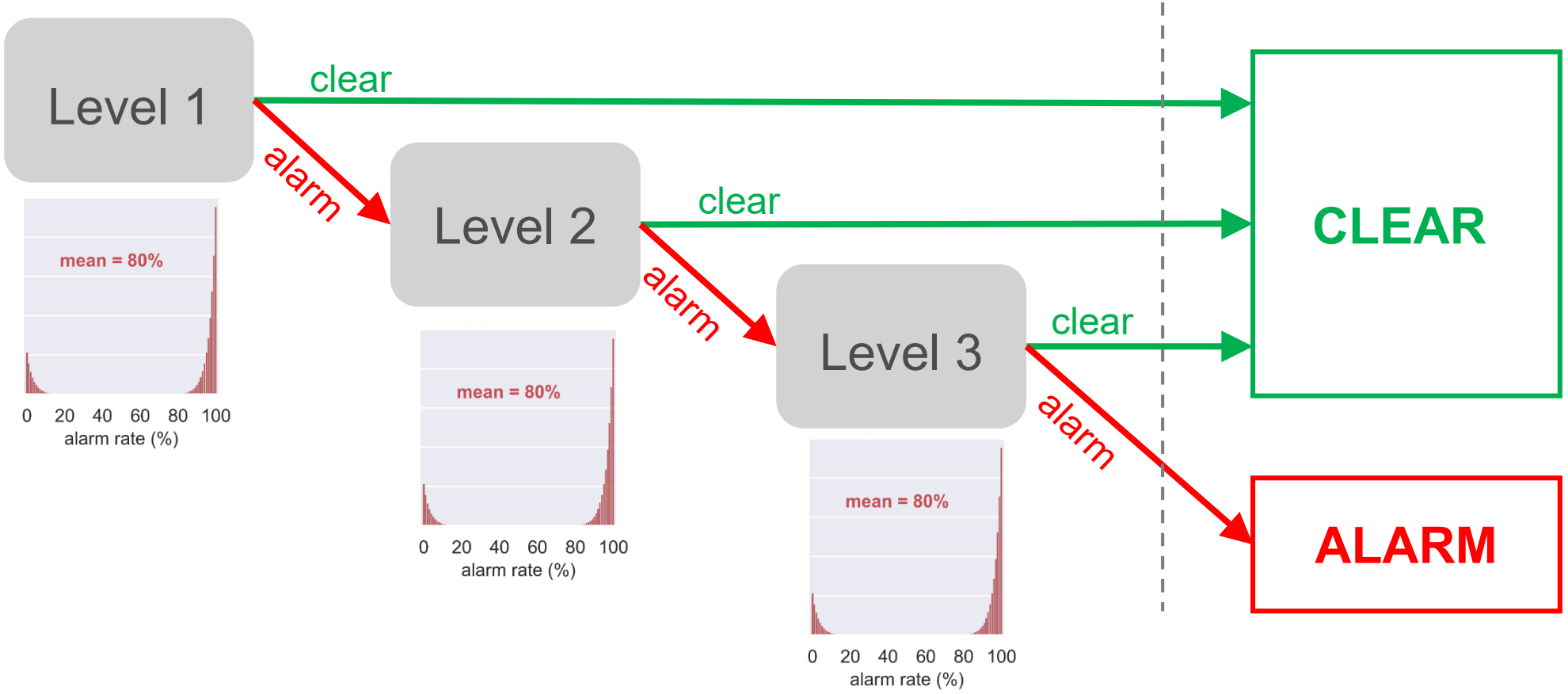
So what? Who cares?

- **Space**: Almost all security screening processes are **multi-layered**.
- **Problem**: We rarely *regulate* or *test* **system-level performance.**
- This presentation summarises a software model of multi-layered screening (Jupyter notebook available upon request).
- **System-level performance** depends on i) how correlated / orthogonal the layers are, and ii) how we combine the outputs of each layer.
- **Solution**: Cumulative screening architecture can significantly outperform cascading screening architectures. (For cumulative screening, the more orthogonal the layers the better.)

Multi-layered screening: “cascading”

What is the system performance?



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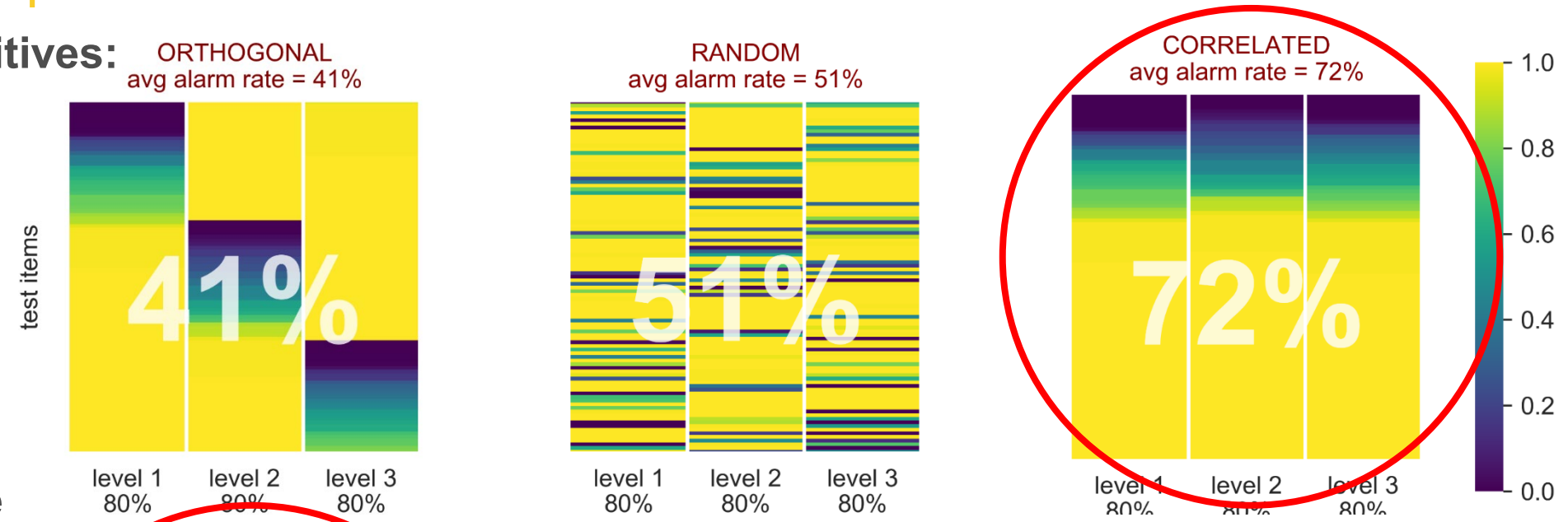
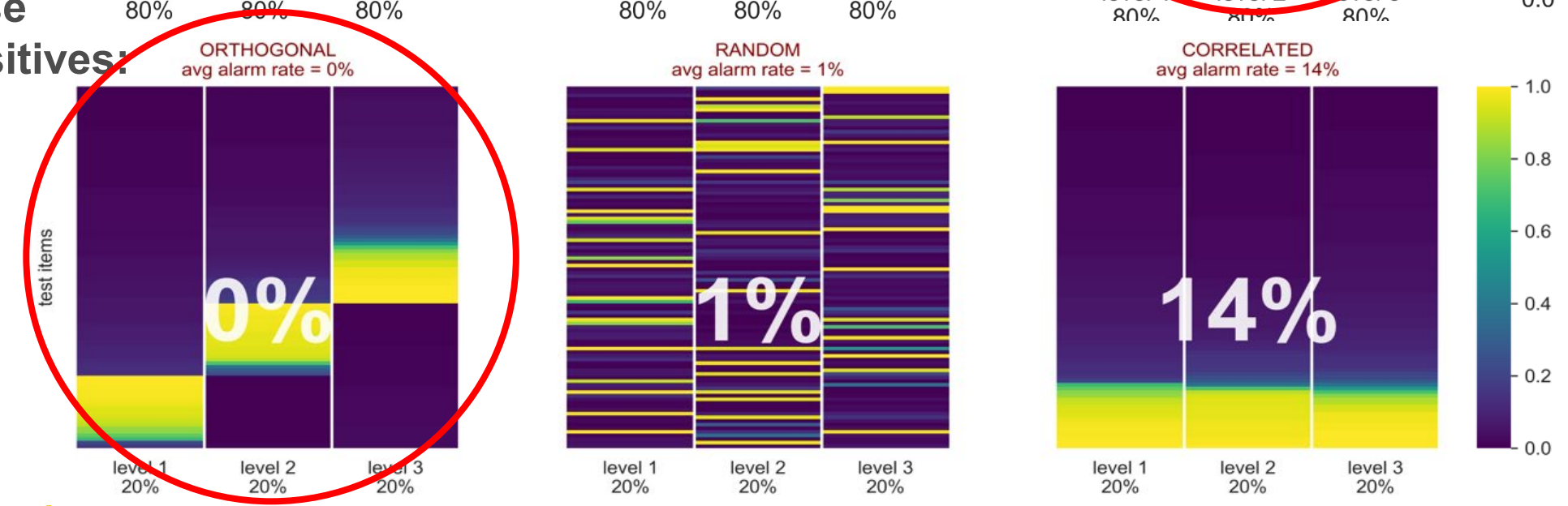
Multi-layered screening: orthogonal vs correlated

true positives:



false positives:



Conflicting requirements!

TPR: correlated

FPR: orthogonal

We need a new screening architecture…

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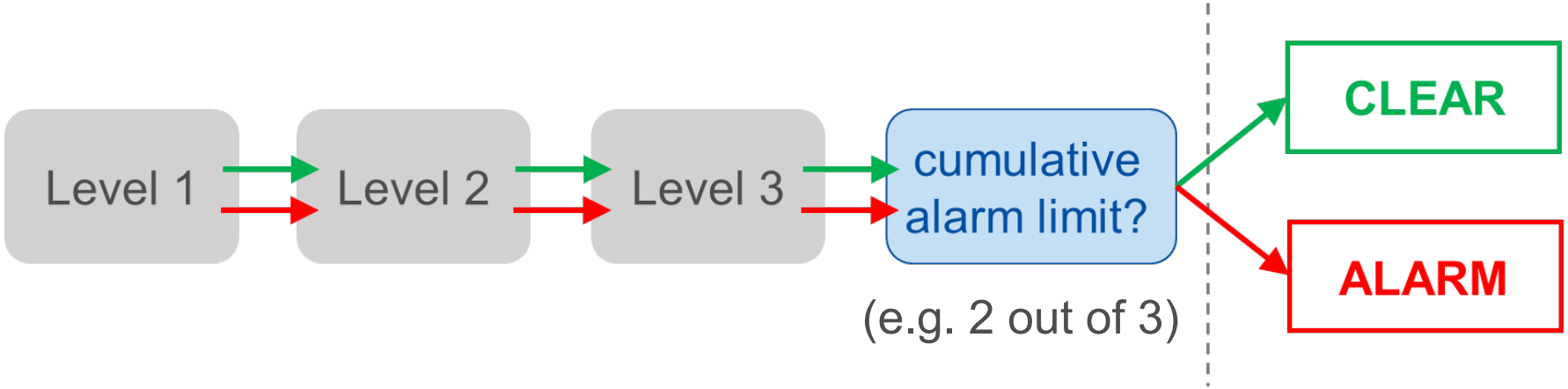
A different design: “cumulative” screening



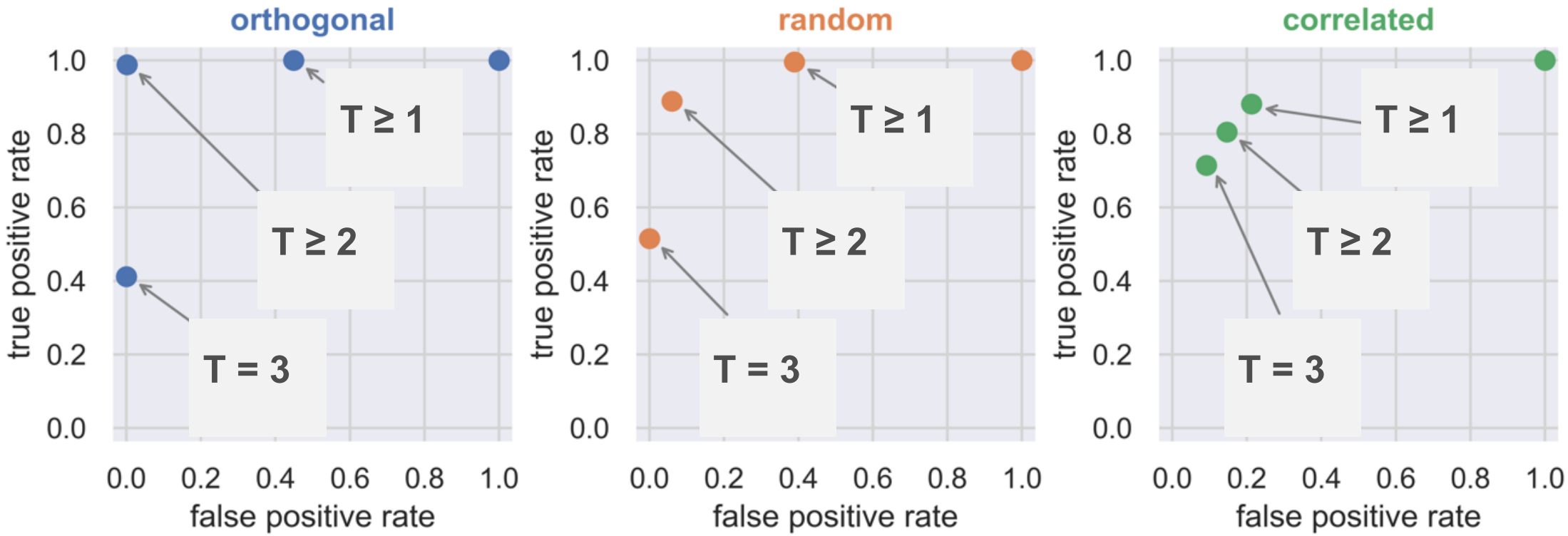
Scan with all layers regardless of individual outputs “alarm” or “clear”. Weaknesses of one layer can be complemented by strengths of other layers.

Requirements for cumulative screening:

- High-throughput (< 5 secs) screening technologies
- Orthogonal screening technologies
- Data fusion

System-level performance: cumulative screening

Showing different thresholds, *T*, required to generate a system-level alarm



Key message: we should move from T=3 to T ≥ 2
(and as orthogonal as possible)

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Recommendations

- Move from equipment-based thinking to systems thinking
- Move from cascading screening to cumulative screening
- Prioritise **orthogonal, high-throughput detection** technologies
- Embrace testing of **system-level performance**
- Promote **open architecture** to enable data fusion

Thank you for your attention.

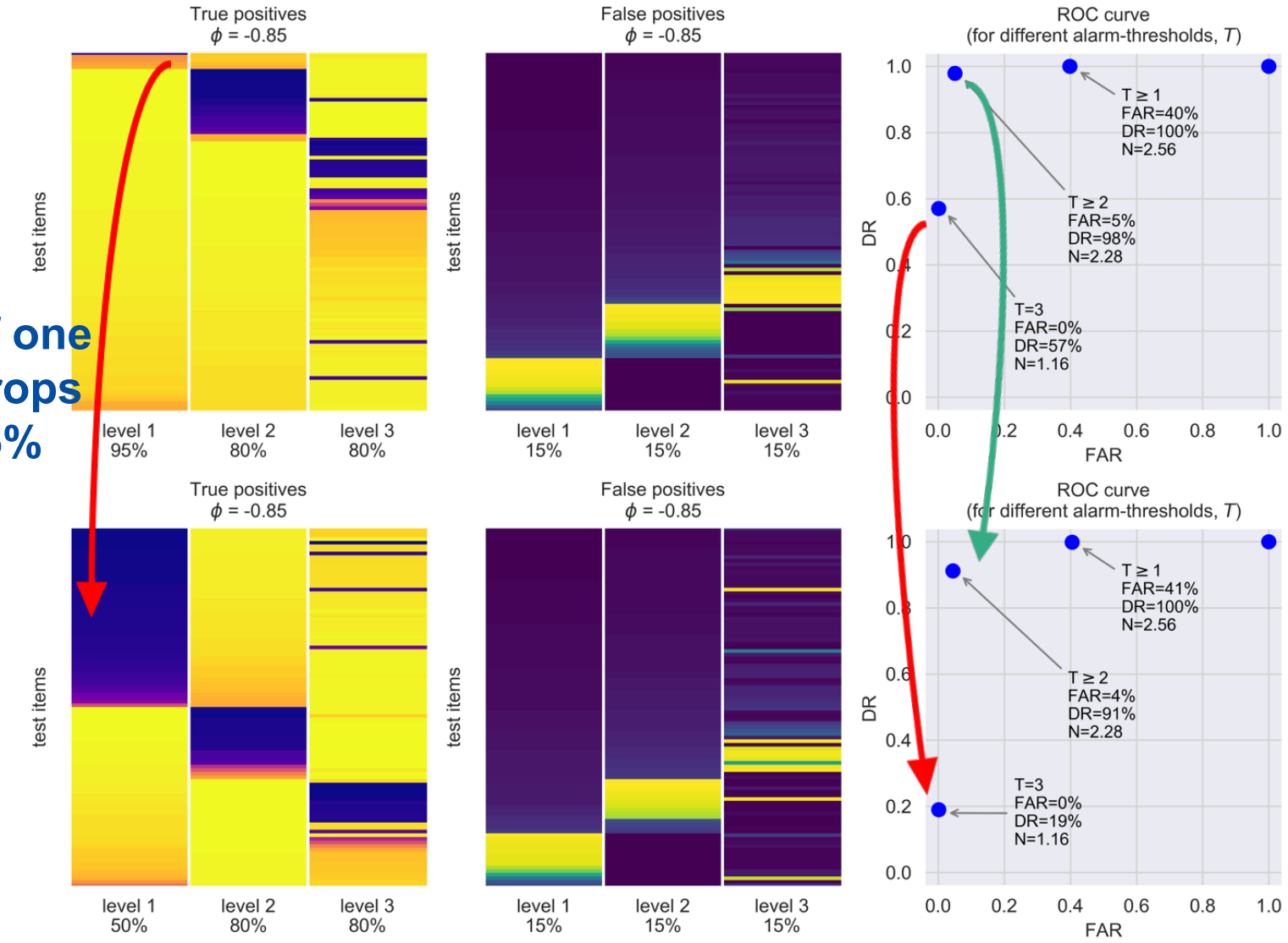
For more details…

Anderson, D. Optimising multi-layered security screening. *J Transp Secur* **14,** 249–273 (2021). https://doi.org/10.1007/s12198-021-00237-3

Note: Software model (interactive dashboard) of multi-layer screening available as Jupyter notebook upon request.

Back-up slide

Cumulative screening is more **resilient** than cascading



If DR of one layer drops from 95% to 50%

T≥2: from 98% to 91%

T=3: from 57% to 19%

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