Reducing false-positive recalls by adding **temporal changes** information to an **AI system** for breast cancer detection

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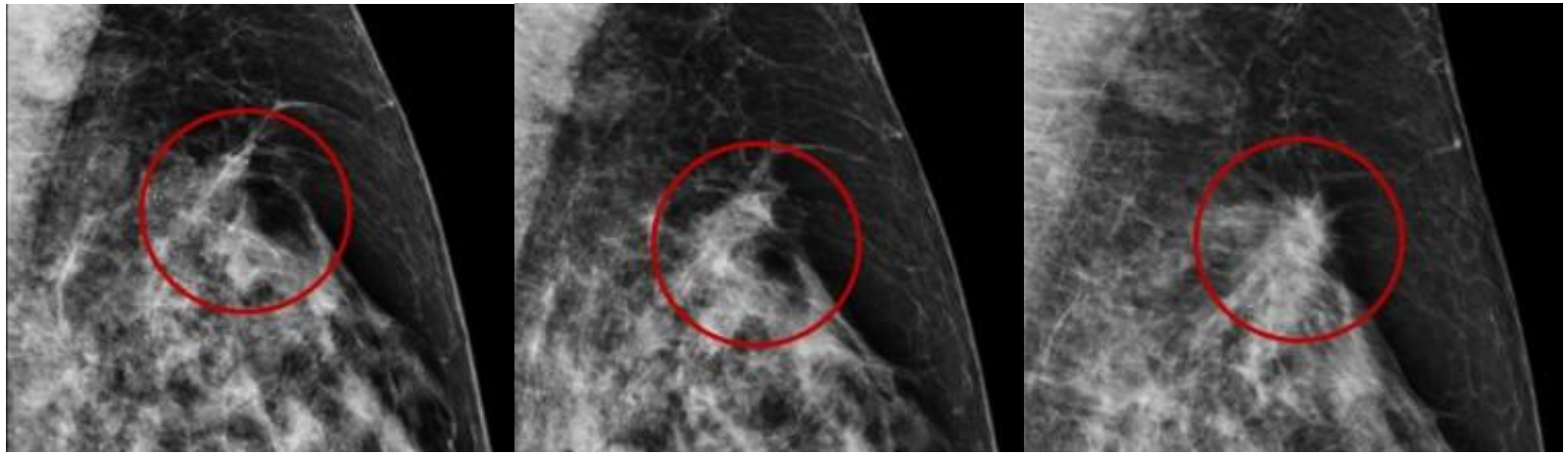
Introduction & Research Question

- **Temporal change** = **major biomarker** for the presence of **malignancy**:
  - No temporal change: **low suspicion** of malignancy
  - Fast temporal change: **high suspicion** of malignancy:

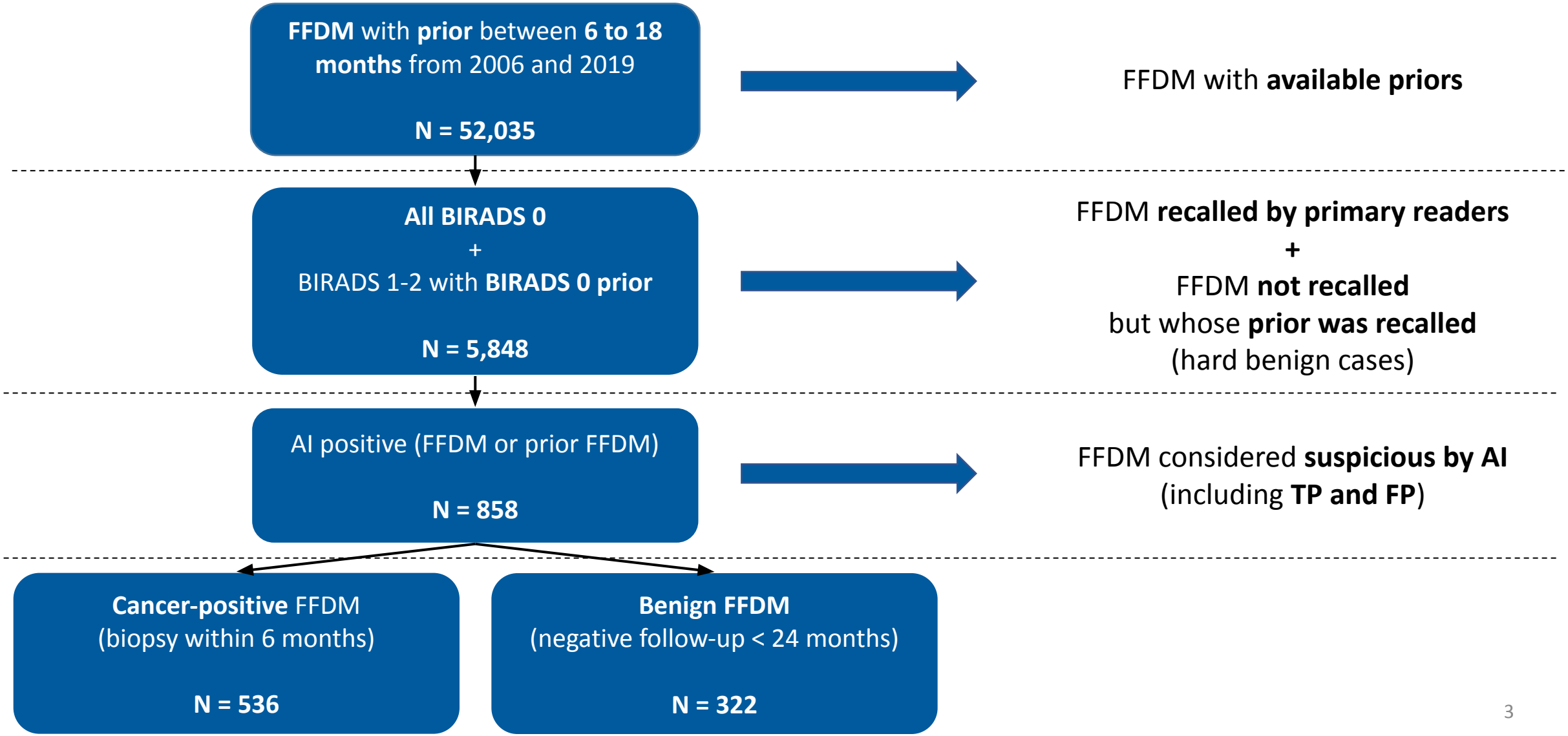


- **Specificity of AI** algorithms remains a **concern** (higher FP rate than radiologists)[1]

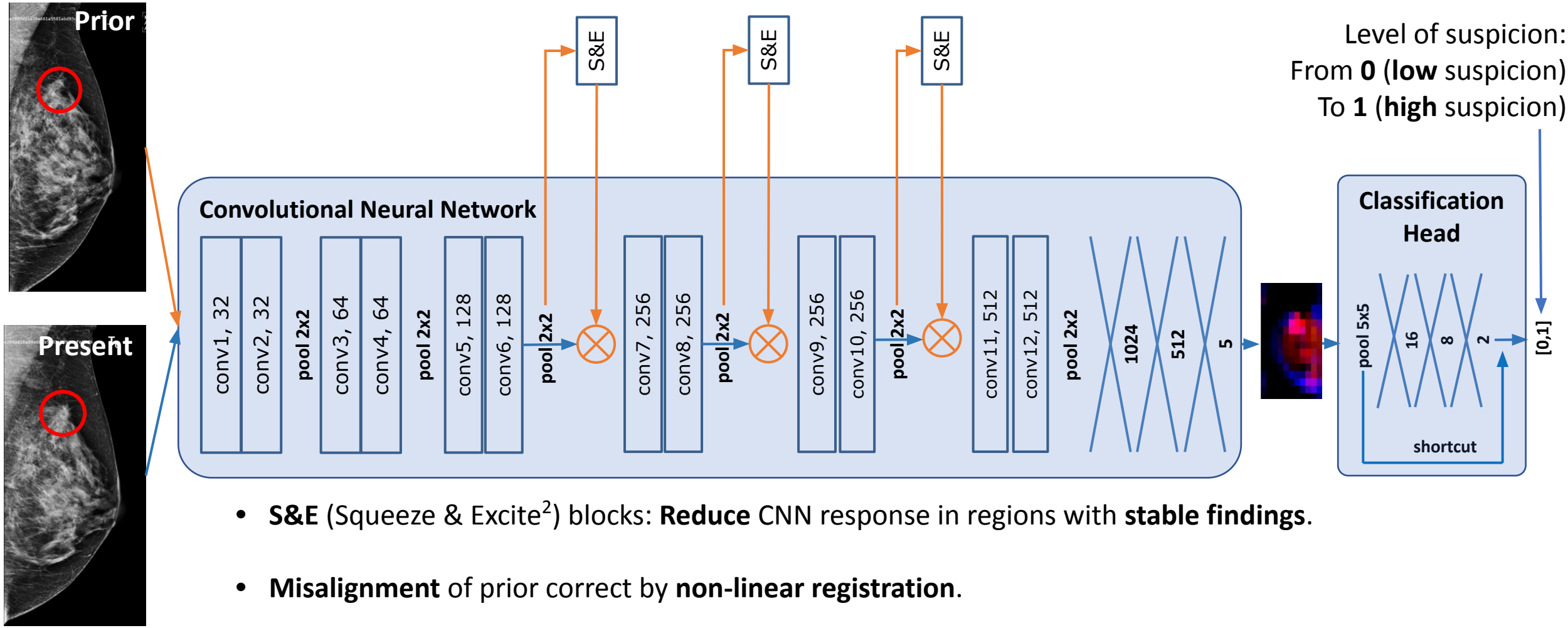
- Can **AI leverage this temporal** information and **gain in specificity**?

[1]Freeman et al. Use of artificial intelligence for image analysis in breast cancer screening programmes: systematic review of test accuracy BMJ 2021; 374 :n1872 doi:10.1136/bmj.n1872

Material and Methods: Data Selection



Material and Methods: AI System[1]

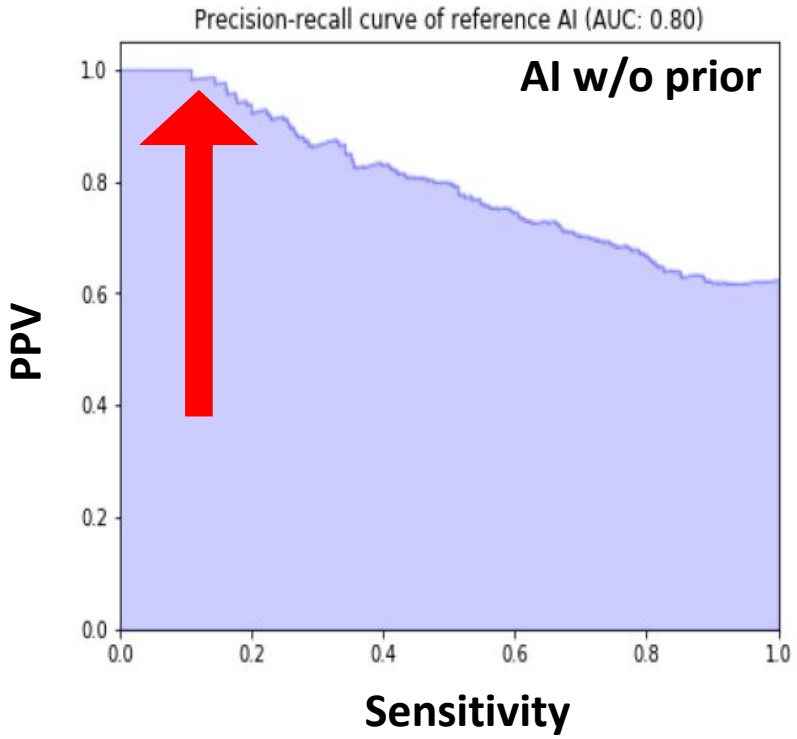


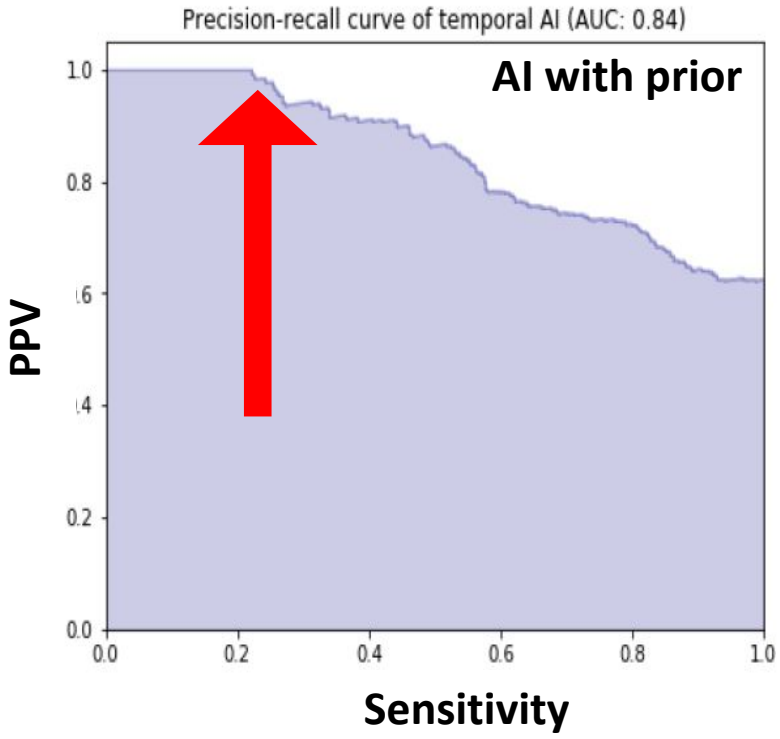
- **S&E** (Squeeze & Excite[2]) blocks: **Reduce** CNN response in regions with **stable findings**.
- **Misalignment** of prior correct by **non-linear registration**.

[1]Therapixel MammoScreen v1.2 (no prior) / MammoScreen v1.3 (prior)
[2]Hu et al., Squeeze-and-Excitation Networks. Computer Vision and Pattern Recognition, 2018.

Results

- **Sensitivity @ 100% PPV: +10.2%** (CI: 4.4% - 15%)
  - AI w/o prior: 12.5% (CI: 8.3% - 17.6%)
  - AI with prior: 22.7% (CI: 19.2% - 27%)
- **AUCPR**: **+4.5%** (CI: 3.2% - 5.9%)
  - AI w/o prior: 79.7% (CI: 76.5% - 82.7%)
  - AI with prior: 84.2% (CI: 81.8% - 86.7%)





Discussion

- **Specificity** of temporal AI is **higher** than standard AI:
  - **20% of cancer-positive cases** found by temporal AI **without creating a single FP** (twice as much as standard AI)
  - Prior information appears **beneficial to AI as it is to humans**
  - Yet, more work needed on AI (e.g., understand the pace of change)

- Possible **use-cases**:
  - **Identifying** (a portion of) **high-risk patients** before leaving the facility (immediate recall)
  - **Prioritizing patients** from **Covid backlog** for screening

- Limitations / extension of the present study:
  - More cases needed (screening distribution)
  - Does it apply to DBT as well?
  - **Validate prospectively** the benefits of a temporal AI

Key Points

- Temporal AI **produces less FP** than standard AI
- **20% of cancer-positive** cases may be found by temporal AI **without creating a single FP**
- Possible use-cases: **immediate recall** and **Covid backlog prioritization**.

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