

# Recent Advances in Breast Screening CAD Research: a Scoping Review

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# Brief History of Mammo CAD

- Early system development by Univ of Chicago 1990s (Nishikawa, Giger)
- Subsequent refinements produced “Imagechecker” marketed by R2
- Validation by ACRIN network DMIST trial 2001-3 on ~50,000 images
- Further commercial developments by ICAD, Hologic, Philips, Sectra...
- High sensitivity but low specificity, increasing recall rate

# Objectives

- Examination of peer reviewed research literature from 2010 to present
- Scope limited to CAD for screening 2D compression X-ray mammograms
- Seeking to identify major contribution areas developing the field further
- Establish whether any clear trends are emerging within these areas

# Search Protocol

- Search term ontology derived by expert consensus from sentinel papers
- Search formula developed and applied in Google Scholar and PubMed

mammogram OR mammography

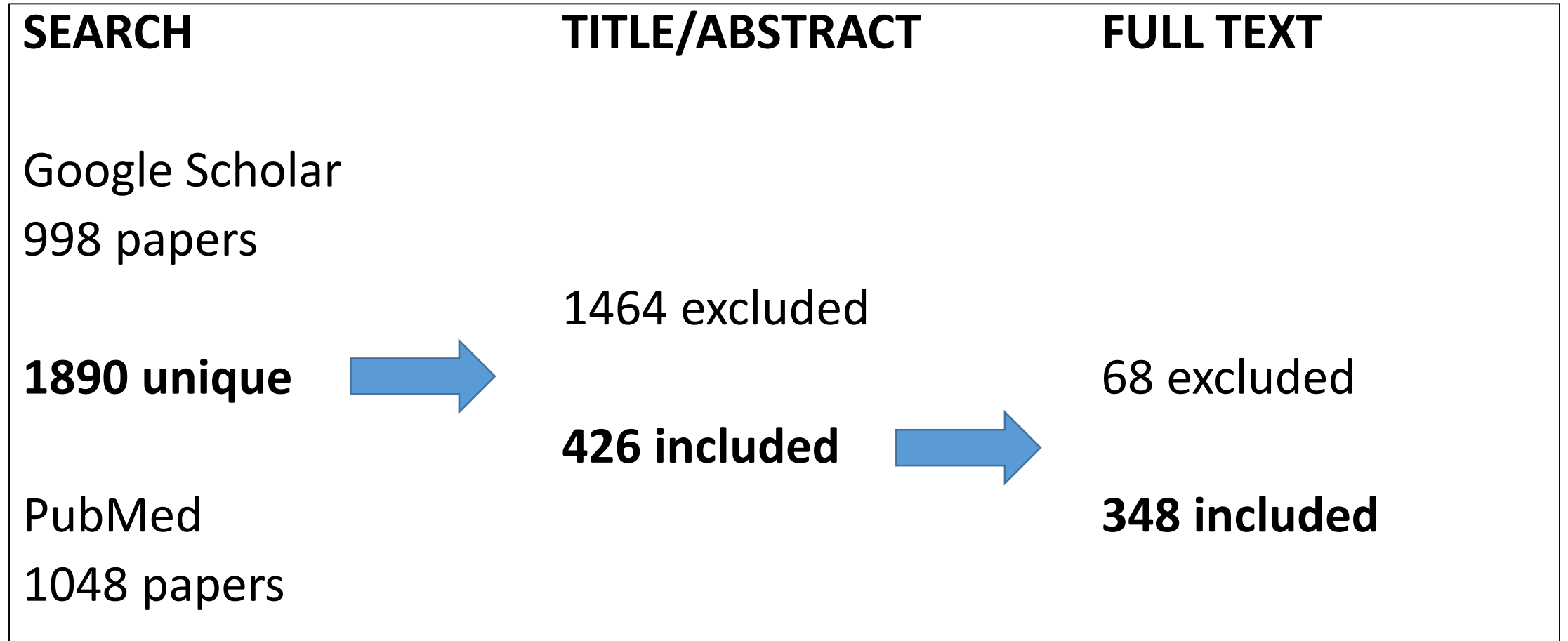
AND

breast screening OR breast cancer detection OR breast cancer diagnosis

AND

computer aided detection OR computer aided diagnosis OR computer assisted detection OR computer assisted diagnoses

# Review Process



# Analysis

- 6 papers provided comprehensive reviews of pre 2010 CAD landscape
- 45 papers were identified as direct contributions of substance (major algorithm innovation, large testset volume, significant performance)
- Remaining 297 papers were judged incremental or minor contributions
- No recent review papers of 2010 onwards CAD directions were identified

# Major areas

- **Image Processing** – enhancement of raw images to address contrast, texture and breast density effects
- **Image Analysis** – new techniques for feature extraction and pattern matching using adaptive and higher order statistical methods
- **Machine Learning** – assimilate information from large number of images to refine accuracy of CAD systems over time
- **Multiple Modalities** – incorporate knowledge from other imaging sources e.g. infra red, tomosynthesis

# Some Trends

- **Image Processing** – line/edge detection, segmentation, texture enhancement; focus on elements which are challenging visual recognition
- **Image Analysis** – transformation, reconstruction, simulation, comparison; focus on specific clinical situations and associated featural indicators
- **Machine Learning** – big data, deep learning, grouping, counterexamples; focus on adaptation and improvement of knowledge over time



# Conclusion

- Current research areas are essentially refinements and extensions
- Interest in image processing/analysis and machine learning/classification
- Multiplicity of approaches to achieve improvements: “second order effects”
- Literature suggests most promise lies in multiple/alternative modalities

# Contact

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