UNIVERSITY OF COPENHAGEN - DEPARTMENT OF COMPUTER SCIENCE

Improving breast cancer risk estimation by combining mammographic texture and AI for lesion detection

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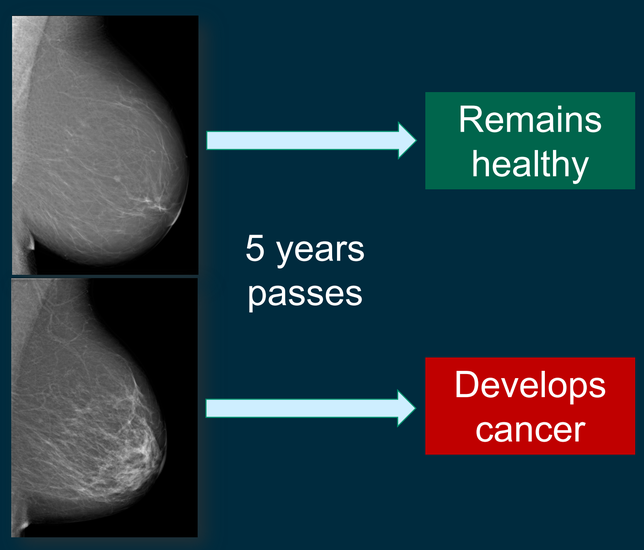
Conclusions

Mammographic texture can be learned by deep neural networks in a data-driven fashion and is a breast cancer risk factor.

Localized findings and precursors found by an AI system for lesion detection can improve long-term risk models.

Auxiliary information such as breast density and biopsy metal clips can improve short-term risk models additionally.

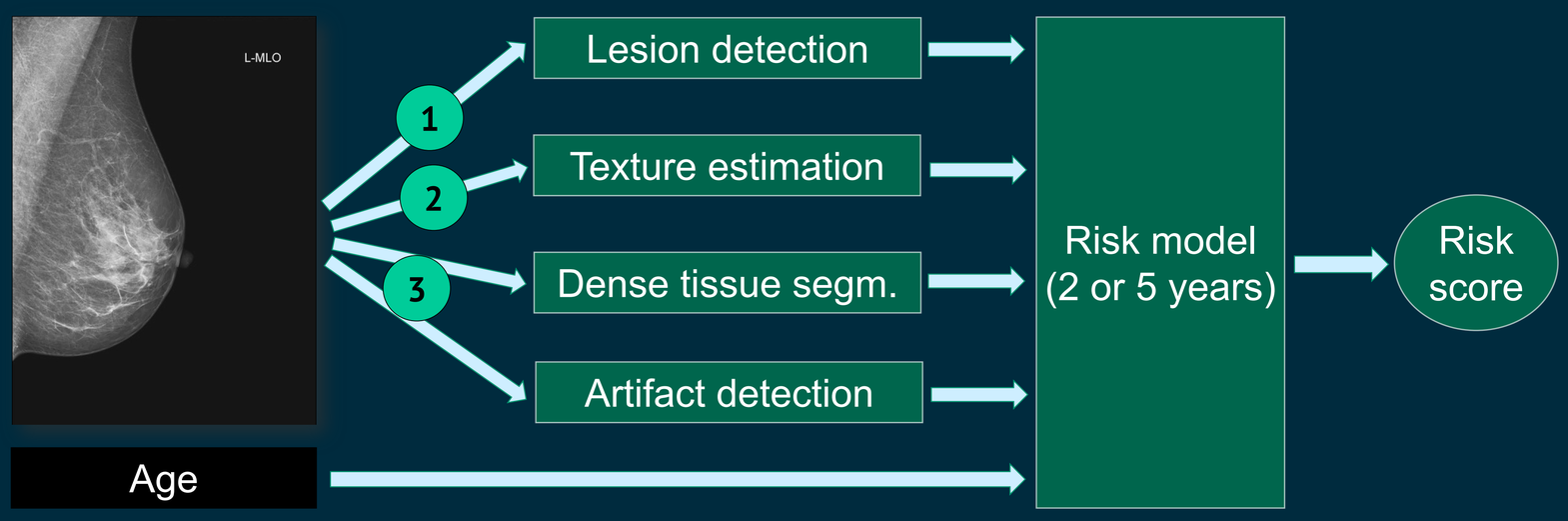


Breast cancer screening – One size fits all

In DK, women between 50-69y are screened biannually breast cancer, but participating women might be over or under-screened.

Certain factors is known to increase risk: age, family history, genetics, hormonal factors, lifestyle, and tissue composition

Personalized risk-stratified screening could alleviate radiologists' workload, decrease inconvenience for women, increase efficiency, and might improve overall screening outcome.

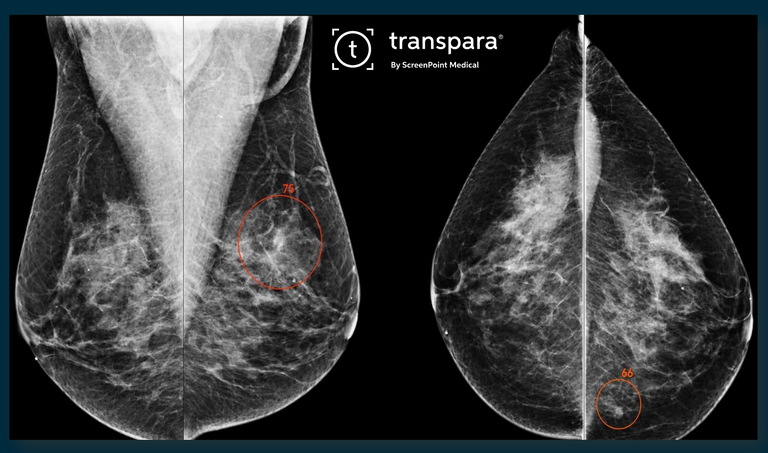


Aim: to estimate risk of breast cancer using factors available at screening: Age & mammogram-based factors

We use a logistic regression model to combine risk factors to estimate for short-term (½ - 2y) and long-term risk (2 - 5y).

Can precursors and systemic differences in breast tissue complement each other and increase predictive power?

1: Immediate risk: lesions/precursors



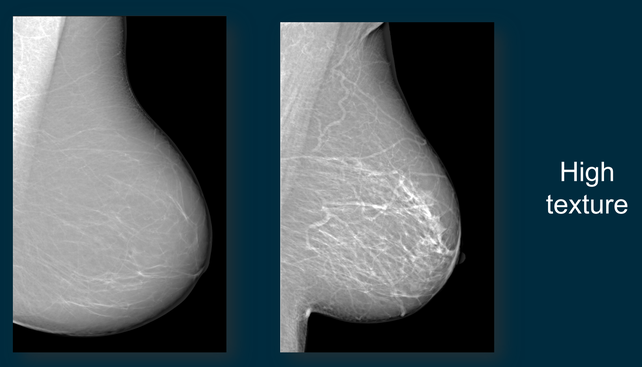
Transpara® is an AI system for decision support and can detect, segment, and rate suspicious findings in mammograms.

Provides an exam score (1-10): Likelihood of finding a malignancy.

Estimate of immediate breast cancer risk by detecting localized finding and precursors.

AUC (2y)	AUC (5y)	AUC (all)
0.73 (0.69 - 0.77)	0.69 (0.67 - 0.71)	0.70 (0.68 - 0.71)

2: Long-term risk: texture



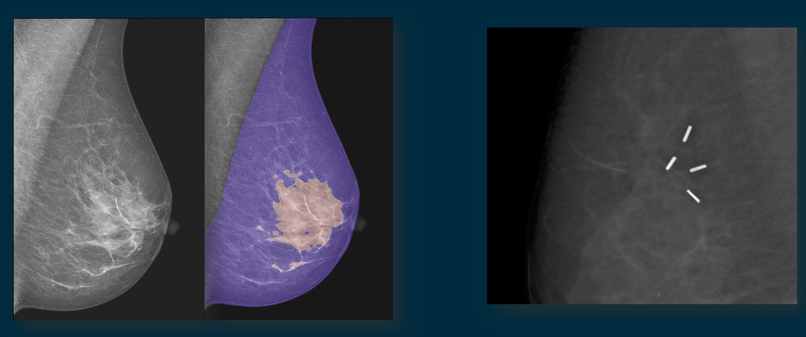
Texture is systemic differences in breast tissue across high and low risk individuals.

Mammographic texture measures heterogeneity in parenchymal tissue, breast density, microcalcifications, and combinations of these,

Texture is learned in a data-driven fashion by training deep learning models with mammograms of healthy women who develop breast cancer 2-5y in the future.

AUC (2y)	AUC (5y)	AUC (all)
0.66 (0.62 - 0.71)	0.67 (0.66 - 0.69)	0.67 (0.66 - 0.69)

3: Auxiliary factors



In a mammogram fat is dark and glands, ducts, and connective tissue, also called dense tissue, is bright. A large amount dense tissue compared to fat, is associated with increased breast risk.

Metal clips are often left after a biopsy. Having had a biopsy is known to be associated with an elevated breast cancer risk.

Var.	AUC (2y)	AUC (5y)	AUC (all)
PMD	0.65 (0.60 - 0.69)	0.58 (0.56 - 0.60)	0.59 (0.57 - 0.61)
Clip	0.56 (0.53 - 0.59)	0.52 (0.52 - 0.53)	0.53 (0.52 - 0.54)

LR covariates (age included)	AUC (2y)	AUC (5y)	AUC (all)
Texture & Transpara	**0.74 (0.70 - 0.78)**	**0.71 (0.69 - 0.73)**	**0.72 (0.70 - 0.73)**
Texture & Transpara & PMD	**0.75 (0.71 - 0.79)**	**0.71 (0.69 - 0.73)**	**0.72 (0.70 - 0.73)**
Texture & Transpara & PMD & Clip	**0.77 (0.73 - 0.81)**	**0.71 (0.70 - 0.73)**	**0.72 (0.71 - 0.74)**