Application of AI & CI for Diagnosis of Breast Cancer

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Abstract

To replicate humans, AI systems require large training datasets to imitate perception of humans. We must supply examples of both malignant and benign mammograms to train a system how to identify abnormalities. After many iterations and trial and error, it will eventually learn to get things right.

To find out if AI and CI are making complementary decisions in breast cancer diagnosis. If we are able to catch more cancer at screening to reduce the amount of false positives by 100%. To show the benign or malignancy able to be caught by the AI algorithm but which the recruited CI crowd of human miss to enhance diagnosis.

Objective

Our objective is to empower radiologists with these tools and hope they become ubiquitous, and doctors would not interpret a mammogram without the use of AI and CI as assistance tools.

Proposed Approach

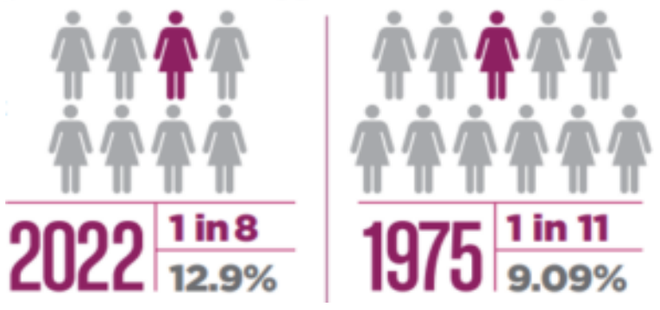
Collective Intelligence CI Approach: Crowd of humans rate the imaging with ***non-zero knowledge*** by responding to the survey for classification of these imaging with their analytics and reasoning skills to detect if the imaging are benign or malignant for early detection of breast cancer.

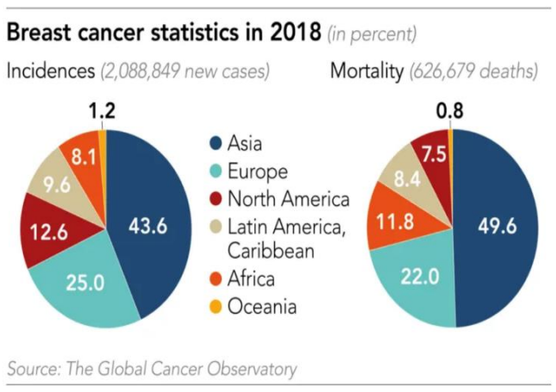
Artificial Intelligence AI Approach: We implement DenseNet201 architecture, CNN deep learning algorithm for classification of the mammogram imaging into benign or malignant for early detection of breast cancer.

AI: We use accuracy score, classification report, confusion matrix, ROC and AUC .

CI: We use manual un-automated method for respondents score & statistical measure in excel which requires further study as our next step of research to rerun the CI approach.

In 2018, breast cancer claimed lives of 74,072 in Africa and 168,690 estimated cases [2]. In 2012, Moroccan women breast cancer recorded death is 2,878 [1].





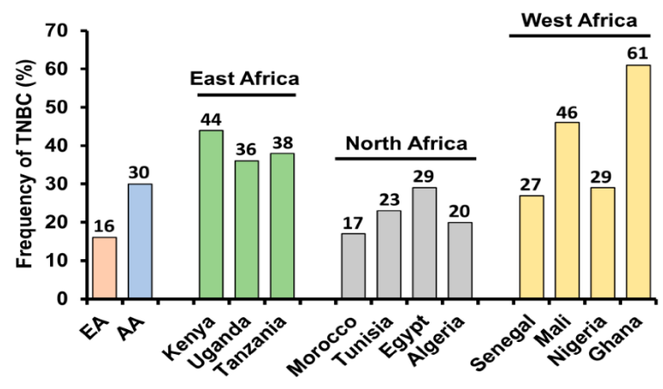


Fig. 1 & 2 Breast Cancer Fact & Figures (2012, 2018, & 2022)

Artificial Intelligence DL-CNN Model

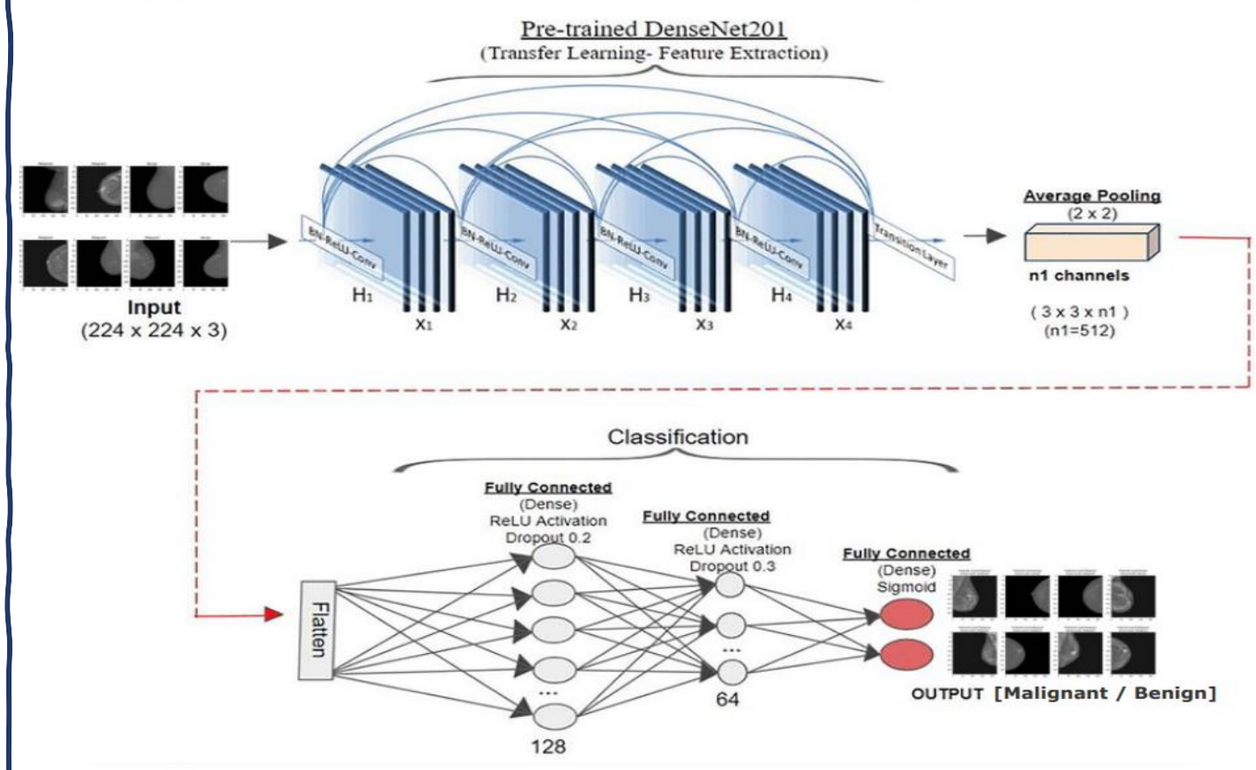


Fig. 3 A I deep learning CNN model (Jaiswal, et al. 2021)

Collective Intelligence CC Model

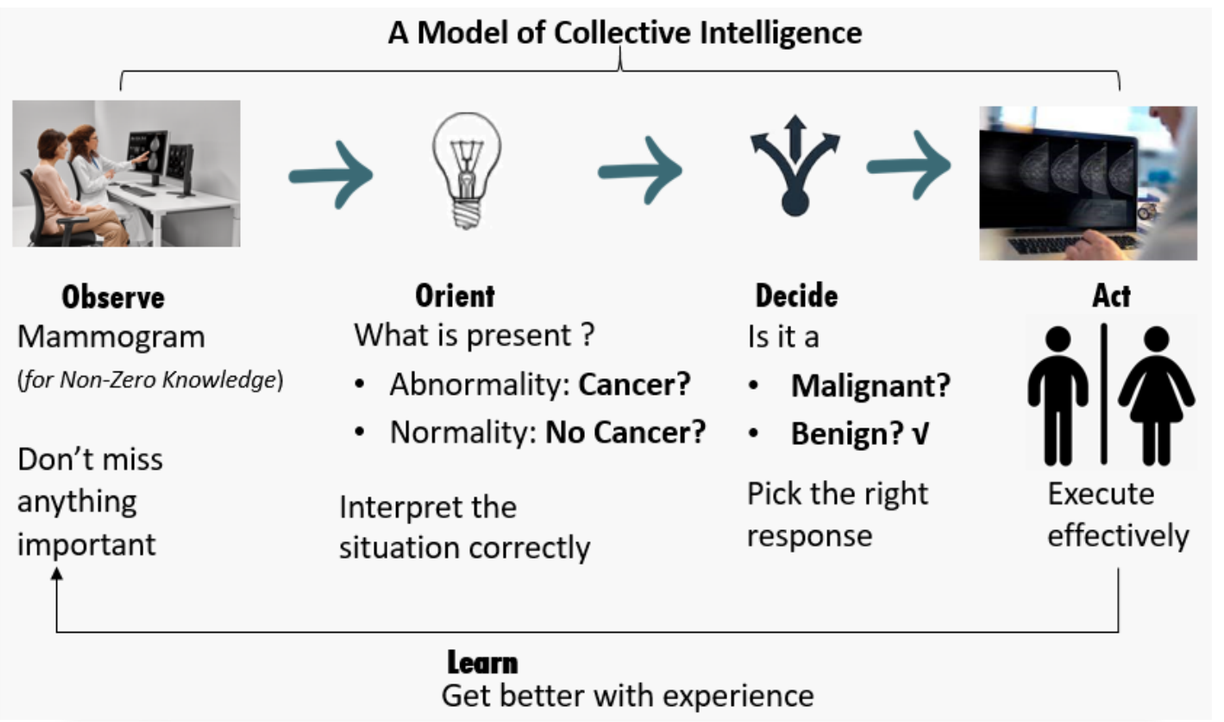


Fig. 4 A model of Collective Intelligence (Mark Klein, 2022)

AI Simulation Results / CI Experiment Simulation in Progress

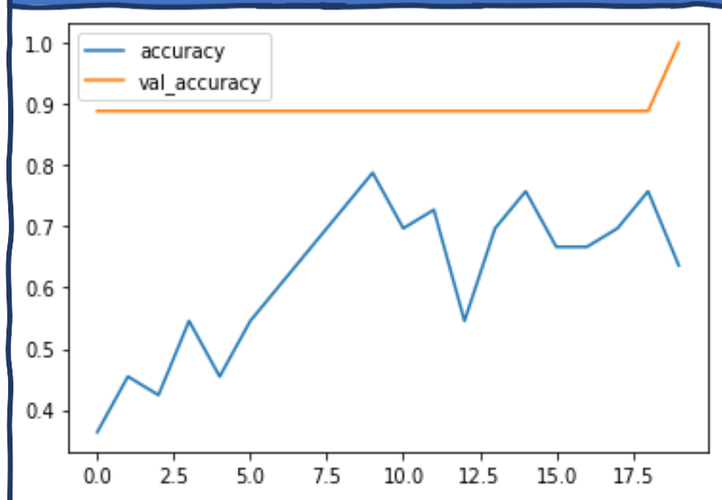


Fig. 5 DenseNet201 Accuracy Measure

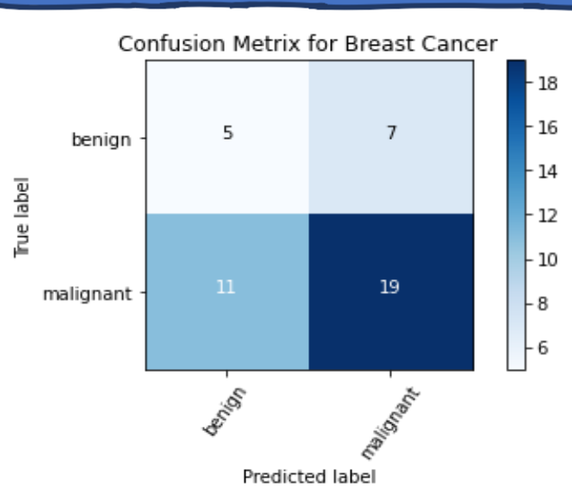


Fig. 6 True Label vs Predicted Label

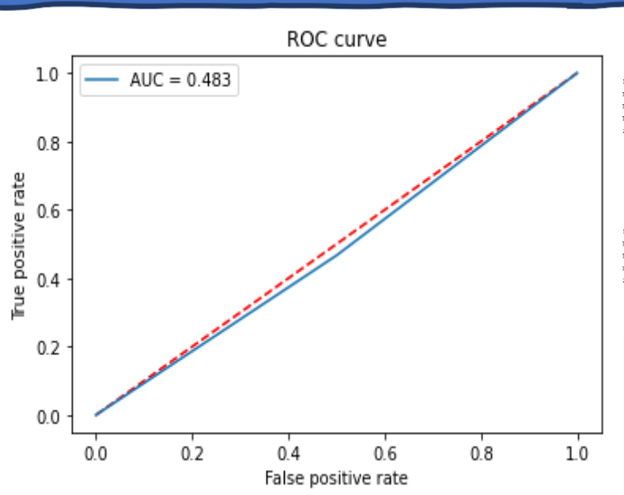


Fig. 7 ROC vs AUC curve

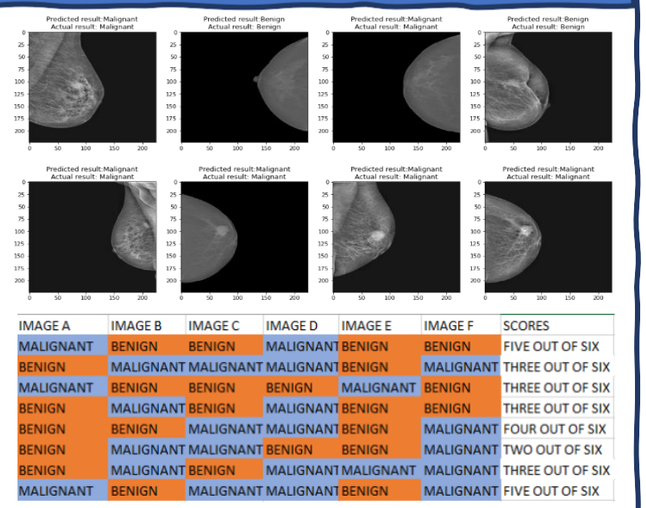


IMAGE A	IMAGE B	IMAGE C	IMAGE D	IMAGE E	IMAGE F	SCORES
MALIGNANT	BENIGN	BENIGN	MALIGNANT	BENIGN	BENIGN	FIVE OUT OF SIX
BENIGN	MALIGNANT	MALIGNANT	MALIGNANT	BENIGN	MALIGNANT	THREE OUT OF SIX
MALIGNANT	BENIGN	BENIGN	BENIGN	MALIGNANT	BENIGN	THREE OUT OF SIX
BENIGN	MALIGNANT	BENIGN	MALIGNANT	BENIGN	BENIGN	THREE OUT OF SIX
BENIGN	BENIGN	MALIGNANT	MALIGNANT	BENIGN	MALIGNANT	FOUR OUT OF SIX
BENIGN	MALIGNANT	MALIGNANT	BENIGN	BENIGN	MALIGNANT	TWO OUT OF SIX
BENIGN	MALIGNANT	BENIGN	MALIGNANT	MALIGNANT	MALIGNANT	THREE OUT OF SIX
MALIGNANT	BENIGN	MALIGNANT	MALIGNANT	BENIGN	MALIGNANT	FIVE OUT OF SIX

Fig. 9 Predicted vs Actual Results (AI & CI)

References

1 Khalis, et al. (2022). Female breast cancer incidence and mortality in Morocco: comparison with other countries. Asian Pacific Journal of Cancer Prevention: APJCP, 17(12), 5211. APJCP Journal

2 Sharma, R. (2021). Breast cancer burden in Africa: evidence from GLOBOCAN 2018. Journal of Public Health, 43(4), 763-771. https://pubmed.ncbi.nlm.nih.gov/32657321/

3 Jaiswal, A., et al. (2021). Classification of the COVID-19 infected patients using DenseNet201 based deep transfer learning. Journal of Biomolecular Structure and Dynamics, 39(15), 5682-5689.

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