Title : Project Asclepius

Theme: Integrated Healthcare Informatics

Application No: RUASIC/19/45

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Introduction

Category

Applied ML & AI in the field of medicine and image scanning.

Context

Breast cancer is cancer that develops from breast tissue. Mammograms are usually used to determine the existence of malignant tissues.

Problem statement

To come up with a modern-technology driven solution to early stage breast cancer detection, revolutionizing the way cancer is currently detected.

Challenges deep-dive

Challenge 1

Extensive Research

At least a minimum of 5 best research papers were filtered out and thoroughly understood. Links are mentioned in the references.

Challenge 2

Develop a model & Implement

After writing the code, we had to ensure that in the fully working model, everything had to work seamlessly well

Challenge 3

Follow up & scalability

Several maintenance and scalability checks were performed in order to make certain of it usability.

Abstract

Lesion and its contours are prominent signatures to determine malignancy in mammograms. Detection of the masses and their spread in mammogram is important for radiologists. It is also important to detect the shape of the contour or boundary to delineate malignant and benign lesions as malignant lesions have speculated or ill defined boundary and benign mass have smooth boundary. Automatic detection of boundary helps the doctors in analyzing the lesion in less time and prevents unnecessary biopsies.

Fabrication

Artificial Intelligence
Machine Learning

Python, Jupyter Notebook codes which apply several filters and narrow down on the suspicious zone. The zone is then marked in red, which is your output.

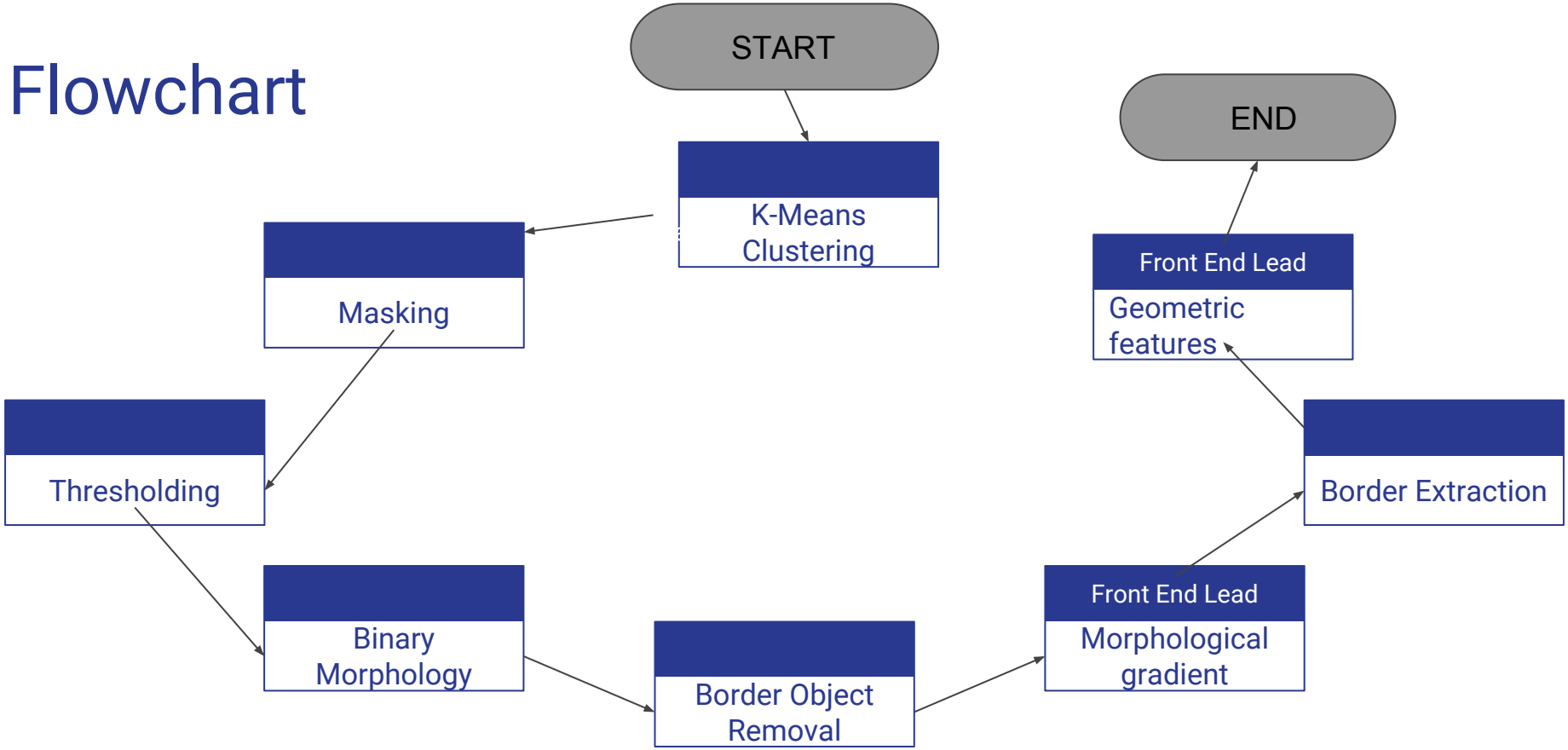
Input:- DCM Image

Output:- Demarcated cyst region with cancer detection result

Simulation & Demonstration

1. User loads image onto portal and the software handles the rest
2. The software primarily carries out 5 filters on the image, namely
   A. Homomorphic filter
   B. Top Hat transform
   C. Bottom Hat transform
   D. CLAHE
   E. High pass filter
3. The output image is enhanced, and the lesion is spotted and classified
4. Further assessment is thus performed based on these results, serving as validations for manual analysis.

Flowchart



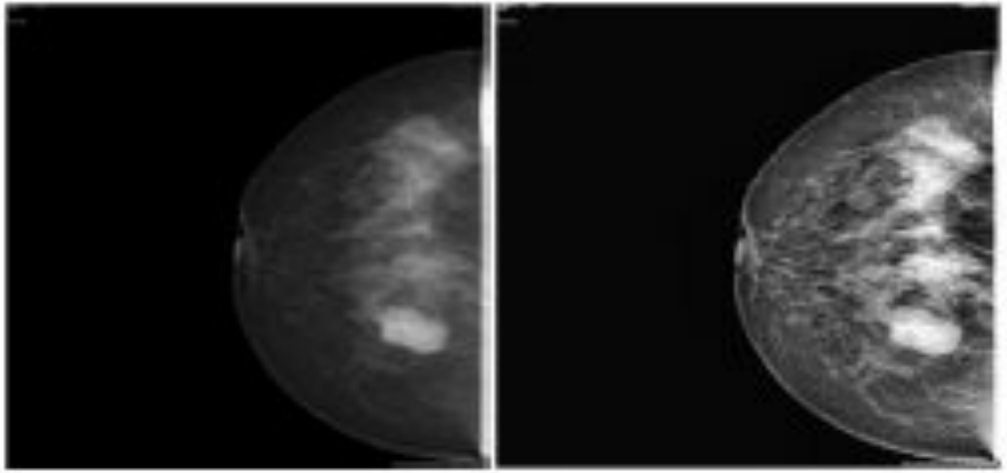
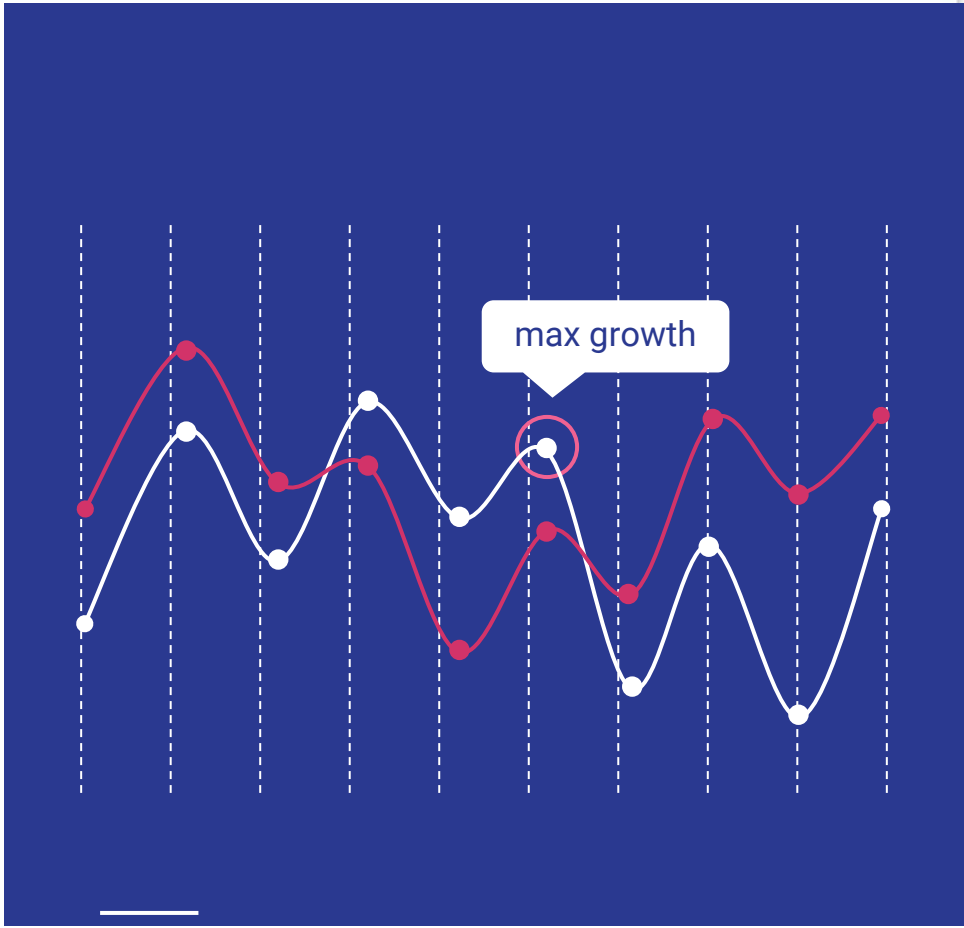


Fig.2. a) Original Mammogram b) Enhanced Mammo

As you can see, the output image on the right is much enhanced, revealing minute details which can't normally be seen through the naked eye. This will thus greatly improve the positive cancer detection rate if implemented as per necessary requirements.
Extensive research is still ongoing in this respect.

Applications & Future Prospects

1. To emerge as a software development company looking at further products improving on healthcare among other things.
2. To continually develop on existing products by applying the “Incremental development model” for application production and development, simultaneously taking user feedback.
3. Reach out to hospitals to test and use our product.



Budget

It becomes necessary here to mention that an exact detailed budget would be not practical to come up with, however, a rough estimate of the total amount may be ascertained.

Resources & Requirements

1. Internet for software updates
2. GPU (Moderately Powerful CPU)
3. Python Interpreter
4. DCM mammogram images

Total Cost:- 10,000 INR (initial stage funding)
This amount would mainly be spent in reimbursement, as a lot of processing power and time has gone into making this project possible. Apart from that, there will be a lot of overhead costs like government approvals, travel, documentation etc. which hasn't been included in this budget for now .

Findings and Conclusion

Through the various step processes of RUASIC 2018-19 we have faced a lot of challenges and have relentlessly worked in order to make our product as perfect as possible. Initiatives have been planned to be taken up to make sure this product reaches the desired market ASAP.

Findings

1. It is impossible to accurately predict whether a lesion is cancerous or benign, but if this process can be automated with a high degree of accuracy, then we could be looking upon a brilliant solution.
2. After an FNAC test, when results lie in the range of C2 to C4, nothing can be conclusively said about the nature of the lesion. Biopsy is thus suggested in such cases.
3. Biopsies are time intensive tests.

Conclusion

Our product will thus aim to replace manual methods of inspection and prevent the need for unnecessary biopsies to be conducted, thus saving on the patients time and money.