

Evaluation, Analysis and Designing of a Computer-aided Diagnostic (CAD) System for Digital Mammograms in Iran

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Abstract

In this study, the need of a CAD system and its capabilities has been investigated and then a sample program for a mammographic CAD system proper to Iranian tropical patients was designed. In the first step, the analog mammographic images were digitized by 56 and 112 mm spatial resolution and then were processed by the designed sample program.

Analysis and technical details for designing and implementing the program included for following steps: The capability of the program image displayer consisting of viewing four mammographic images from four breast views (RCC, RMLO, LCC, LMLO) in one window, determining breast region by background removing and other conventional preprocessing application tools; Software processing tools including thresholding, histogram, ROI determination; Patient information fields such as clinical information, conventional reporting section as used in radiological department in Iran; Computer-aided diagnostic section including proper diagnostic processing algorithm to automatic detection of breast abnormality. For instance the application of wavelet and fuzzy logic for detecting malignant clusters of microcalcification.

The introduced mammographic CAD system can provide the collection, organizing and the availability of the patient local information. Therefore by using the prepared database the evaluation of the sensitivity and specificity of the detecting algorithm for comparison of different research methods would be possible.

Keywords: CAD; Digital mammograms; Microcalcification; Image displayer software; Image processing,

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CAD

CAD

(RCC, RML0, LCC, LMLO)

CAD

CAD

CAD :

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riahinad@sina.tums.ac.ir :

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CAD

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CAD

PACS

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DICOM

CAD

CAD

GB

MB

micron

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CAD

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CAD

CAD

CAD

CAD

¹ Intera observer variability

² Inter observer variability

³ Computerized Aided Diagnosis

⁴ Picture and Archival Communications System

⁵ Digital Imaging & Communication Medicine

⁶ Left & Right-Crania Caudal (CC)- Right & Left-Media Lateral-Oblique

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CAD :

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(

(× × ×)

(× × ×)

. [] (ROI)

⁷ Region of Interest
¹¹ Flip
¹⁵ Wavelet and Fuzzy
¹⁹ Report

⁸ Thumbnail
¹² Histogram-Equalization
¹⁶ Visual C 6.5
²¹ Information

⁹ Clipboard
¹³ Sobel, Canny, Laplacian and Gussian Filters
¹⁷ Access
²² Template

¹⁰ Window Level
¹⁴ Kernel
¹⁸ Search



Patient Information

General Information

Patient ID: 214642788 | First Name: Masumeh | Last Name: Dabir | Age: 76 | Date: 2004-06-16_20-03-59 | Modality: mammo | Previous work: sono

Address: saadat abad st., No.15 | Phone: 09123146517 | Location: tehran | Referring Physician: Dr.Nazari

[Register]

Patients' List

Number	Reception ID	First Name	Last name	Age	Date	Present Modality	Previous Work
1	214642788	Masumeh	Dabir	76	2004-06-16_20-03-59	mammo	sono
2	216750390	pooneh	derakhshan	NA	2004-06-16_20-03-40	NA	NA
3	216750390	pooneh	derakhshan	25	2004-06-09_20-54-56	mammo	sono
4	216750390	susan	hashemi	42	2004-06-09_20-53-10	mammo	mammo
5	216750389	masoumeh	hajj	79	2004-06-09_20-53-09	NA	NA
6	215615439	poonehgg	derakhshan	24	2004-05-26_17-45-53	NA	NA
7	215615434	maryam	zare	75	2004-05-26_17-37-14	mammo	NA
8	215615427	maryam	zare	49	2004-05-26_17-37-07	mammo	NA
9	214644000	Susan	Taslimi	61	2004/05/15-11:46:40	Mammo	NA
10	214642788	Masumeh	Dabir	73	2004/05/15-11:45:51	NA	NA
11	214643929	fahimeh	noorbakhsh	50	2004/05/15-11:45:29	sono	sono
12	214643926	Zahra	Rahaei	59	2004/05/15-11:45:26	sono	sono
13	213967544	sima	darabi	23	2004/05/07-15:58:21	mammo	NA

Buttons: New, Duplicate, Delete, Search, First, Previous, Next, Last, Import, Select, Load Four, Load All, Report, Info.

Search

Select Item:

- ID
- First
- Last
- Date

[OK] [Cancel]

Report: 214642788-2004-06-16_20-03-59.txt - Notepad

```

File Edit Format View Help
----- Patient Information -----
Name:Masumeh surname:dabir Age:NA Referring-Physician: NA
----- Case Report -----
M5
Bilateral Mammography:
dense glandular tissue and scattered puctate macrocalcifications are
seen in both breasts.
Follow up mammogram in 1-2 yrs recommended.
  
```

The image displays two windows from the MammCAD software. The top window, titled "Patient Information", is divided into three sections: "General Information", "Clinical Information", and "Case Report".

General Information:

Patient ID	First Name	Last Name	Age	Date	Modality	Previous work
214642788	Masumeh	Dabir	76	2004-06-16_20-03-59	mammo	sono

Address: saadat abad st., No.15
Phone: 09123146517
Location: tehran
Referring Physician: Dr.Nazari

Clinical Information:

Complaint: HRT
Side: Right
Breast Radiology: Yes

Duration of Disease: Week 0, Month 0
Age of Meno: Menorch NA, Menopause NA
Pregnancies: 0
HRT: History After Menopause Yes, Type Est.+Prog.
Breast Cancer History: Relatives Mother, Age Post Menopause

Surgery #1: Date 2.2.2001, Side Right, Path. Malignant
Surgery #2: Date 3.7.2003, Side Right, Path. Malignant
Surgery #3: Date 1.4.2004, Side Left, Path. Malignant
Surgery #4: Date NA, Side NA, Path. NA

Digitizer Info: Model NA, Sampling rate NA, Grey Levels NA, Optical Density NA

Pathology Result: invasive lobular carcinoma
ACR Code: NA
Alive: NA

Buttons: Modify, Save

Case Report:

Template: M5Bilateral Mammography:Dense glandular tissue and scattered puctate macrocalcifications are seen in both breasts.Follow up mammogram in 1-2 yrs recommended.

The bottom window, titled "Please select required report template:", shows a grid of report templates:

#1	#5	#9	#13
#2	#6	#10	#14
#3	#7	#11	#15
#4	#8	#12	#16

Selected report text: M5Bilateral Mammography:Dense glandular tissue and scattered puctate macrocalcifications are seen in both breasts.Follow up mammogram in 1-2 yrs recommended.

Buttons: OK, Cancel

MammCAD

Please modify patient clinical information

Complaint

Routine CH/U

HRT

Pain

Lump

Secretion

Skin/nip retraction

HRT History After Menopause

Yes

No

HRT Type

Est.

Est.+Prog

Prog.

Cortin

Intemit

Side

Left

Right

Both

History of breast radiology

Yes

No

Breast Cancer In Relatives

Mother

Age

Pre Menopause

Post Menopause

Pathology Result of Surgery

invasive ductal carcinoma

insitu ductal carcinoma

invasive lobular carcinoma

insitu lobular carcinoma

proliferative changes without atypia

proliferative changes with atypia

nonproliferative changes

OK

Cancel

Surgery

Surgery #

Surgery1

Surgery2

Surgery3

Surgery4

Side

left

Right

Both

Pathology

Benign

Malignant

Import Image

Import/Replace Images

CCL	<input type="text" value="214642788-2004-06-19_21-05-09-CCL.bmp"/>	<input type="button" value="Reset CCL"/>
CCR	<input type="text" value="NA"/>	<input type="button" value="Reset CCR"/>
MLOL	<input type="text" value="NA"/>	<input type="button" value="Reset MLOL"/>
MLDR	<input type="text" value="NA"/>	<input type="button" value="Reset MLDR"/>
Image05	<input type="text" value="NA"/>	<input type="button" value="Reset Image05"/>
Image06	<input type="text" value="NA"/>	<input type="button" value="Reset Image06"/>
Image07	<input type="text" value="NA"/>	<input type="button" value="Reset Image07"/>
Image08	<input type="text" value="NA"/>	<input type="button" value="Reset Image08"/>

OK

Cancel

Select Image File:

Look in:

- 00-Phantom.bmp
- 01-Brain01.bmp
- 02-Brain02.bmp
- 03-BreastB.bmp
- 04-BreastRB.bmp
- 05-Breast-112.bmp
- 06-Breast-56.bmp

File name:

Files of type:

Open

Cancel

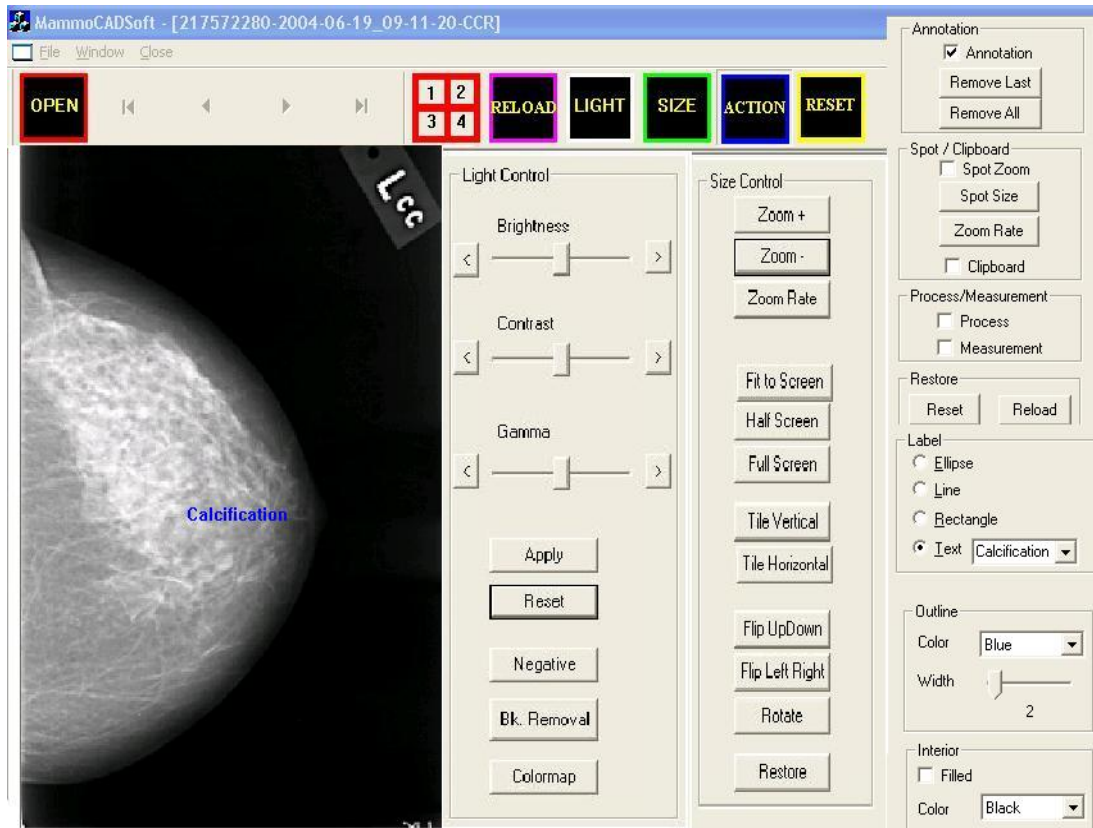
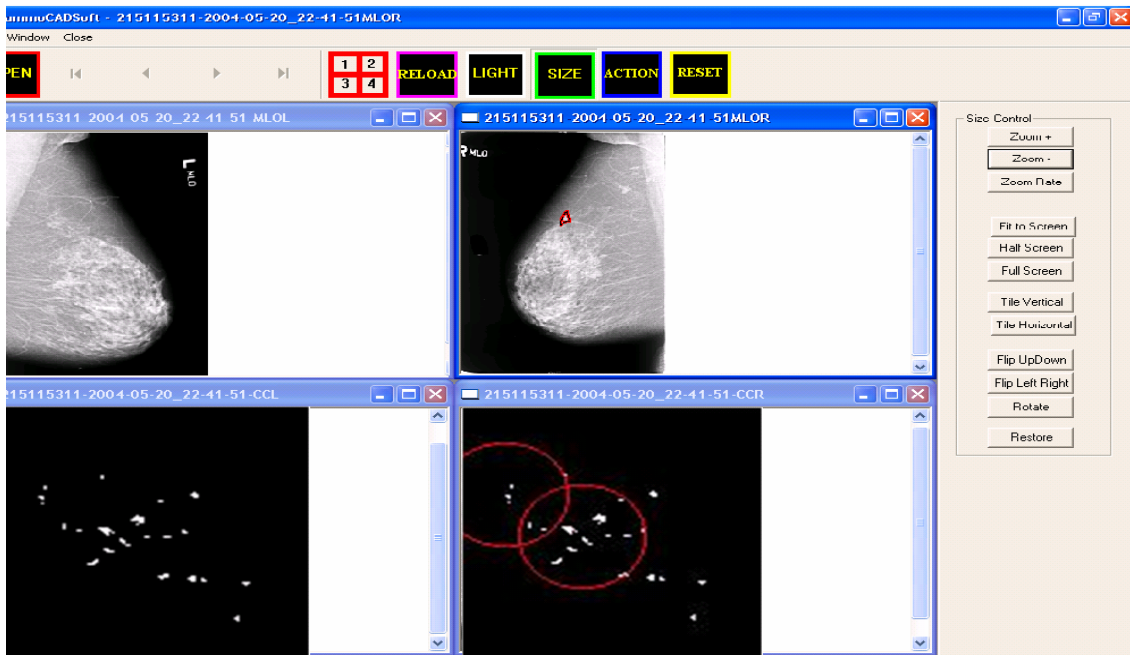
Import Image

Import/Replace Images

CCL	<input type="text" value="NA"/>	<input type="button" value="Reset CCL"/>
CCR	<input type="text" value="NA"/>	<input type="button" value="Reset CCR"/>
MLOL	<input type="text" value="NA"/>	<input type="button" value="Reset MLOL"/>
MLDR	<input type="text" value="NA"/>	<input type="button" value="Reset MLDR"/>
Image05	<input type="text" value="NA"/>	<input type="button" value="Reset Image05"/>
Image06	<input type="text" value="NA"/>	<input type="button" value="Reset Image06"/>
Image07	<input type="text" value="NA"/>	<input type="button" value="Reset Image07"/>
Image08	<input type="text" value="NA"/>	<input type="button" value="Reset Image08"/>

OK

Cancel



DICOM

CAD

iCAD

CAD_x

CAD

R2-TECNOLOGY

CAD

R2-TECNOLOGY .

CAD

CAD

CAD

Pen Rad

Pen Rad

CAD

CAD

MRS

(ACR)

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CAD

PACS

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²⁷ Second Pair of Eyes
³⁰ Conventional
³³ Database for Patient Information
³⁶ Voice Reporting

²⁸ Mammography Reporting System, Inc
³¹ Viewer
³⁴ Image Processing

²⁹ American College of Radiology
³² Reporting system
³⁵ Screening- Mammography

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