Detection and Diagnosis of Breast Tumors using Deep Convolutional Neural Networks

Final Presentation

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Introduction

Breast Cancer Overview

Breast cancer

Breast Cancer Overview

Breast cancer

Most common cancer in women

Breast Cancer Overview

Breast cancer

Most common cancer in women

50%

Breast Cancer Overview

Breast cancer: Most common cancer in women

50%: Of the cases occur in less developed countries

Breast Cancer Overview

Breast cancer — Most common cancer in women

50% — Of the cases occur in less developed countries

508k

Breast Cancer Overview

Breast cancer	Most common cancer in women
50%	Of the cases occur in less developed countries
508k	Women are estimated to have died in 2011 worldwide due to BC

Breast Cancer Overview

Breast cancer — Most common cancer in women

50% — Of the cases occur in less developed countries

508k — Women are estimated to have died in 2011 worldwide due to BC

WHO

Breast Cancer Overview

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50%	Of the cases occur in less developed countries
508k	Women are estimated to have died in 2011 worldwide due to BC
WHO	Early detection increases the chances of developing a successful treatment plan

Breast Cancer Overview

Breast cancer	Most common cancer in women
50%	Of the cases occur in less developed countries
508k	Women are estimated to have died in 2011 worldwide due to BC
WHO	Early detection increases the chances of developing a successful treatment plan

Source: World Health Organization (2016)

Goal

Computer-Aided Diagnosis System

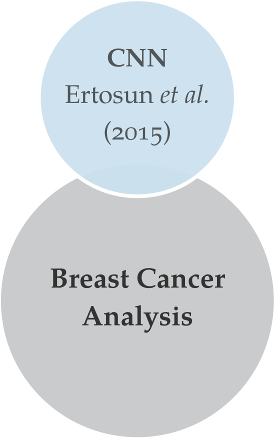
To develop a computer system which can assist medical personnel with the early detection of tumors based on mammography images.

Related Work

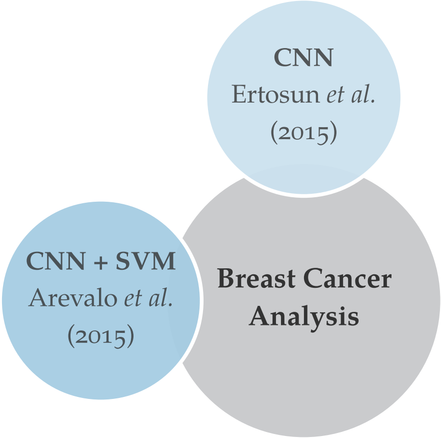
Related Work

Breast Cancer Analysis

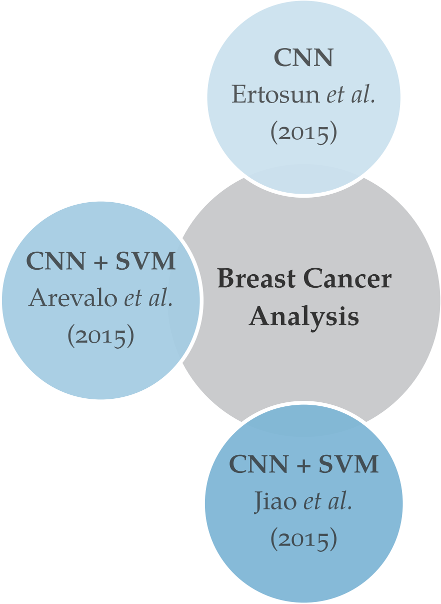
Related Work



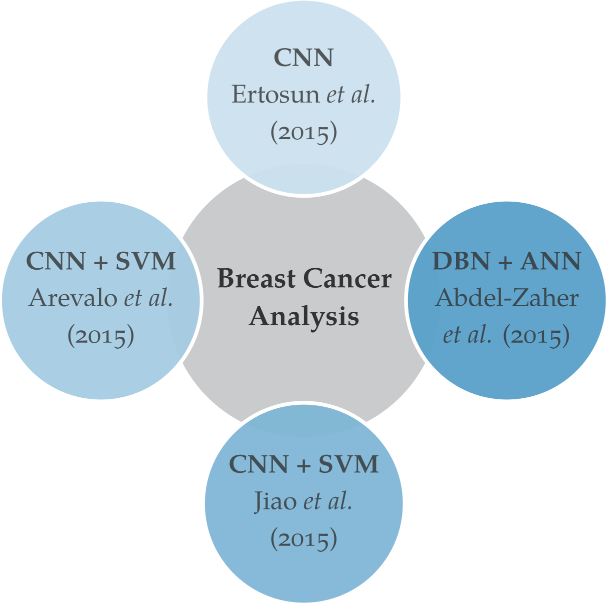
Related Work



Related Work

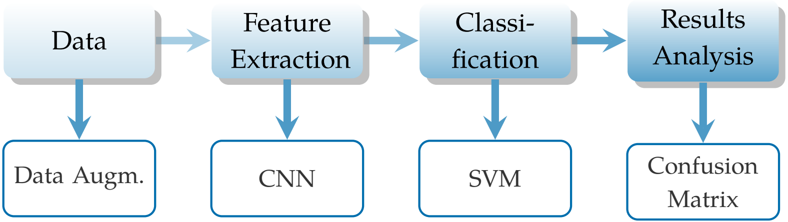


Related Work



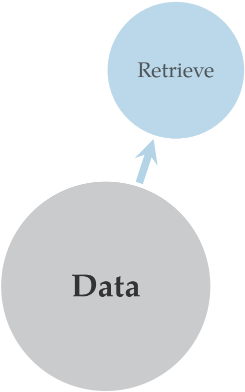
Methodology

Methodology



Data

Data



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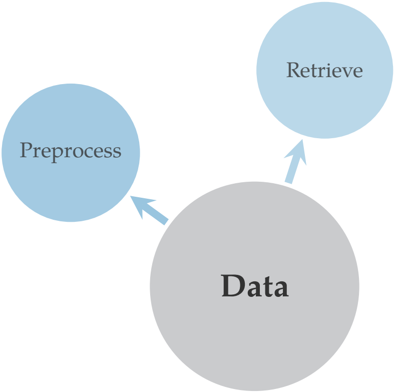

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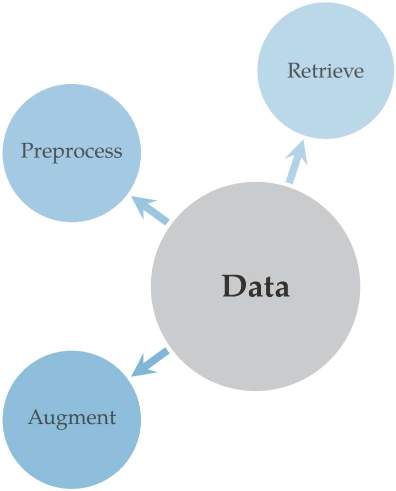

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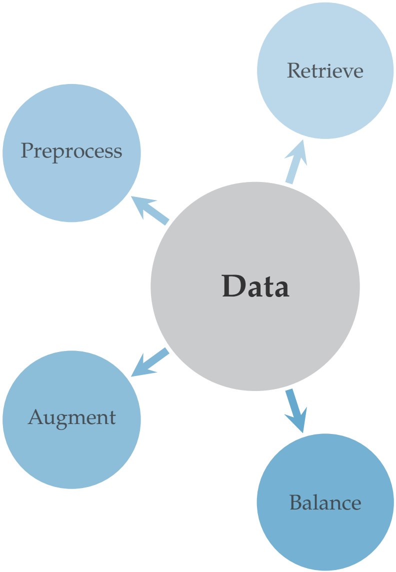

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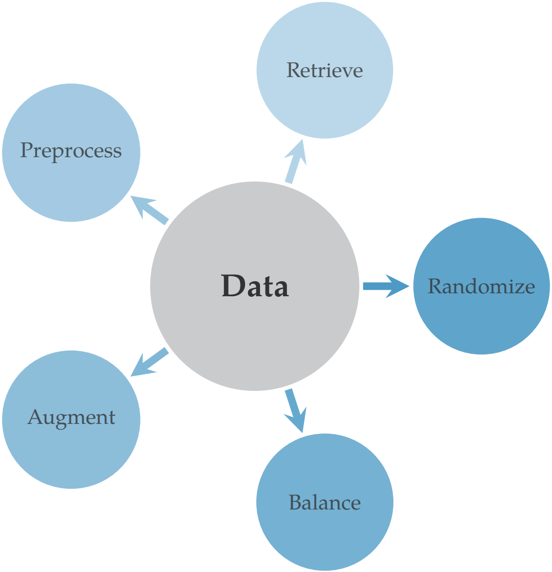
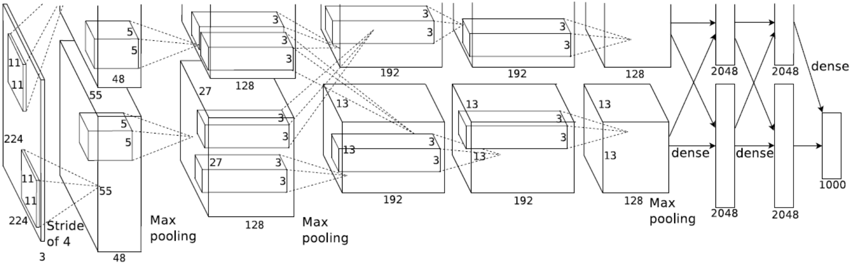
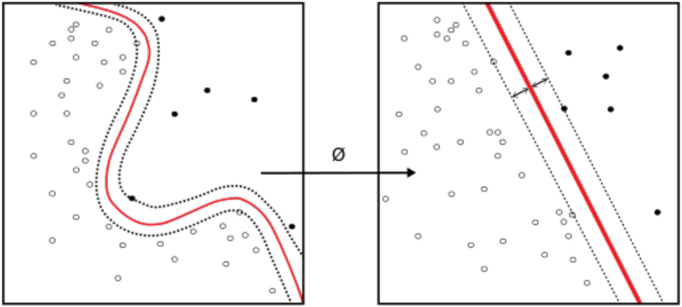


Feature Extraction - AlexNet



Source: Krizhevsky *et al.* (2012)

SVM

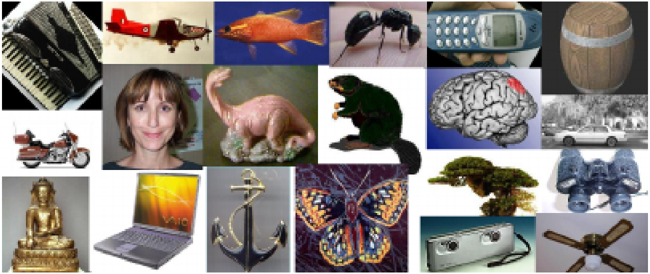


"Kernel machines are used to transform NON-LINEARLY *separable sets into a* HIGHER DIMENSION *space in which they are linearly separable."*

Image retrieved from https://goo.gl/E8UywE

Caltech-101

Data



- Compiled by California Institute of Technology
- RGB and B&W pictures
- 101 different categories

Image retrieved from https://goo.gl/587ZkJ

Results - Caltech + VGG

Target

Output		Airplanes	Faces	Bikes	Watches	Total
	Airplanes	97.5	0	0	2.5	97.5
	Faces	0	97.5	0	2.5	97.5
	Bikes	0	0	100	0	100
	Watches	0	0	0	100	100
	Total	100	100	100	95.24	98.75

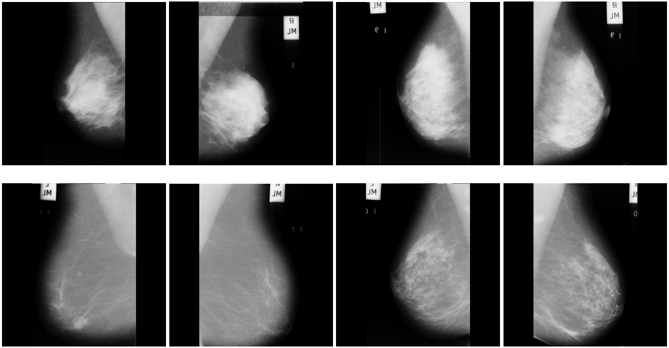
Results - Caltech + AlexNet

Target / *Output*

	Airplanes	Faces	Bikes	Watches	Total
Airplanes	**97.5**	0	0	2.5	**97.5**
Faces	0	**100**	0	0	**100**
Bikes	0	0	**100**	0	**100**
Watches	0	0	0	**100**	**100**
Total	**100**	**100**	**100**	**97.56**	**99.38**

mini-MIAS

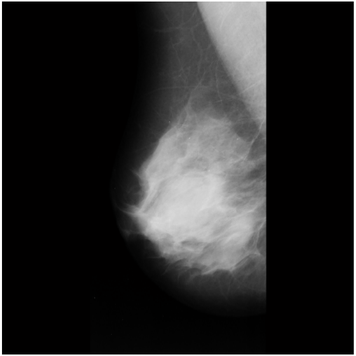
Data



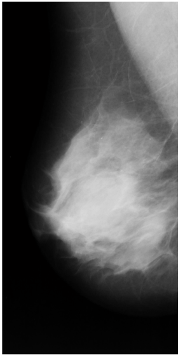
- United Kingdom National Breast Screening Programme [6]
- 322 mammograms - 3 categories
- 1024×1024 pixels

Source: Suckling *et al.* (1994)

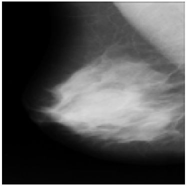
Data Preprocessing



Original



Cropped



Resized

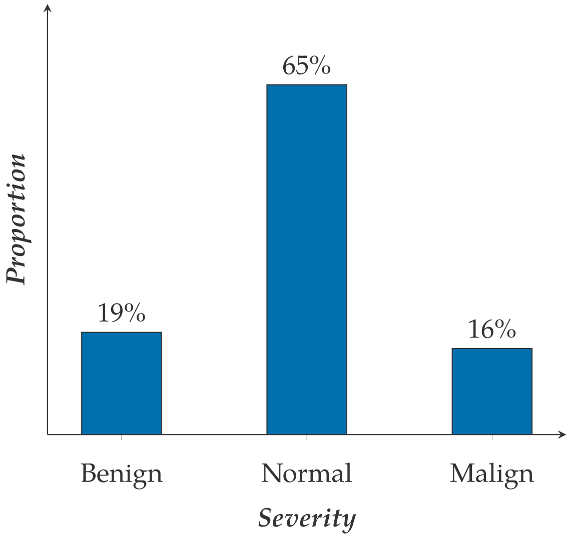
Source: Suckling *et al.* (1994)

Results - mini-MIAS + AlexNet

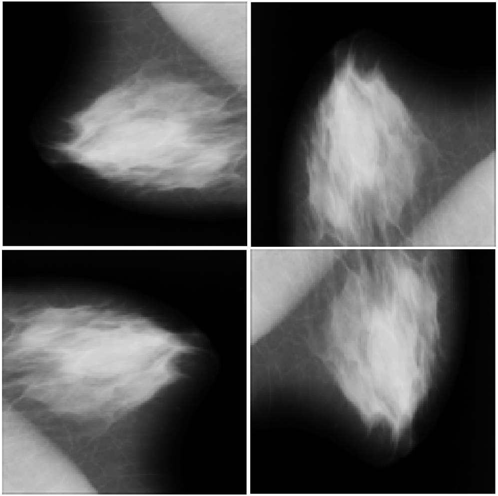
Target

Output	Benign	Malign	Normal	Total
Benign	**36.53**	48.12	15.35	**36.53**
Malign	27.39	**56.12**	16.49	**56.12**
Normal	31.34	56.29	**12.36**	**12.36**
Total	**38.35**	**34.96**	**27.97**	**35.01**

Unbalanced Data



Data Augmentation



Source: Suckling *et al.* (1994)

Results - Augmented mini-MIAS + AlexNet

Target

Output		Benign	Malign	Normal	Total
	Benign	**61.79**	20.33	17.87	**61.79**
	Malign	18.79	**61.75**	19.46	**61.75**
	Normal	22.88	20.67	**56.46**	**56.46**
	Total	**59.73**	**60.10**	**60.20**	**60.01**

Results - Augmented mini-MIAS + VGG

		Target			
		Benign	**Malign**	**Normal**	**Total**
Output	**Benign**	**63.63**	18.45	17.92	**63.63**
	Malign	17.86	**64.37**	17.77	**64.37**
	Normal	16.91	17.54	**65.55**	**65.55**
	Total	**64.66**	**64.14**	**64.75**	**64.52**

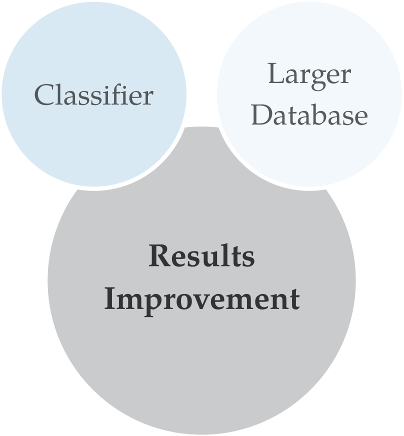
Conclusions

Conclusions + Future Work

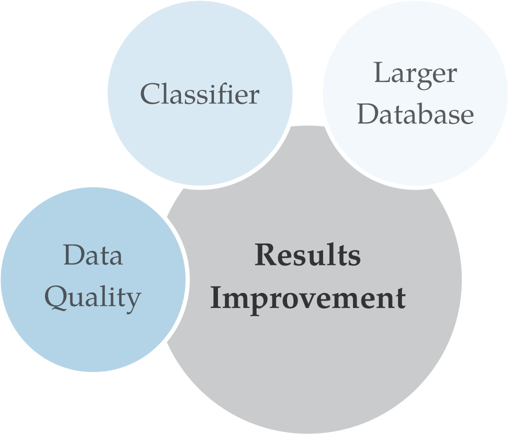
Results Improvement

Conclusions + Future Work

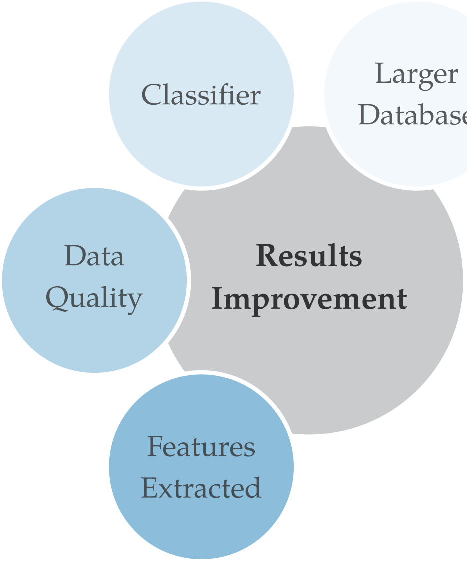
Conclusions + Future Work



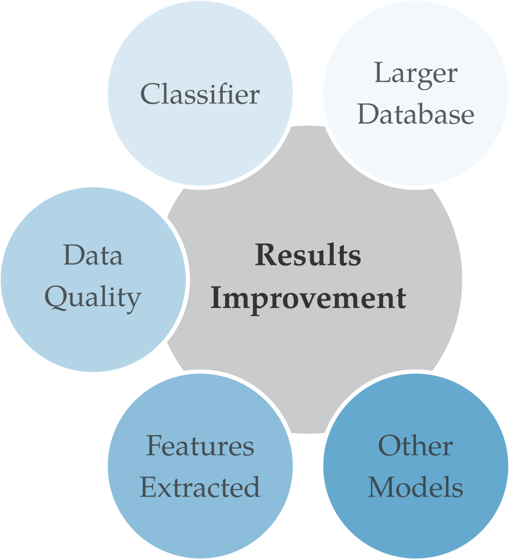
Conclusions + Future Work



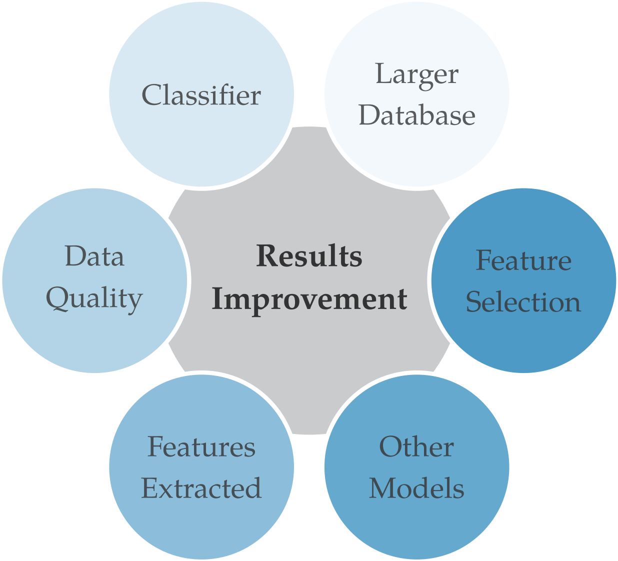
Conclusions + Future Work



Conclusions + Future Work



Conclusions + Future Work



References

References I

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[6] J. Suckling, J. Parker, D. Dance, S. Astley, I. Hutt, C. Boggis, I. Rick-etts, E. Stamatakis, N. Cerneaz, S. Koket al., “The mammographic image analysis society digital mammogram database,” in *Exerpta Medica. International Congress Series*, vol. 1069, 1994, pp. 375–378.

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Questions