

Visualisation and Topological Aspects of Higher Dimensional Data

Final Report for CS39440 Major Project

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Abstract

Include an abstract for your project. This should be no more than 300 words.

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Background & Objectives

1.1 Mammography

Breast cancer is the leading cause of death among women and is the most common form of cancer found in women [6]. Early screening of breast cancer using mammography has been shown to reduce the mortality rate of women [4, 7].

Mammography is the analysis of female breast tissue through the use of X-ray radiology with the goal of producing high resolution images of the structure within the female breast. The composition of the parenchymal patterns and tissue density revealed by in a mammographic evaluation can be used in the early detection of breast cancer.

Qualitatively speaking the composition of breast tissue can be split into four distinct categories. These are Nodular densities (corresponding to Terminal Ductal Lobular Units (TDLUs), linear densities (corresponding to ducts, vessels, and fibrous strands), homogeneous, structureless densities (corresponding to fibrous supporting tissue), and radiolucent areas (corresponding to adipose tissue). Typical markers used in the detection of cancer can be the presence of clusters of microcalcifications, masses, architectural distortions, breast density and parenchymal patterns [2, 5].

1.1.1 Risk Assessment

Mammograms provide a non-invasive means to assess the risk of a patient developing cancer given a set of mammographic images. There are multiple classification systems used in the classification of mammographic risk. The composition of breast tissue can be categorised using the Breast Imaging Reporting And Data System (BI-RADS) [3]. BI-RADS classifies mammograms based on the density of tissue (and therefore risk) in the mammogram.

1.2 Features

1.2.1 Shape Features

1.2.2 Texture Features

1.3 Dimensionality Reduction

1.3.1 Linear

1.3.2 Non Linear

1.4 Visualisation

1.5 Analysis

1.6 Research Method

Chapter 2

Experiment Methods

2.1 Overview

2.2 Techniques

2.2.1 Features

2.2.2 Dimensionality Reduction

2.2.3 Visualisation

2.3 Datasets

2.3.1 Synthetic Data

2.3.2 Real Data

2.4 Implementation

2.4.1 Languages

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Chapter 3

Results and Conclusions

3.1 Comparison of Real and Synthetic Datasets

3.2 Investigation of Mapping

Chapter 4

Critical Evaluation

4.1 Conclusions

4.2 Evaluation of the Project

4.3 Future Work

Appendices

Appendix A

Third-Party Code and Libraries

Appendix B

Code samples

Annotated Bibliography

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