# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER NO.</th>
<th>TITLE</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ABSTRACT</td>
<td>v</td>
</tr>
<tr>
<td></td>
<td>LIST OF TABLES</td>
<td>xii</td>
</tr>
<tr>
<td></td>
<td>LIST OF FIGURES</td>
<td>xiii</td>
</tr>
<tr>
<td></td>
<td>LIST OF ABBREVIATIONS</td>
<td>xv</td>
</tr>
<tr>
<td>1</td>
<td>INTRODUCTION TO MAMMOGRAMS AND BREAST CANCER DETECTION</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1.1 INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1.2 BREAST CANCER</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>1.2.1 Types of Breast Cancer</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>1.3 MAMMOGRAM</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>1.3.1 Types of Mammography</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>1.4 COMPUTER-AIDED DIAGNOSIS USING MAMMOGRAMS</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>1.4.1 Typical Architecture for Cancer Detection Using Mammograms</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>1.5 THE MAMMOGRAPHIC IMAGE ANALYSIS SOCIETY (MIAS)</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>1.6 OBJECTIVE OF THE RESEARCH</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>1.7 RESEARCH CONTRIBUTION</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>1.8 ORGANIZATION OF THESIS</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>LITERATURE SURVEY</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>2.1 INTRODUCTION</td>
<td>23</td>
</tr>
<tr>
<td>CHAPTER NO.</td>
<td>TITLE</td>
<td>PAGE NO.</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>2.2</td>
<td>BREAST CANCER DETECTION USING MAMMOGRAMS</td>
<td>24</td>
</tr>
<tr>
<td>2.3</td>
<td>FEATURE EXTRACTION TECHNIQUES IN MAMMOGRAMS</td>
<td>29</td>
</tr>
<tr>
<td>2.4</td>
<td>FEATURE SELECTION TECHNIQUES IN MAMMOGRAMS</td>
<td>32</td>
</tr>
<tr>
<td>2.5</td>
<td>SURVEY ON MICRO-CALCIFICATION DETECTION</td>
<td>35</td>
</tr>
<tr>
<td>2.6</td>
<td>MASS DETECTION AND CLASSIFICATION</td>
<td>40</td>
</tr>
<tr>
<td>2.7</td>
<td>CLASSIFIERS IN MAMMOGRAM</td>
<td>44</td>
</tr>
<tr>
<td>2.8</td>
<td>OPTIMIZATION TECHNIQUES USED IN MAMMOGRAM</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>PREDICTION OF MICRO CALCIFICATIONS IN MAMMOGRAM USING PARALLEL NEURAL NETWORK</td>
<td>55</td>
</tr>
<tr>
<td>3.1</td>
<td>INTRODUCTION</td>
<td>55</td>
</tr>
<tr>
<td>3.2</td>
<td>PREDICTION OF MICRO CALCIFICATIONS</td>
<td>56</td>
</tr>
<tr>
<td>3.3</td>
<td>METHODOLOGY</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>3.3.1 Feature Extraction</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>3.3.2 Feature Selection</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>3.3.3 Proposed Neural Network</td>
<td>63</td>
</tr>
<tr>
<td>3.4</td>
<td>EXPERIMENTS AND RESULTS</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>3.4.1 Sample RMSE/MSE Calculations</td>
<td>75</td>
</tr>
<tr>
<td>3.5</td>
<td>SUMMARY</td>
<td>76</td>
</tr>
<tr>
<td>4</td>
<td>EFFICACY OF FEATURE SELECTION TECHNIQUES FOR MULTILAYER PERCEPTRON NEURAL NETWORK TO CLASSIFY MAMMOGRAM</td>
<td>77</td>
</tr>
<tr>
<td>CHAPTER NO.</td>
<td>TITLE</td>
<td>PAGE NO.</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>4.1</td>
<td>INTRODUCTION</td>
<td>77</td>
</tr>
<tr>
<td>4.2</td>
<td>ARTIFICIAL NEURAL NETWORK</td>
<td>79</td>
</tr>
<tr>
<td>4.2.1</td>
<td>Architecture of Neural Network</td>
<td>80</td>
</tr>
<tr>
<td>4.3</td>
<td>METHODOLOGY</td>
<td>83</td>
</tr>
<tr>
<td>4.3.1</td>
<td>Feature Extraction</td>
<td>83</td>
</tr>
<tr>
<td>4.3.2</td>
<td>Feature Selection</td>
<td>88</td>
</tr>
<tr>
<td>4.3.3</td>
<td>Mutual Information (MI)</td>
<td>89</td>
</tr>
<tr>
<td>4.3.4</td>
<td>Genetic Algorithm (GA) based Feature Selection</td>
<td>89</td>
</tr>
<tr>
<td>4.3.5</td>
<td>Multi-Layer Perceptron (MLP)</td>
<td>91</td>
</tr>
<tr>
<td>4.4</td>
<td>EXPERIMENTS AND RESULTS</td>
<td>93</td>
</tr>
<tr>
<td>4.5</td>
<td>SUMMARY</td>
<td>99</td>
</tr>
<tr>
<td>5</td>
<td>AN IMPROVED NEURAL NETWORK FOR MAMMOGRAM CLASSIFICATION USING GENETIC OPTIMIZATION</td>
<td>100</td>
</tr>
<tr>
<td>5.1</td>
<td>INTRODUCTION</td>
<td>100</td>
</tr>
<tr>
<td>5.2</td>
<td>GENETIC ALGORITHM (GA)</td>
<td>101</td>
</tr>
<tr>
<td>5.3</td>
<td>METHODOLOGY</td>
<td>102</td>
</tr>
<tr>
<td>5.3.1</td>
<td>Proposed Feature Selection using Genetic Algorithm (GA)</td>
<td>103</td>
</tr>
<tr>
<td>5.3.2</td>
<td>Proposed Neural Network Weight Optimization</td>
<td>106</td>
</tr>
<tr>
<td>5.4</td>
<td>RESULTS AND DISCUSSION</td>
<td>107</td>
</tr>
<tr>
<td>5.5</td>
<td>SUMMARY</td>
<td>115</td>
</tr>
<tr>
<td>6</td>
<td>CONCLUSION AND FUTURE WORK</td>
<td>116</td>
</tr>
<tr>
<td>6.1</td>
<td>CONCLUSION</td>
<td>116</td>
</tr>
<tr>
<td>6.2</td>
<td>FUTURE WORK</td>
<td>118</td>
</tr>
<tr>
<td>CHAPTER NO.</td>
<td>TITLE</td>
<td>PAGE NO.</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>REFERENCES</td>
<td></td>
<td>119</td>
</tr>
<tr>
<td>LIST OF PUBLICATIONS</td>
<td></td>
<td>133</td>
</tr>
</tbody>
</table>