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DIRA-Net on Breast Cancer Diagnosis

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Abstract

Breast cancer is a leading cause of death among women, with one in eight affected globally [1]. Early detection is crucial as it can spread rapidly in its malignant stage [3]. Traditional mannual diagnostic methods like mammography and biopsy face challenges, including being time-consuming and error-prone. To address these issues, this project developed a deep learning-based system using the Depthwise-Inception-ResNet model, which achieved 96.45% accuracy, 93% AUC, and 92.14% F1-Score in testing on histopathological images, demonstrating significant improvements in diagnostic precision and efficiency.

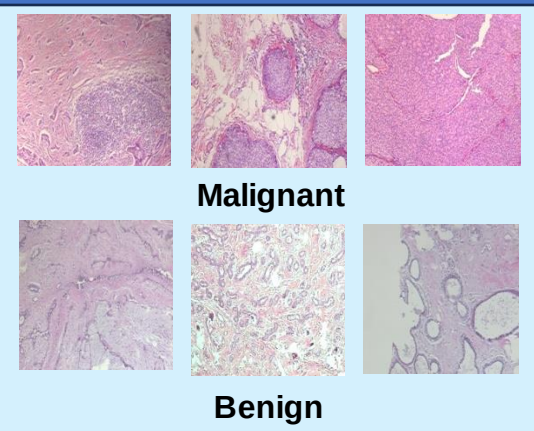


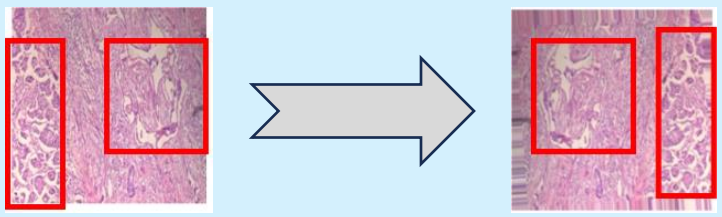
Figure 1: Histopathological Images of Breast Cancer From the Dataset

Dataset & Data Process

- **About dataset:** The Breast Cancer Histopathological Image Classification (BreakHis) dataset consists of 9,109 microscopic images of breast tumor tissue from 82 patients. The images are 700x460 pixels, 3-channel RGB, and 8-bit depth PNG format. The dataset includes eights types of tumors. This project separates into benign and malignant for binary classification, each magnification has Benign and Malignant.

Magnification	Benign		Malignant		Resize
	Before	After	Before	After	
40X	532	1300	1300	1300	700 * 460 TO 224 * 224
100X	548	1222	1222	1222	
200X	530	1182	1185	1182	
400X	500	1048	1050	1048	

Table 1:Data preprocessing to balance the images, and resize images



Before **After**

Figure 2:Augmentation with Horizontal Flip, Rotation 0.2, Zoom Range 0.2, Shear 0.2, Horizontal and Vertical Shift 0.2

Deployment

- Home page shows the sources of BreakHis link and other common used datasets of breast cancer.
- Click the **<<Get Diagnose>>** button one home page, and leads user to diagnosing page.
- Upload the image of breast cancer histopathological images and click **<<Get Diagnosis>>**

Home Page **Diagnosis Page** **Diagnosis Results**

Figure 5:Deployment on Web

Implementation & Results

- The model is constructed as the integration of Depthwise and Attention mechanism, Inception and Residual Network structure.
- The training is evaluated with Accuracy, Loss, Precision, Recall, Specificity, F1-Score, AUC, ROC, Confusion Matrix and the total parameters of the network.

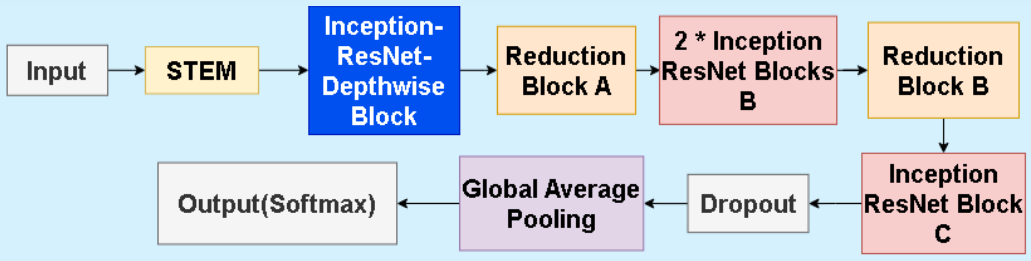
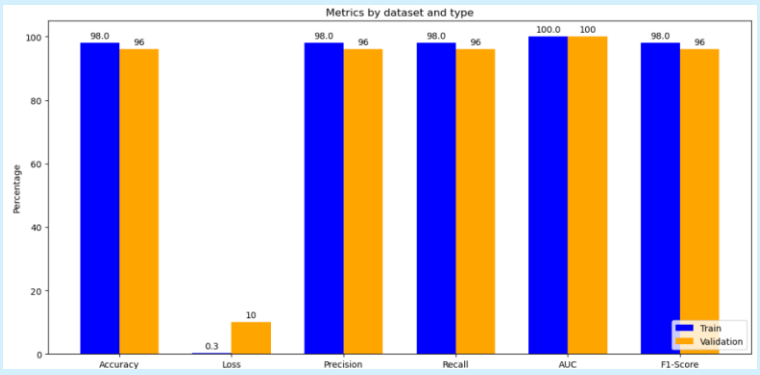
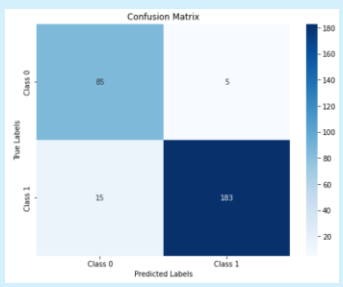


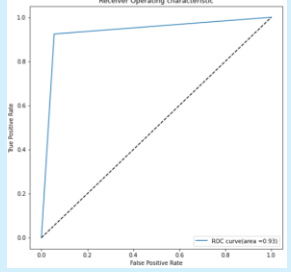
Figure 3: Model Overview



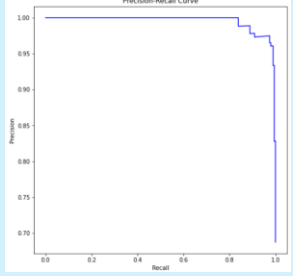
Accuracy, Loss, Precision, F1-Score, Recall, AUC



Confusion Matrix



ROC



Precision-Recall Curve

Figure 4: Training Results Summary

Conclusion

- Developed DIRA-Net for breast cancer diagnosis.
- Achieved high accuracy and performance metrics.
- Improved efficiency and real-time use.
- Requires better multi-class classification.
- Future work: enhance multi-class capabilities.
- Validate on more public datasets.

Reference

[1] I. Hirra et al., “Breast Cancer Classification From Histopathological Images Using Patch-Based Deep Learning Modeling,” IEEE Access, vol. 9, pp. 24273–24287, 2021, doi: 10.1109/ACCESS.2021.3056516.

[2] M. Desai and M. Shah, “An anatomization on breast cancer detection and diagnosis employing multi-layer perceptron neural network (MLP) and Convolutional neural network (CNN),” Clin. EHealth, vol. 4, pp. 1–11, 2021, doi: 10.1016/j.ceh.2020.11.002.