Harnessing Inception Depthwise Attention CNN of Residual Learning for Improved Skin Cancer Classification

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Introduction

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01 INTRODUCTION - ABOUT

Problem:

There are two main types of skin cancer: melanoma and non-melanoma. There were more than 150,000 new cases of melanoma in 2020.

Rank	Country	Number	ASR/100,000
	World	*324,635*	*3.4*
1	Australia	16,171	36.6
2	New Zealand	2,801	31.6
3	Denmark	2,886	29.7
4	The Netherlands	8,310	27.0
5	Norway	2,567	26.4
6	Sweden	4,266	23.3
7	Switzerland	3,357	21.6
8	Germany	31,468	20.5
9	Slovenia	735	19.7
10	Finland	2,090	19.5

Table 1: total global melanoma skin cancer incidence and rates

Contribute:

The objective of this project is to explore the application of depthwise separable CNNs to enhance the diagnosis of skin cancer

This will be achieved through an innovative approach that integrates Depthwise Convolutional Neural Networks with Residual Learning, Inception modules, and an Attention Network.

01 INTRODUCTION - ABOUT

Aspect	Traditional Approach	Deep Learning
Data Requirement	visual examination	Dataset of skin images.
Dependency	Expertise.	Model
Accuracy	Experience.	Data-driven models
Efficiency	Workload	Model
Accessibility	Medical resources and location.	Devices and Cloud.

Table 1: difference between traditional skin detection and applying deep learning techniques

03 About Dataset

HAM0000

- Human Against Machine
- 10015 dermatoscopic images

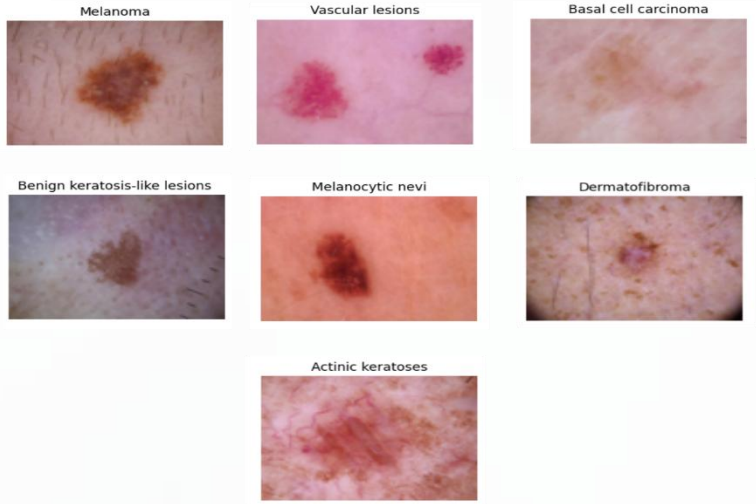
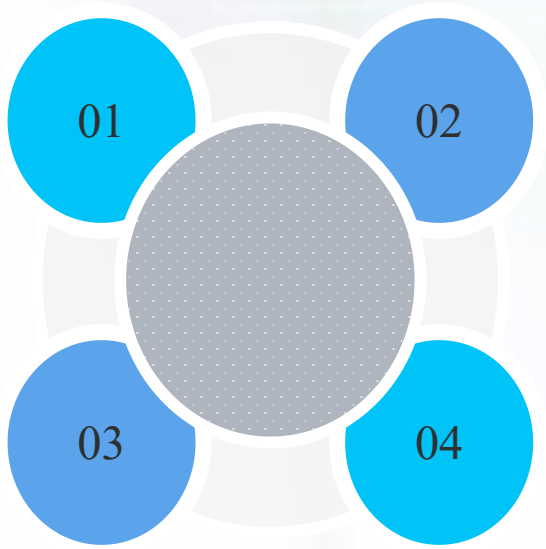


Figure 1:Examples of HAM10000



Training Plan

- Total Image:46935(balanced)
- Each Class:6705
- Training:35201
- Test:11734

Figure 2:Balanced dataset

Dataset Categories

- NV: melanocytic nevi
- Mel: melanoma
- Bkl: benign keratosis-like lesions
- Bcc: basal cell carcinoma
- Vasc: pyogenic granulomas and hemorrhage
- Akiec: Actinic keratoses and intraepithelial carcinomae
- Df: dermatofibroma

Data Augmentation

- rotation_range:10
- zoom range :0.1
- width_shift_range:0.1
- height_shift_range:0.1

Methodology

03

04 Overall Architecture

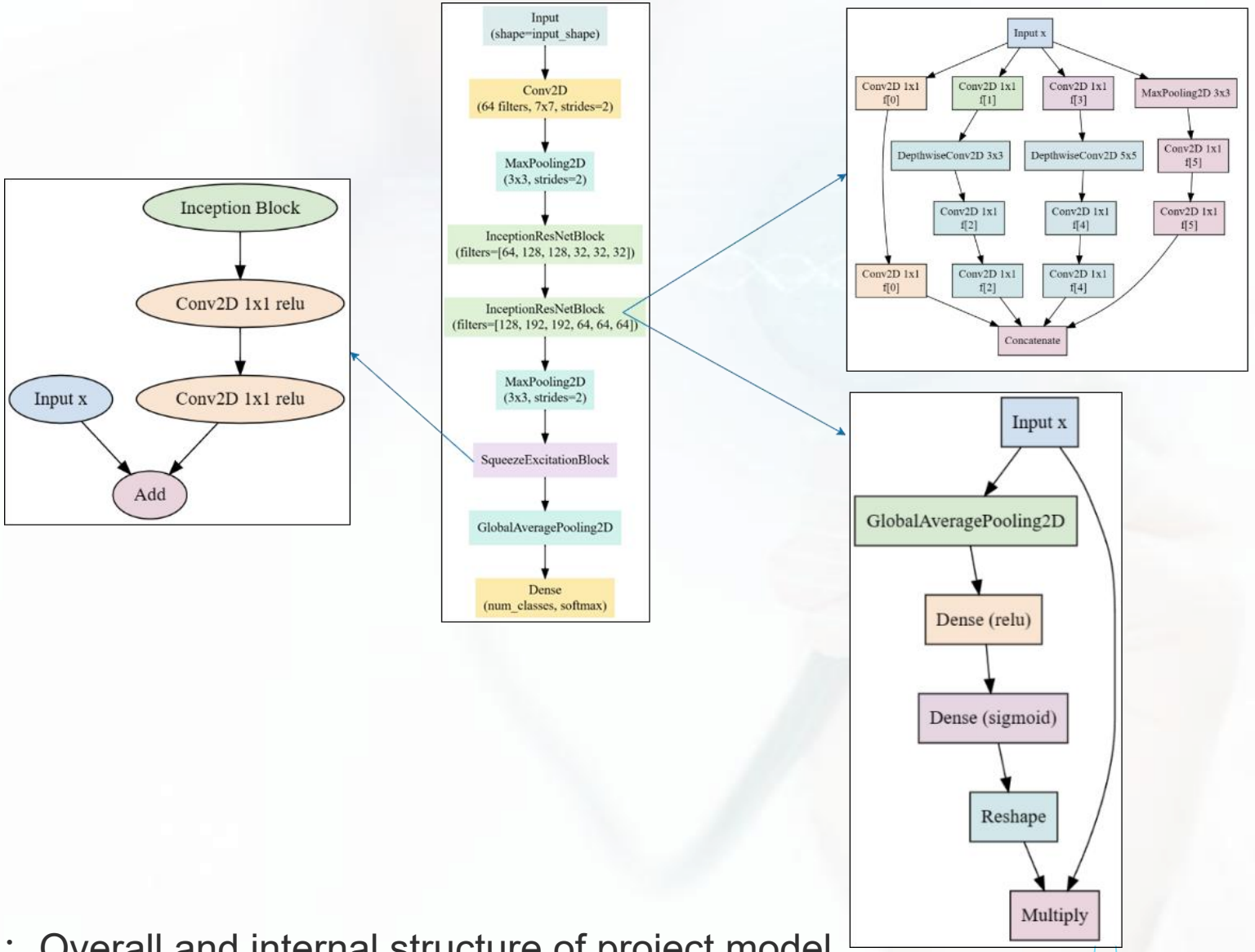


Figure 3： Overall and internal structure of project model

05 Model Parameter Settings

Parameter/Function	Setting
Input Shape	(28, 28, 3)
Number of Classes	7
Model Type	Depthwise Attention Inception ResNet
Optimizer	Adam
Loss Function	Categorical Cross-Entropy Loss
Metrics	Accuracy
Learning Rate Scheduler	ReduceLROnPlateau (Monitor: Validation Accuracy, Factor: 0.5, Patience: 4, Min_LR: 0.00001)
Early stopping strategy	EarlyStopping (Monitor: Validation Loss, Patience: 4, Restore Best Weights)
Number of Epochs	200
Batch Size	60

Figure 4：Parameters of project model

06 Project Hardware

Software	Framework	TensorFlow
	Language	Python
	Libraries	NumPy, Scikit-learn, Pandas, OpenCV, Matplotlib, NumPy, Keras, OS
	Version management plan	GitHub repository: https://github.com/Chocolate-O/Final-Project
Hardware	Central processing unit (CPU)	Intel(R) Core (TM) i7-12500H CPU @ 2.60GHz 2.59 GHz
	Graphic Processing Unit (GPU)	NVIDIA GeForce GTX 2070 Super

Table 2：Training environment

Result

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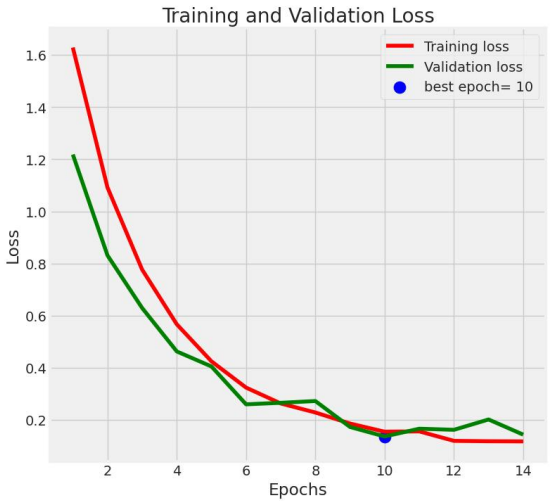
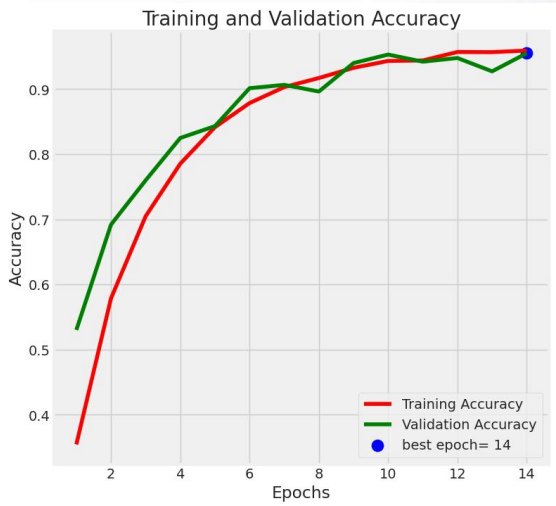
07 Results



a) T_L: 0. 0003, Val loss: 0. 0625



b) T_A:0.9999, Val acc: 0.9864

Figure 5 ：a) and b) shows loss, accuracy of train and validation of proposed Model

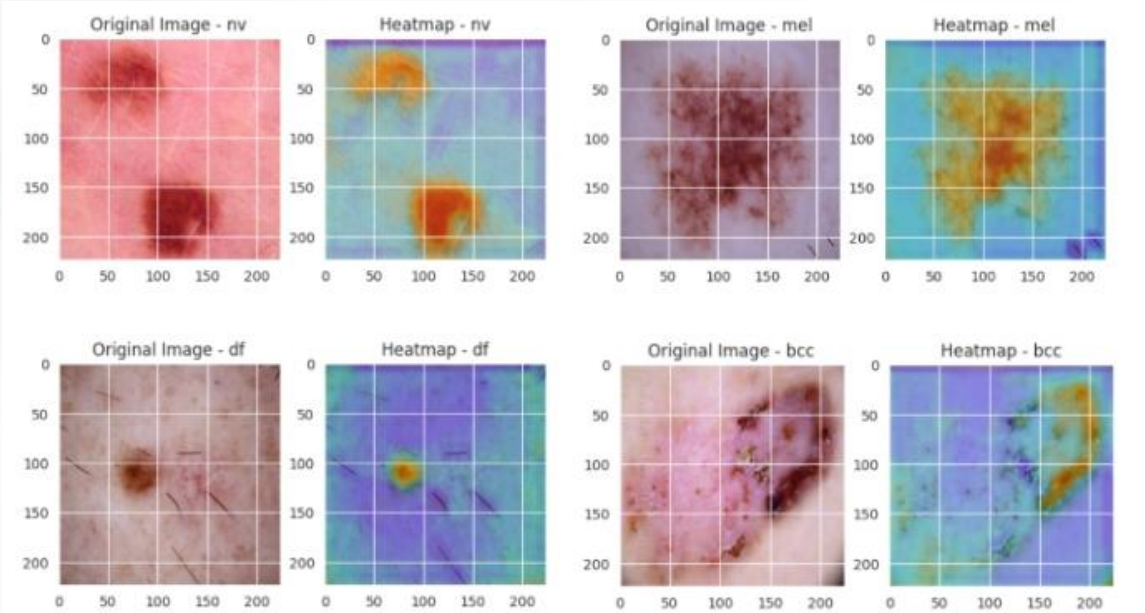


Figure 6 ： Visualization of heat maps for NV, MEL, DF, BCC

08 Confusion Matrix

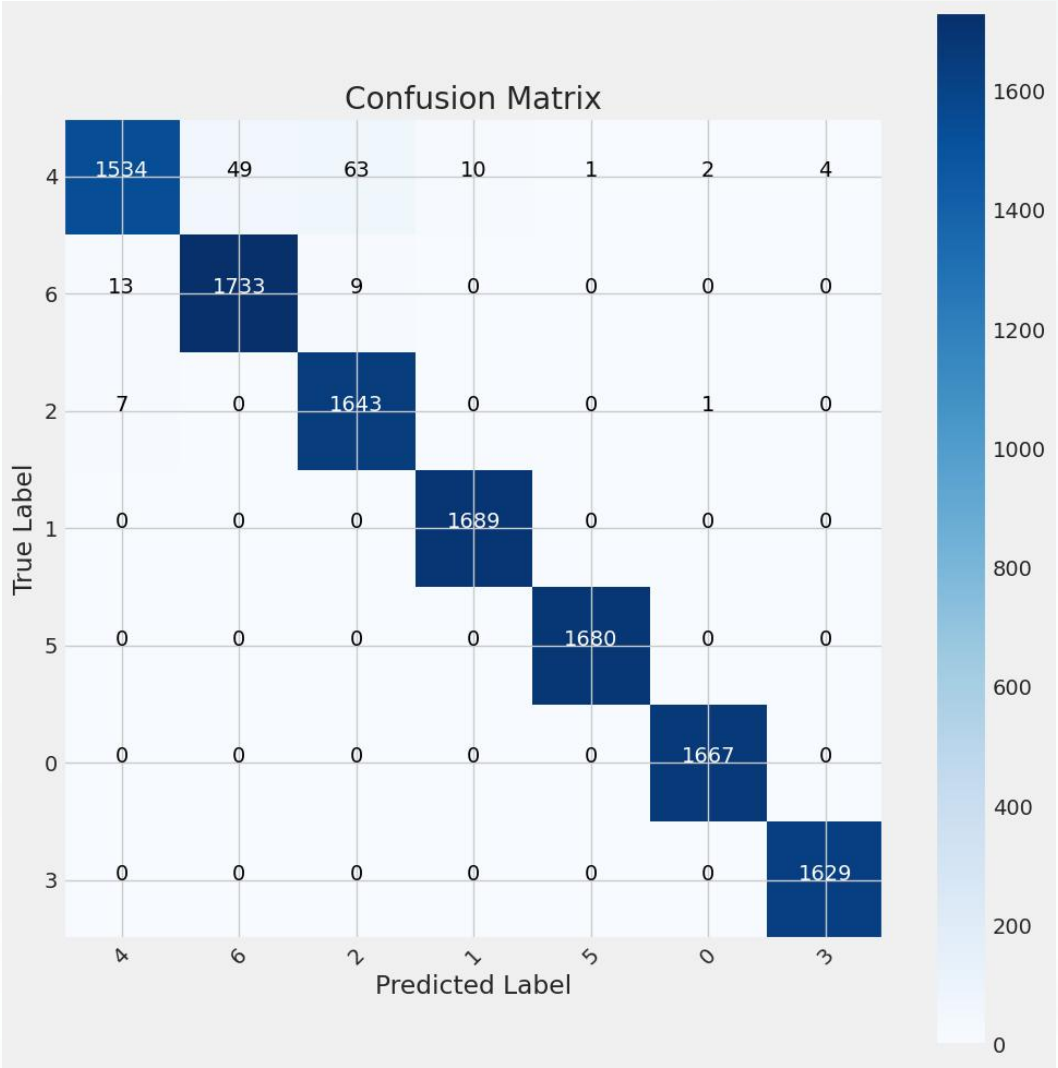


Figure 7： Confusing matrix of training results

GUI

04

09 GUI

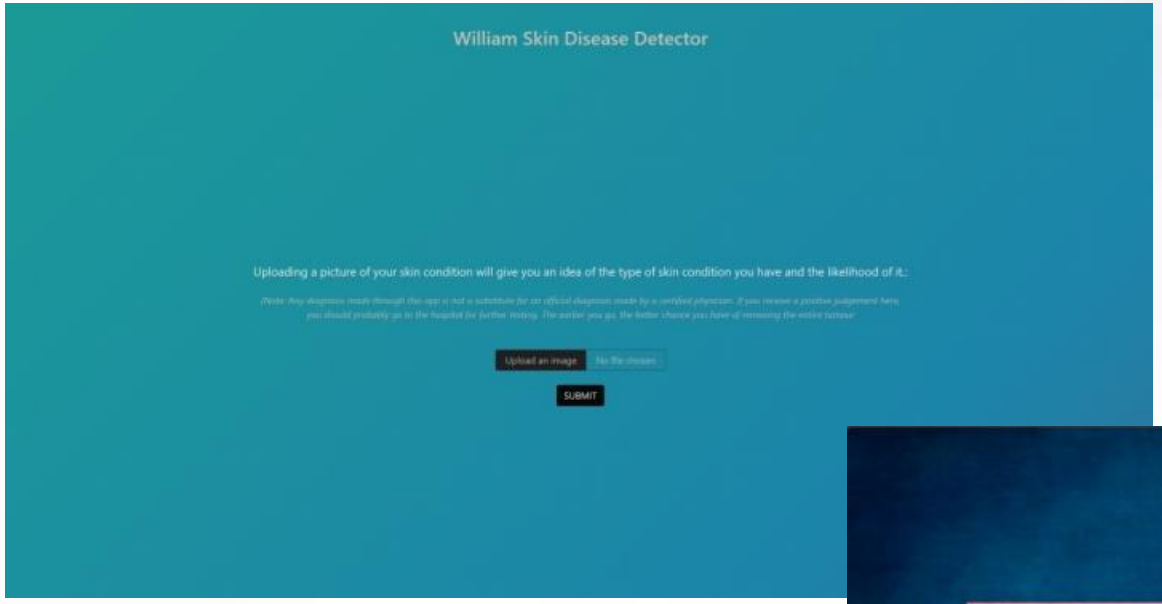


Figure 8：Home page of project web GUI

Figure 8：Feedback page of project web GUI

Challenge

04

Challenge

01 Overfitting

The model's recognition performance for the Nevus (NV) category is a significant limitation

02 Hyperparameter tuning

Find best Hyperparameter took lots of time

03 Environment

Hardware and software environment

04 Interpretability

Model interpretability have not been sufficiently addressed

Conclusion

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11 Conclusion

The "Harnessing Inception Depthwise Attention CNN of Residual Learning" model, proposed for skin cancer classification, shows significant promise with high accuracy, precision, and recall in various experimental evaluations. However, it has limitations, such as struggle in recognizing the Nevus category and potential impact from outliers and noise.

Future Work:

- Exploring advanced feature extraction and complex network architectures.
- Improving data quality and sensitivity to minority classes.
- Regular model retraining.
- Enhancing model interpretability and real-world testing.

Thanks