



ResNet50

■ ■	■ ■
■ ■ ■	2024 ■ 11 ■
■ ■ ■	■ ■ ■
■ ■	■ ■ ■ ■ / ■ ■ ■ ■ ■ AI ■ ■ ■ ■
■ ■ ■	Accuracy 77.62%, Recall 81.84%



1. ■■■■■

2. ■■■■■

3. ■■■■■

4. ■■■■■■■■

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9. ■■■■■■■■■■

10. ■■■■■■■■■■

11. ■■■■■■■■■■

12. ■■

## 1.

### 1.1

 Binary Classification AI

### 1.2

  (dermatoscope)           (Benign)   (Malignant)  AI       .

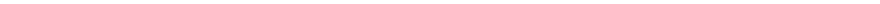
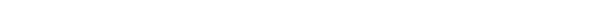
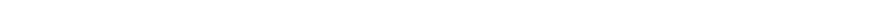
### 1.3

		
Accuracy	77.62%	
Recall	81.84%	
Precision	75.47%	
AUC	0.8585	

## 2. ■■■ ■ ■■■

## 2.1

## 2.2

-  : All  1 
  -  :
  -  :

### 3. ■■■■

## 3.1 HAM10000

## 3.2

■■■	■■■■	■■■	■■■■■
■■■	nv	■, ■■	6,705■
■■■	bkl	■■■■■	1,099■
■■■	df	■■■■■	115■
■■■	vasc	■■■■	142■
■■■	mel	■■■ (■■■)	1,113■
■■■	bcc	■■■■■	514■
■■■	akiec	■■■■■	327■

## 3.3 Binary

80.5%, 19.5%. Train 80% (1,954), Validation 20% (3,908). 1:1.

4. 

4.1 ■■■

EfficientNetB0. ResNet50 Transfer Learning.

4.2 

## Input Layer (224×224×3)

↓

## ResNet50 Base (ImageNet Pretrained)

↓

## Global Average Pooling 2D

↓

Dense Layer (256 units) + ReLU + Dropout (0.5)

↓

Dense Layer (128 units) + ReLU + Dropout (0.3)

↓

Output Layer (1 unit) + Sigmoid

↓

Output (0~1 ■■■)

## 4.3

Total params	24,647,489
Trainable (Freeze)	1,115,649
Trainable (Fine-tuning)	23,592,577

## 5.

## 5.1

- 1: - OpenCV, RGB, 224x224
  - 2: CLAHE - Contrast Limited Adaptive Histogram Equalization
  - 3: ImageNet Normalization - MEAN=[123.675, 116.28, 103.53], STD=[58.395, 57.12, 57.375]

## 5.2

Horizontal/Vertical Flip, Random Rotation ( $\pm 15^\circ$ ), Random Zoom (10%), Random Brightness (0.8~1.2).

## 5.3

EfficientNet

6. 

6.1 2  3 4 5

- Stage 1: Freeze Learning - ResNet50 Base [50%] Custom Layers [50%]
  - Stage 2: Fine-tuning - [50%] 50% [50%] (Learning Rate [50%])

6.2

Optimizer	Adam
Initial Learning Rate	0.001
Fine-tuning Learning Rate	0.0001
Batch Size	32
Epochs	10
Loss Function	Binary Crossentropy
Dropout Rate	0.5, 0.3

## 6.3 ■■■

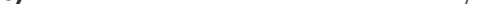
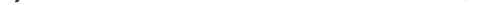
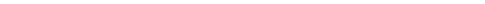
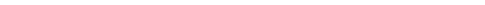
Kaggle Notebooks NVIDIA P100 GPU (16GB). TensorFlow 2.15.0 2.17.0. Kaggle (12),

7.

## 7.1 ■■■

Accuracy	77.62%	✓ ■■ 75% ■■ ■■
Recall	81.84%	✓ ■■ ■■■ ■■
Precision	75.47%	✓ ■■ ■■■ ■■
AUC	0.8585	✓ ■■■ ■■■ ■■

7.2 ■■■

- Recall (81.84%):  AI 
  - Accuracy: Accuracy  Recall 
  - AUC (0.8585):  AUC 

## 7.3

EfficientNet preprocessing (-1~1) ImageNet normalization.

## 8. ■ ■ ■ ■ ■ ■ ■ ■ ■

8.1 Streamlit

Python Streamlit UI/UX.

## 8.2

- **AI**: **CSV**, **JSON**, **XML**, **YAML**, **INI**, **YAML**, **YAML**
  - **AI**: **CSV**, **JSON**, **XML**, **YAML**, **INI**, **YAML**, **YAML**
  - **AI**: **CSV**, **JSON**, **XML**, **YAML**, **INI**, **YAML**, **YAML**

## 8.3 ■■■

	
	Streamlit 1.28.0
	TensorFlow 2.17.0
	OpenCV 4.8.0, PIL/Pillow
	NumPy 1.24.3, Pandas 2.0.3

9. 

# 9.1 PC

- **Python**: Python 3.13 (TensorFlow) → Conda (Python 3.11)
  - **TensorFlow**: 2.17 vs requirements.txt 2.15 → 'Could not deserialize class'
  - **Streamlit**: use container width → use column width

## 9.2

Conda  ,     (requirements.txt),     (QUICK\_START.md, SETUP\_GUIDE.md) .

## 9.3

skin/

■■■ Model Files/final\_model\_resnet50.keras (94MB)

streamlit\_app.py

## ■■■ requirements.txt

## ■■■ QUICK\_START.md

■■■ SETUP\_GUIDE.md

■■■ README.md

## 10. ■■■■■

### 10.1 ■■■■■

- ■■■■■: Train/Test Split ■■■■■■■■, ■■■■■■■■
- **Transfer Learning** ■■■: Freeze → Fine-tuning 2■■■■■, Learning Rate ■■■
- ■■■■■■■■: ■■■■■■■■, ■■■■■■■■■■
- ■■■■■■■■: Keras ■■■■■■, TensorFlow ■■■■■■, compile=False ■■■■■

### 10.2 ■■■■■■■■

- ■■■■■: ■■■■■■■■ (Accuracy 70%+), ■■■■■■■■
- ■■■■■: ■■■■■■■■■■, ■■■■■■■■■■
- ■■■■■■: ■■■■■■■■■■, ■■■■■■■■■■

## 11. ■■■■■

### 11.1 ■■■■■

- ■■■■■ (ROC ■■■■)
- Test-Time Augmentation (TTA)
- ■■■■■ (EfficientNet + ResNet)
- ■■■■■ (ResNet101, EfficientNet B4~B7, Vision Transformer)

### 11.2 ■■■■■■■

- ■■■■■■■■■ (■■■■■■■■■■■■, ■■■■■■■■■■■■)
- 7-Class ■■■■■
- ■■■■■■■■■ (■■■■■■■■■■■■, ■■■■■■■■■■■■, ■■■■■■■■■■■■)

### 11.3 ■■■■■

- ■■■■■■■ (Streamlit Cloud, AWS, GCP, Azure)
- ■■■■■■■■■ (Flutter, React Native)
- API ■■■■■ (RESTful API, ■■■■■■■■■)

### 11.4 ■■■■■

- ■■■■■ (■■■■■■■■■■■■, ■■■■■■■■■■■■)
- ■■■■■ (■■■■■■■■■■■■ FDA/CE, ■■■■■■■■■■■■ HIPAA)
- ■■■■■■■■■ (■■■■■■■■■■■■, ■■■■■■■■■■■■)

## 12. ■■■

12.1

✓ [■■■■] (Accuracy 77.62% > 75%)

✓ ███ Recall (81.84%) - ███ ████ ███

✓  AUC (0.8585)

A horizontal scale consisting of eleven evenly spaced squares. The first square, which contains a checkmark, represents the value 0. The last square represents the value 10.

A horizontal row of seven dark gray square boxes. The first square contains a white checkmark symbol, while the other six are empty.

12.2 ■■■



**12.3**  (15)

End-to-End AI [REDACTED], [REDACTED] AI [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED]. Transfer Learning [REDACTED], [REDACTED] [REDACTED], [REDACTED], [REDACTED] [REDACTED], [REDACTED] [REDACTED] AI [REDACTED] [REDACTED] [REDACTED] [REDACTED].

12.4

AI 等等。等等，等等。

AI 算法，机器学习，深度学习，自然语言处理。

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- ■■■■■: HAM10000 - Human Against Machine with 10000 training images
  - **Kaggle Dataset:** <https://www.kaggle.com/datasets/kmader/skin-cancer-mnist-ham10000>
  - ■■■: Dermatologist-level classification of skin cancer with deep neural networks (Nature, 2017)
  - ■■■: Deep Residual Learning for Image Recognition (ResNet, 2015)
  - ■■■■■■: TensorFlow (<https://www.tensorflow.org/>)
  - ■■■■■■: Keras (<https://keras.io/>)
  - ■■■■■■: Streamlit (<https://streamlit.io/>)