

# AI皮膚疾病偵測服務

## Skin Disease & Cancer Detection AI Services

吳智鴻

# 目的

- ▶ 以網路公開之兩個皮膚疾病圖片資料庫，以深度學習網路，開發AI皮膚病自動偵測系統。
- ▶ 具有：1.判斷疾病良惡性。 2.判斷疾病種類（7種）

# 解決痛點

- ▶ 皮膚為常見之疾病，解決

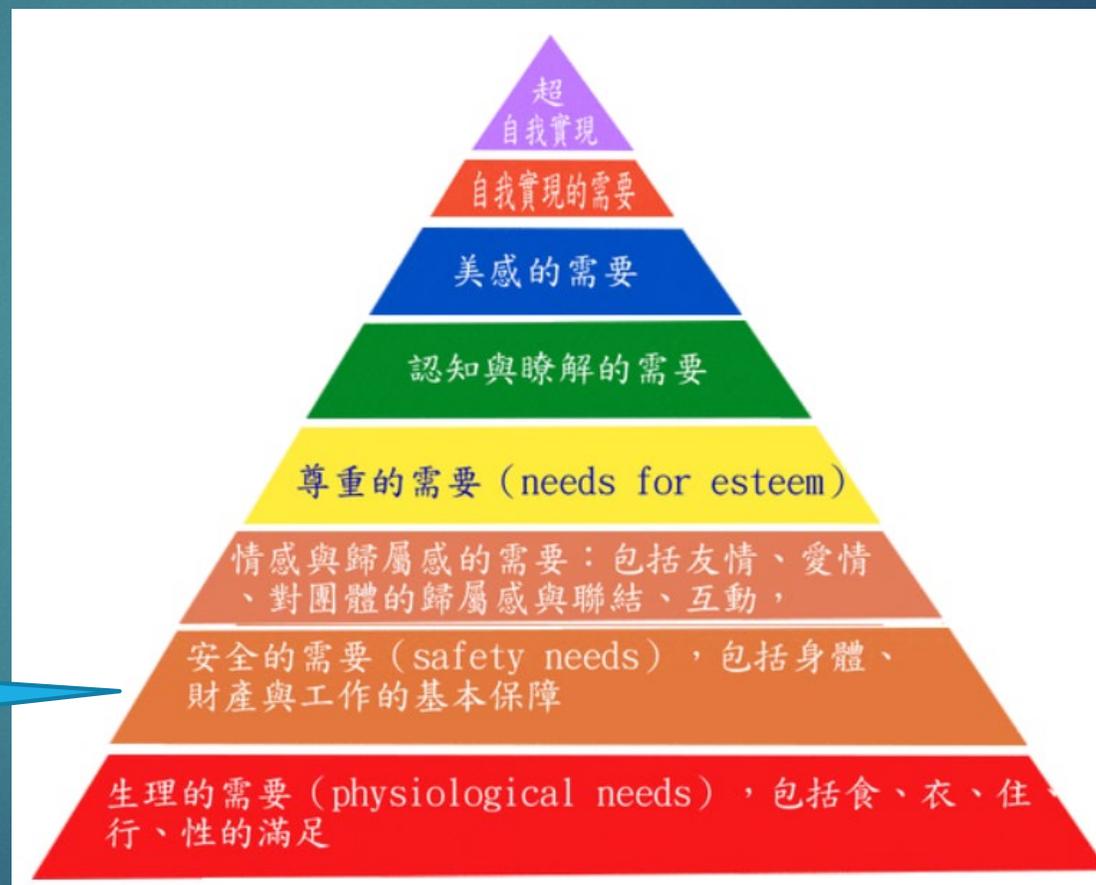
- ▶ 1. 延誤就醫問題

- ▶ 2. 醫師推薦

- ▶ 解決方式

- ▶ 透過手機/電腦，拍攝皮膚狀況照片，上傳AI程式。AI程式透過電腦視覺技術，分析照片，提供皮膚病的疾病辨識。

# 馬斯洛的需求層級理論



解決 身體安全的需求

# SWOT分析

- ▶ Strength
  - ▶ AI技術
  - ▶ 擁有醫師團隊支援
- ▶ Weakness
  - ▶ 尚未建立自己的人工標註資料集
- ▶ Opportunity
  - ▶ 提供線上AI服務尚不多見
- ▶ Trend
  - ▶ 大廠的資源優勢

# 產業分析（同性質、類似產品分析）



The screenshot shows the DermAI website homepage. At the top, there is a navigation bar with the DermAI logo and links for '首頁', '關於我們', '服務介紹', '夥伴服務', '媒體報導', and 'More'. The main heading reads '結合AI人工智慧及皮膚科學'. Below this, it states 'DermAI皮智 提供線上皮膚諮詢 用專業守護您的皮膚健康'. A paragraph describes the service: '以皮膚科專科醫師數十年的臨床皮膚照護經驗為基礎，搭配專利先端AI技術，我們提供關鍵皮膚AI應用及線上皮膚醫師諮詢服務，以實現個人化精準皮膚照護的未來！'. A '服務項目' button is visible. Two service cards are shown: '痣能達人 MoleMe' and '痘痘達人 DoeDoe'. Each card includes a brief description of the service and buttons for '瞭解更多' and '點我啟動'.

皮智成立於2018年，是臺北醫學大學第一間醫療AI應用的衍生公司，以皮膚科專科醫師群的臨床經驗為基礎，結合影像分析與AI辨識技術，開發出的第一項產品「痣能達人 MoleMe」，可判斷痣的變性風險，正確率超過93%。今年3月發佈後，已經累積超過兩萬次的風險判斷。



皮智執行長靳嚴博表示，痣能達人可以透過給予及時評估，協助使用者判斷是否需要就診。

開發「痣能達人 MoleMe」時，就以超過5000筆手機拍攝的痣醫療影像進行模型的訓練與測試，建立的模型正確率超過93%。

從今年三月推出至今僅三個月餘，已經累積超過兩萬次的風險判斷，隨著未來數據持續增加，正確率有再升高的可能性。

民衆只要回答五個問題並上傳一張照片，就可以馬上獲得評估結果。該軟體最大的好處，在於提醒較高風險的民衆趕快就醫、以及對於較低風險的民衆提供定期提醒的服務，提昇民衆自我健康識能。

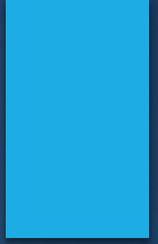


WHY

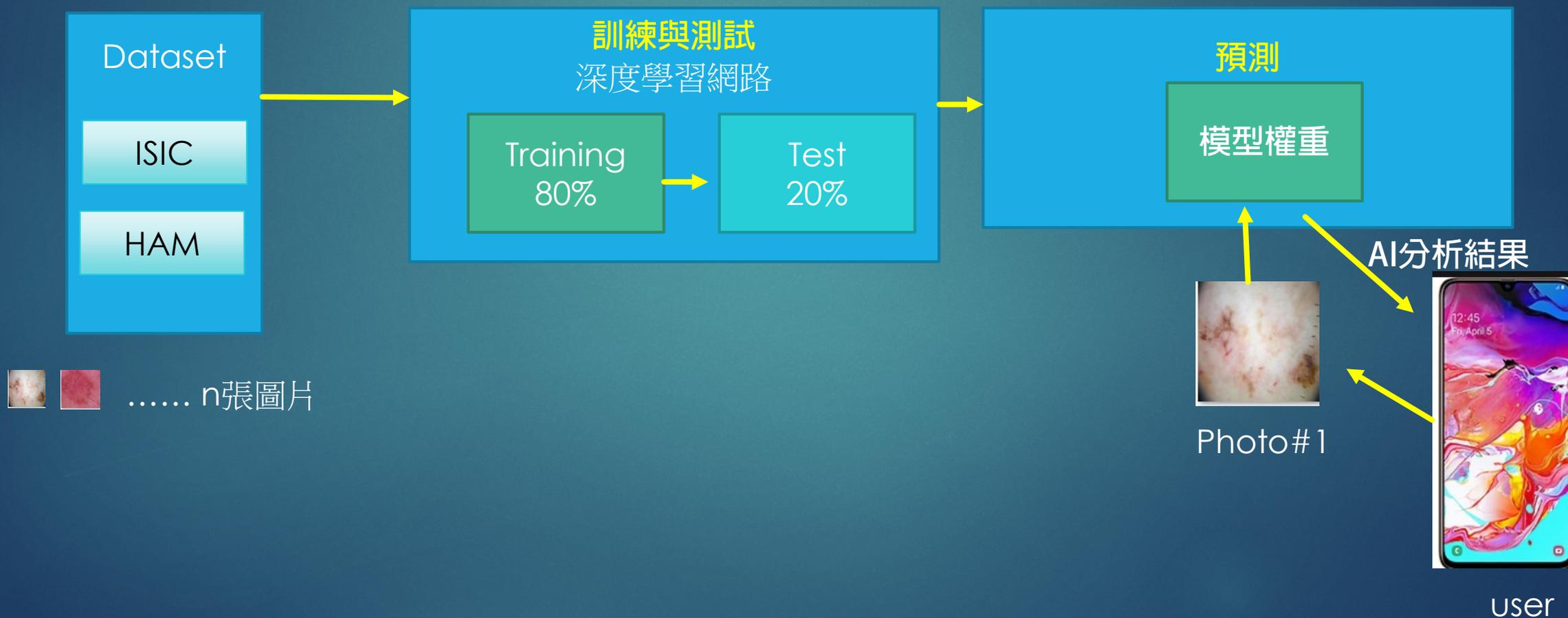
民衆不直接去看皮膚科而需要AI服務？

- ▶ 不知道這各疾病的嚴重程度，延誤就醫。
- ▶ 比較私密的位置，比較避諱就醫。
- ▶ 當地可能就醫較不方便

# 系統流程



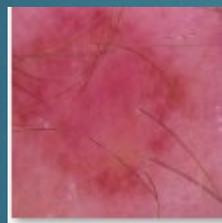
# AI Model Development



# API#1 皮膚良/惡性判斷

## 預計輸入輸出結果

- ▶ 輸入：based64編碼的圖片（手機/PC）尺寸 224\*224 彩色圖檔
- ▶ 處理：CNN卷積神經網路模型
- ▶ 輸出：



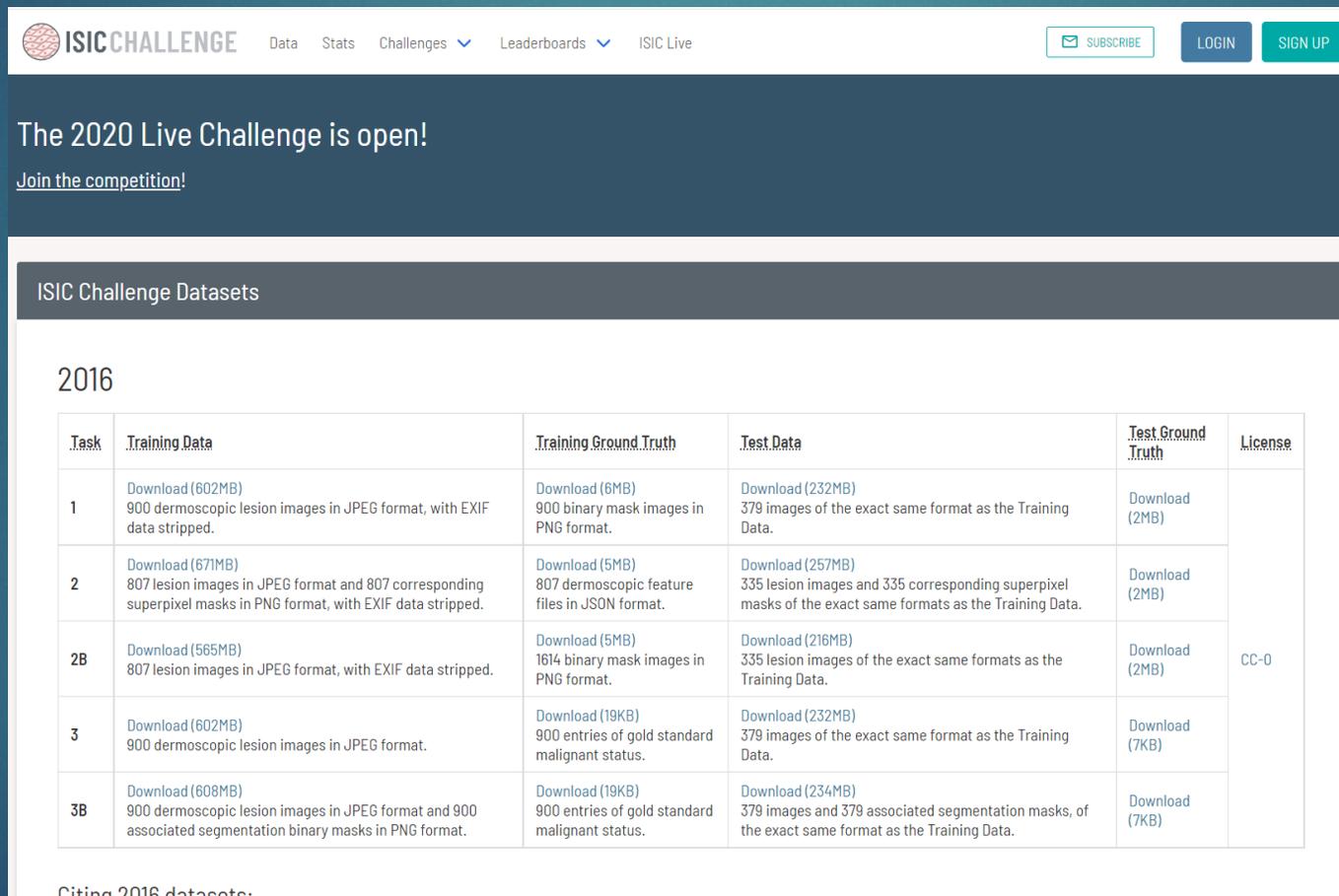
▶ 良性



▶ 惡性

# 資料集來源#1

- ▶ International Skin Image Collaboration (ISIC)
- ▶ <https://challenge.isic-archive.com/data/>



The screenshot shows the ISIC Challenge website interface. At the top, there is a navigation bar with the ISIC Challenge logo, links for Data, Stats, Challenges, Leaderboards, and ISIC Live, and buttons for SUBSCRIBE, LOGIN, and SIGN UP. Below the navigation bar, a banner reads "The 2020 Live Challenge is open!" with a link to "Join the competition!". The main content area is titled "ISIC Challenge Datasets" and displays the "2016" dataset information in a table.

Task	Training Data	Training Ground Truth	Test Data	Test Ground Truth	License
1	Download (602MB) 900 dermoscopic lesion images in JPEG format, with EXIF data stripped.	Download (6MB) 900 binary mask images in PNG format.	Download (232MB) 379 images of the exact same format as the Training Data.	Download (2MB)	CC-0
2	Download (671MB) 807 lesion images in JPEG format and 807 corresponding superpixel masks in PNG format, with EXIF data stripped.	Download (5MB) 807 dermoscopic feature files in JSON format.	Download (257MB) 335 lesion images and 335 corresponding superpixel masks of the exact same formats as the Training Data.	Download (2MB)	
2B	Download (565MB) 807 lesion images in JPEG format, with EXIF data stripped.	Download (5MB) 1614 binary mask images in PNG format.	Download (216MB) 335 lesion images of the exact same formats as the Training Data.	Download (2MB)	
3	Download (602MB) 900 dermoscopic lesion images in JPEG format.	Download (19KB) 900 entries of gold standard malignant status.	Download (232MB) 379 images of the exact same format as the Training Data.	Download (7KB)	
3B	Download (608MB) 900 dermoscopic lesion images in JPEG format and 900 associated segmentation binary masks in PNG format.	Download (19KB) 900 entries of gold standard malignant status.	Download (234MB) 379 images and 379 associated segmentation masks, of the exact same format as the Training Data.	Download (7KB)	

Citing 2016 datasets:

# 資料集來源#2

▶ HAM

▶ <https://www.kaggle.com/kmader/skin-cancer-mnist-ham10000>

The screenshot shows the Kaggle dataset page for 'Skin Cancer MNIST: HAM10000'. The page features a grid of dermatoscopic images at the top. Below the grid, the dataset title and description are displayed: 'Skin Cancer MNIST: HAM10000' and 'a large collection of multi-source dermatoscopic images of pigmented lesions'. The creator is identified as 'K Scott Mader' and the dataset was updated 3 years ago (Version 2). The page includes navigation tabs for 'Data', 'Tasks (1)', 'Code (247)', 'Discussion (13)', 'Activity', and 'Metadata'. There are buttons for 'Download (3 GB)' and 'New Notebook'. The 'Usability' is 7.1, the license is 'CC BY-NC-SA 4.0', and the tags are 'health, image data, multiclass classification'. The 'Description' section includes an 'Overview' and 'Original Data Source' with a list of references. At the bottom, the 'Data Explorer' shows a file named 'HAM10000\_metadata.csv' (563.28 kB) with a size of 2.9 GB.

**Dataset**

## Skin Cancer MNIST: HAM10000

a large collection of multi-source dermatoscopic images of pigmented lesions

K Scott Mader • updated 3 years ago (Version 2)

[Data](#) [Tasks \(1\)](#) [Code \(247\)](#) [Discussion \(13\)](#) [Activity](#) [Metadata](#) [Download \(3 GB\)](#) [New Notebook](#)

**Usability** 7.1 **License** CC BY-NC-SA 4.0 **Tags** health, image data, multiclass classification

### Description

#### Overview

Another more interesting than digit classification dataset to use to get biology and medicine students more excited about machine learning and image processing.

#### Original Data Source

- Original Challenge: <https://challenge2018.isic-archive.com>
- <https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/DBW86T>  
[1] Noel Codella, Veronica Rotemberg, Philipp Tschandl, M. Emre Celebi, Stephen Dusza, David Gutman, Brian Helba, Aadi Kalloo, Konstantinos Liopyris, Michael Marchetti, Harald Kittler, Allan Halpern: "Skin Lesion Analysis Toward Melanoma Detection 2018: A Challenge Hosted by the International Skin Imaging Collaboration"

**Data Explorer**  
2.9 GB

< **HAM10000\_metadata.csv** (563.28 kB) [Download](#) [Fullscreen](#)

# API#1 皮膚良/惡性判斷 模型建立

- ▶ 輸入：
- ▶ 模型資料集 人工標註後的資料集。訓練與測試比率為 8:2
- ▶ The dataset is taken from the ISIC (International Skin Image Collaboration) Archive. It consists of 1800 pictures of benign moles and 1497 pictures of malignant classified moles.
- ▶ Train (2637張)
  - ▶ 良性Benign：1440張
  - ▶ 惡性Malignant：1197張
- ▶ Test (660張)
  - ▶ 良性Benign：360張
  - ▶ 惡性Malignant：300張
- ▶ Total: 3297
- ▶ 計算：CNN卷積神經網路
- ▶ 正確率: 約80%



尺寸 224 x 224 RGB 3維彩色圖片

# API#1 皮膚良/惡性判斷

## 預計輸入輸出結果

- ▶ 輸入：based64編碼的圖片（手機/PC）尺寸 224\*224 彩色圖檔
- ▶ 處理：CNN卷積神經網路模型
- ▶ 輸出：



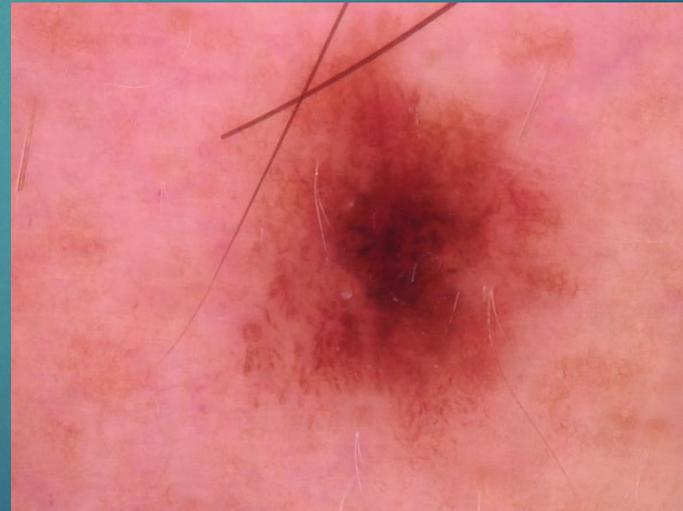
▶ 良性



▶ 惡性

# API#2 皮膚疾病判斷 模型建立

- ▶ 輸入：
- ▶ 模型資料集 HAM
  - ▶ More than 50% of lesions are confirmed through histopathology (histo)
- ▶ 訓練與測試比率 8:2
  - ▶ Train (80012張)
  - ▶ Test (20003張)
  - ▶ Total: 10,015張
- ▶ 計算：CNN卷積神經網路
- ▶ 正確率: 約70%

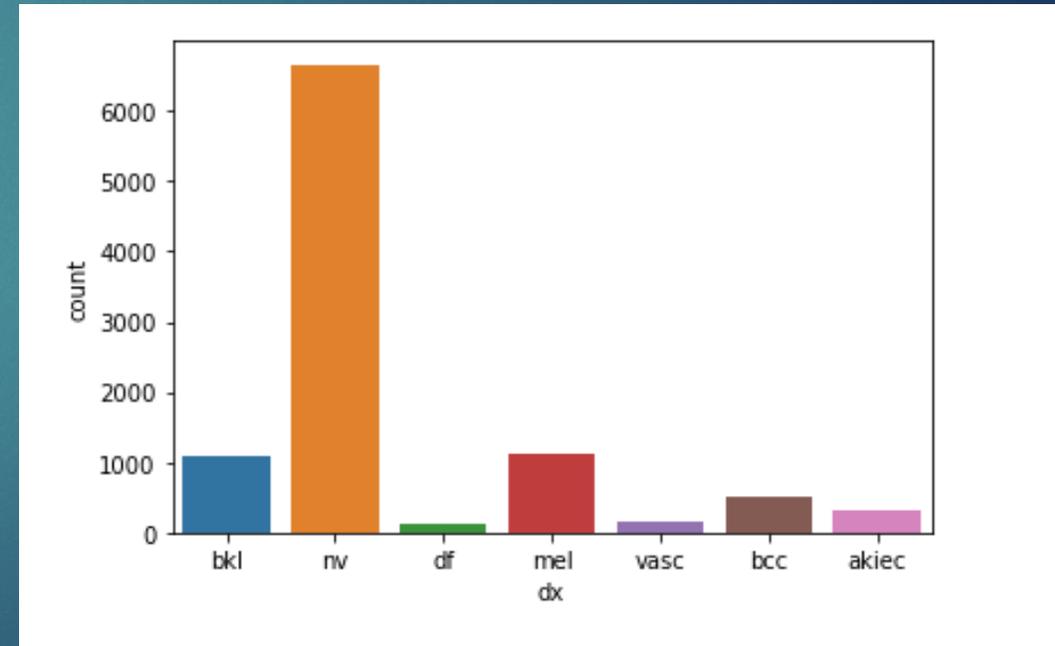


尺寸 224 x 224 or 100 x 100

圖片來源：Ham1000

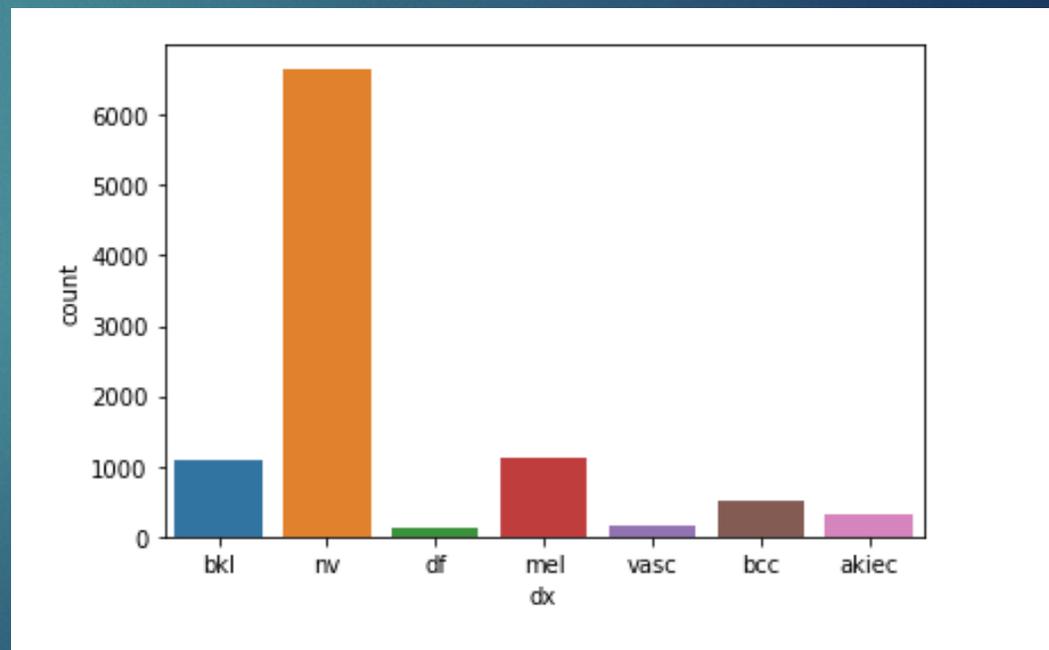
# 疾病分布比例

- ▶ 七種疾病
- ▶ 1. Actinic keratoses and intraepithelial carcinoma / Bowen's disease (akiec), Actinic keratoses (鱗狀細胞癌)、
- ▶ 2. basal cell carcinoma (bcc), 基底細胞癌
- ▶ 3. benign keratosis-like lesions (solar lentigines / seborrheic keratoses and lichen-planus like keratoses, bkl), 良性角化病變
- ▶ 4. dermatofibroma (df), 皮膚纖維瘤
- ▶ 5. melanoma (mel), 黑色素細胞癌/黑色素瘤
- ▶ 6. melanocytic nevi (nv) 黑色素細胞痣
- ▶ 7. vascular lesions (angiomas, angiokeratomas, pyogenic granulomas and hemorrhage, vasc). 血管病變



# API#2 皮膚疾病判斷 預計輸入輸出結果

- ▶ 輸入：based64編碼的圖片（手機/PC）尺寸 224\*224（或100 \* 100) 彩色圖檔
- ▶ 處理：CNN卷積神經網路模型
- ▶ 輸出： bkl / nv / df / mel dx / vasc /bcc / akie

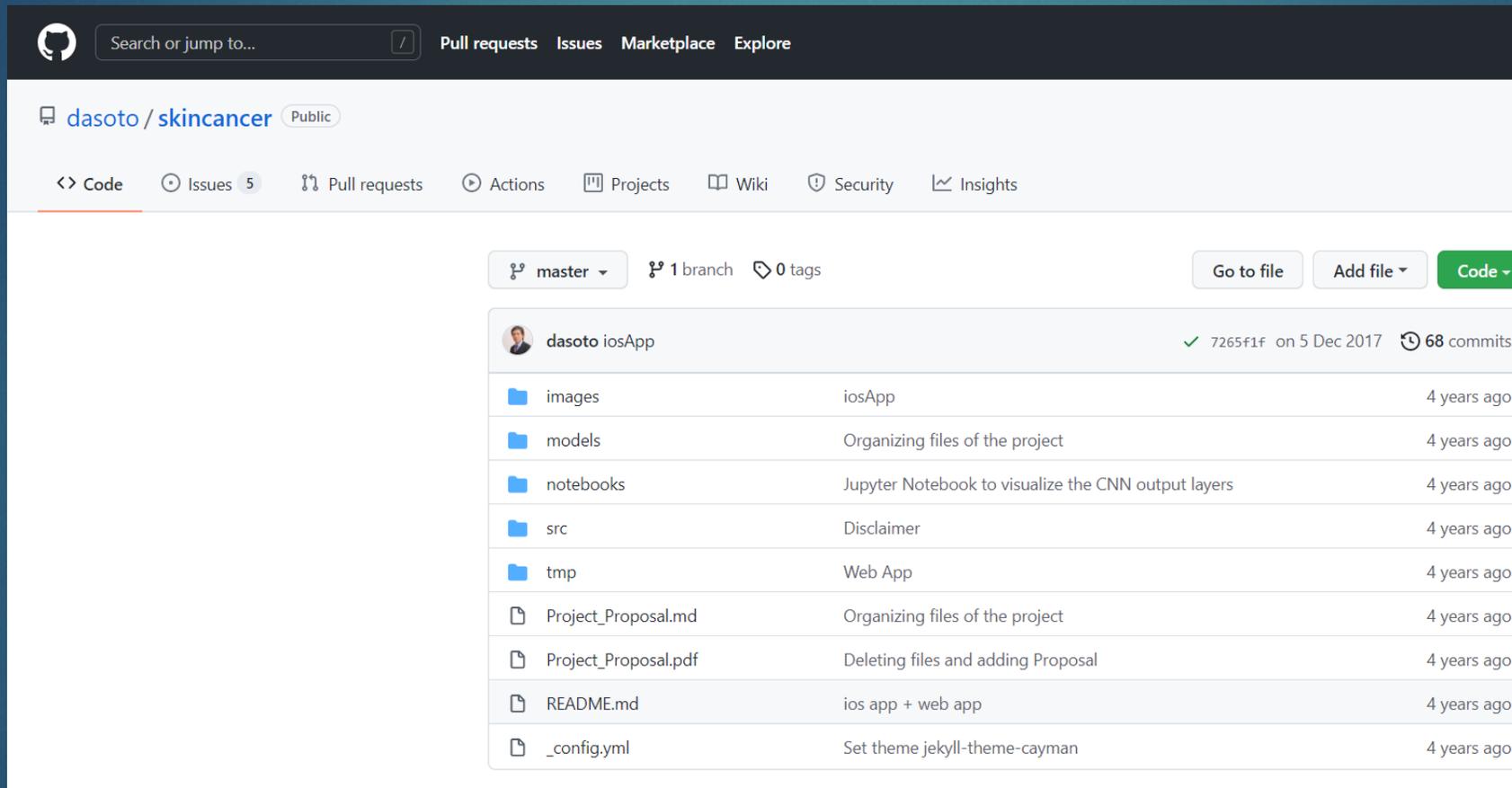


# 開發環境與工具

- ▶ Python
- ▶ Anaconda
- ▶ Tensorflow
- ▶ Keras
- ▶ CNN
- ▶ Flask
- ▶ HTML5

# 程式資源

▶ <https://github.com/dasoto/skincancer>



The screenshot shows the GitHub interface for the repository 'dasoto/skincancer'. The repository is public and has 5 issues, 0 pull requests, 0 actions, 0 projects, 0 wiki pages, 0 security issues, and 0 insights. The repository is currently on the 'master' branch, which has 1 branch and 0 tags. The repository was created by 'dasoto' (iosApp) on 5 Dec 2017, with 68 commits. The repository contains the following files and folders:

File/Folder	Description	Created
images	iosApp	4 years ago
models	Organizing files of the project	4 years ago
notebooks	Jupyter Notebook to visualize the CNN output layers	4 years ago
src	Disclaimer	4 years ago
tmp	Web App	4 years ago
Project_Proposal.md	Organizing files of the project	4 years ago
Project_Proposal.pdf	Deleting files and adding Proposal	4 years ago
README.md	ios app + web app	4 years ago
_config.yml	Set theme jekyll-theme-cayman	4 years ago

# Prepare data

## 2. Development process and Data

The idea of this project is to construct a CNN model that can predict the probability that a specific mole can be malign.

### 2.1 Data:

To train this model the data to use is a set of images from the International Skin Imaging Collaboration: Mellanoma Project ISIC <https://isic-archive.com>.

The specific datasets to use are:

- ISIC\_UA-2\_1: Moles and melanomas. Biopsy-confirmed melanocytic lesions. Both malignant and benign lesions are included.
  - Benign: 23
  - Malign: 37
- ISIC\_UA-1\_1 Moles and melanomas. Biopsy-confirmed melanocytic lesions. Both malignant and benign lesions are included.
  - Benign: 398
  - Malign: 159
- ISIC\_MS-2\_1: Benign and malignant skin lesions. Biopsy-confirmed melanocytic and non-melanocytic lesions.
  - Benign: 1167 (Not used)
  - Malign: 352
- ISIC\_MS-1\_2: Both malignant and benign melanocytic and non-melanocytic lesions. Almost all images confirmed by histopathology. Images not taken with modern digital cameras.
  - Benign: 339
  - Malign: 77
- ISIC\_MS-1\_1: Moles and melanomas. Biopsy-confirmed melanocytic lesions, both malignant and benign.

資料處理方式

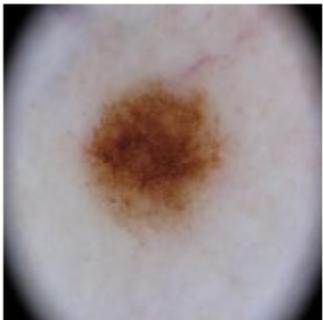
# Sample images

As summary the total images to use are:

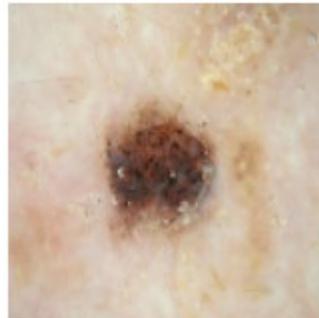
Benign Images	Malignant Images
1208	849



1. Sample images of benign moles:



• Sample images of malign moles:



# Tools

- Tensorflow (GPU High performance computing - NVIDIA)
- keras
- Python
- matplotlib
- scikit-learn
- AWS (EC2 - S3)
- iOS swift + core ML
- Flask



# Results

## Classification Report CNN From scratch, CV Folder.

- Model\_name = models/cnn-scratch-cv.hdf5
- 110 epochs. No early stop.
- AUC: 0.9164

class	precision	recall	f1-score	support
0.0	0.86	0.88	0.87	50
1.0	0.88	0.86	0.87	50
avg / total	0.87	0.87	0.87	100

## Second Model: VGG16 + Dense Layer

### Classification Report VGG16 + Dense Layer.

- Model\_name = models/VGG-Full.hdf5
- 100 epochs. No early stop.
- AUC: 0.9496

class	precision	recall	f1-score	support
0.0	0.87	0.92	0.89	50
1.0	0.91	0.86	0.89	50
avg / total	0.89	0.89	0.89	100

## Third Model: CNN + Data Augmentation

### Classification Report CNN Scratch with Data Augmentation.

- Model\_name = models/CNN-Scratch-DA
- 100 epochs.ModelCheckpoint. Best Val Accuracy
- AUC: 0.9444

class	precision	recall	f1-score	support
0.0	0.81	0.96	0.88	50
1.0	0.95	0.78	0.86	50
avg / total	0.88	0.87	0.87	100

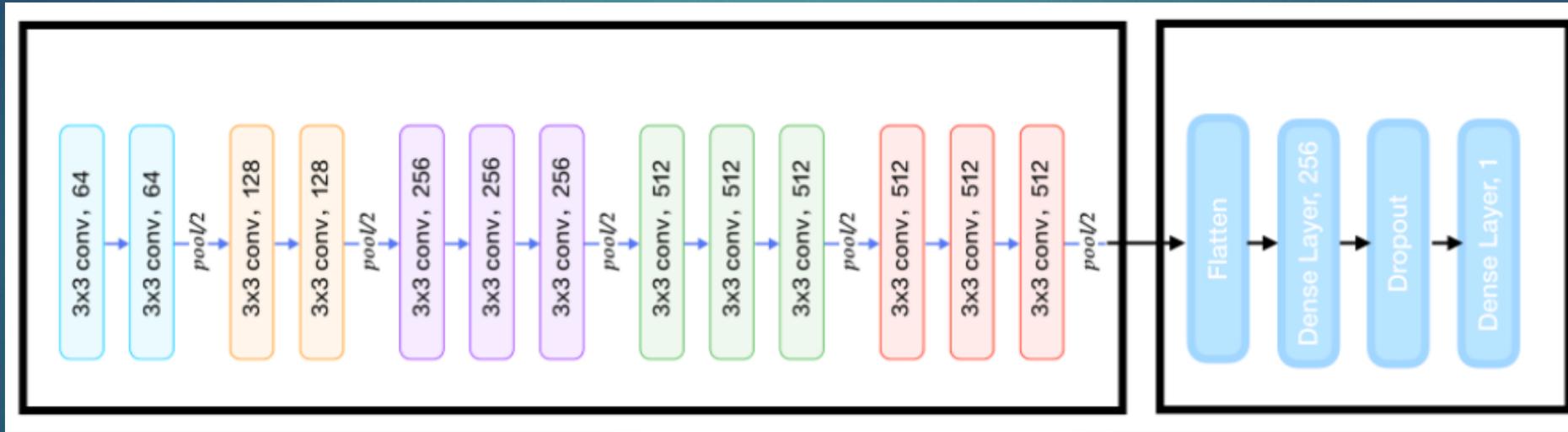
## Fourth Model: VGG16 + Dense Layer + Data Augmentation

### Classification Report VGG16 with Data Augmentation.

- Model\_name = models/BM\_VA\_VGG\_FULL\_DA.hdf5
- 100 epochs.ModelCheckpoint. Best Val Accuracy
- AUC: 0.9612

class	precision	recall	f1-score	support
0.0	0.88	0.88	0.88	50
1.0	0.88	0.88	0.88	50
avg / total	0.88	0.88	0.88	100

# CNN Architecture:



# 報價

## AI 皮膚偵測系統報價

功能	
<p>AI 系統：</p> <ul style="list-style-type: none"><li>▶ API#1 皮膚良惡性分析</li><li>▶ API # 2 皮膚病種類分析 7 種</li><li>▶ 具有再增加新的圖片訓練功能</li><li>▶ 具有圖片裁切功能</li><li>▶ 移植 GCP 雲端主機</li><li>▶ 製作成 Web Services。</li></ul> <p>AI 網頁後台系統：</p> <ul style="list-style-type: none"><li>▶ AI 醫師標註網頁系統，供人工（醫師）標註圖片，以提高 AI 判斷正確性。</li></ul>	
	Total : 

# 驗收

- ▶ 完成兩個AI皮膚病檢測程式
  - ▶ 製作成Web Services方便串接
  - ▶ 製作一個網頁後台，提供後續人工標註。
  - ▶ 程式移植放置GCP雲端主機（主機由眾匯提供）
  - ▶ 網站後台系統與資料庫放置GCP雲端主機（主機同上）
- 
- ▶ 一次性收費。程式保固一年。若有新增功能與重新訓練模型再另行收費。
  - ▶ 競業條款2年
  - ▶ 預估工作時間：3個月