Skin Cancer Recognition via Computer Vision/ Healthcare

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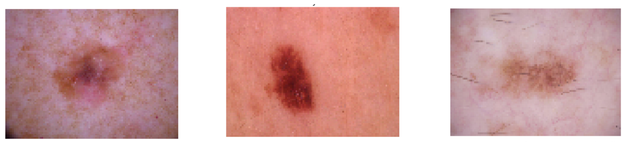
Introduction

- In current medical diagnosis, identifying skin cancer has always been challenging because of it close assemblance to other types of skin diseases.
- Current state-of-the-art methods for skin cancer disease classification uses CNNs[1].
- This project is aim to classify different types of malignant cancers correctly based on images of skin diseases.
- ResNet-50 model can improve the *accuracy* and *recall rate (RC)* of cancerous diseases to 71% and 70% respectively.

Introduction

Dataset: HAM10000[2]

- 10015 dermatoscopic images with seven unbalanced diagnostic categories
- Image size of 600 x 450 pixels (RGB), down sampled to 100 x 75 pixels



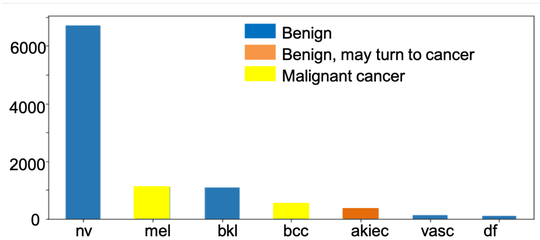
melanoma (mel) | melanoma nevi (nv) | dermatofibroma (df)

Data augmentation:

- Horizontal/vertical flipping
- Cropping

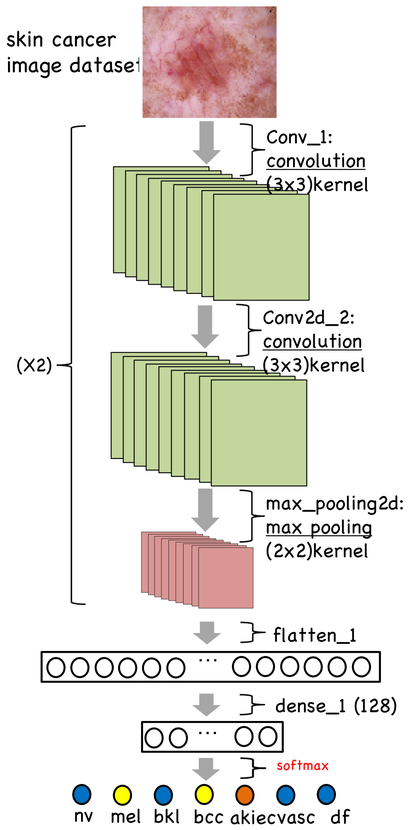
Split:

- 70% training, 15% validation, 15% testing datasets with similar relative classes size



Models

Baseline model (CNNs):



ResNet-50:

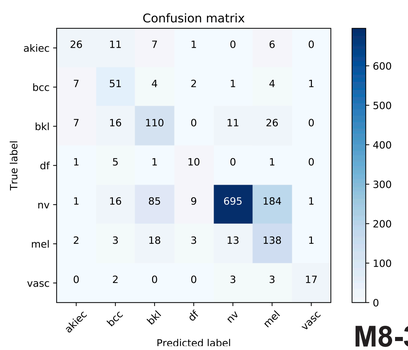
Model	Weight	Multiplier(λ)			Dropout Rate	Data Aug
		akiec	bcc	mel		
M1-3	Sample	No multiplier			0.3	N
M2-3	Computed	1	1	1	0.3	N
M3-3	Computed	1.5	1.5	1.5	0.3	N
M4-3	Computed	2	2	2	0.3	N
M5-3	Computed	3	3	3	0.3	N
M6-3	Computed	4.5	1.5	1.5	0.3	N
M7-3	Computed	6	2	2	0.3	N
M8-3	**Computed**	**9**	**3**	**3**	**0.3**	**N**
M8-1	Computed	9	3	3	0.1	N
M8-2	Computed	9	3	3	0.2	N
M8-4	Computed	9	3	3	0.4	N
M8-5	Computed	9	3	3	0.5	N
M9-3	Computed	9	3	3	0.3	Y

** Computed weight: $W_i = \lambda \frac{N_i}{\sum_{i=1}^{C} N_i}$

***Performance criteria:* 1.** Accuracy **2.** Recall rate for all cancers and each types of cancers

Discussion and Insights

- The decrease in the *accuracy* was mostly contributed by the misclassification of non-cancerous disease “nv”.
- Our best model improved the *recall rate* for cancerous diseases well significantly.
- The *recall rate* for each cancer types can be further improved by using two separate neural networks: one for identifying cancer or non-cancer; one for identifying disease type given cancer or non-cancer from the first network .



M8-3

Results

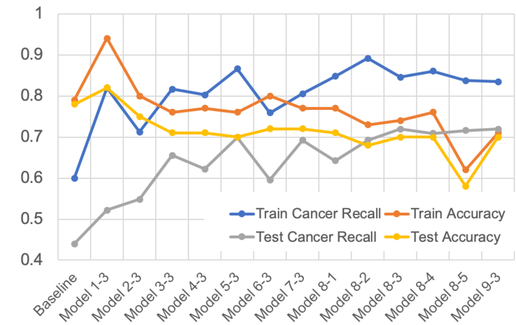


Table 1: Cancer recall & accuracy for train & test

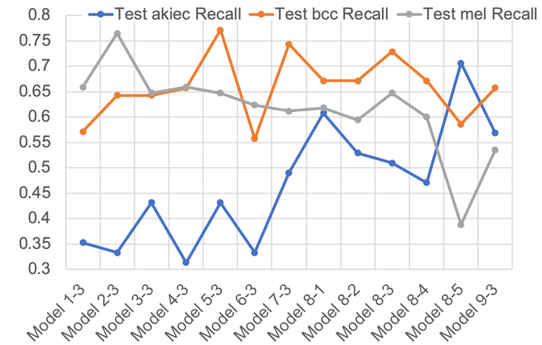


Table 2: Test recall rate for akiec, bcc and mell

- From M1 to M8, all of them achieved test *accuracy* greater than 70%.
- As the **weights** get heavier on cancers, *test accuracy* decreased by 10%, but the *RC* for cancers increased by 20%.
- With a larger **weight** on “akiec”, the *RC* for “akiec” increased monotonically, while *RC* of “mel”&”bcc followed a concave trend.
- To solve overfit, **drop rate** of 0.3 performed the best. **Data augmentation** helped but no improvement *RC* for cancerous diseases.

Acknowledgments:

CS230 teaching staff

[1] Siddhartha, M.Step, https://www.kaggle.com/sid321axn/step-wise-approach-cnn-model-77-0344-accuracy

[2] Data: https://www.kaggle.com/kmader/skin-cancer-mnist-ham10000