Skin Lesion Analysis for Melanoma Detection using Neural Networks

Dwight Velasco ,[*1] Misha Hilario,[1] Kathleen Edquila,[1] and Mikamila Garcia[1]

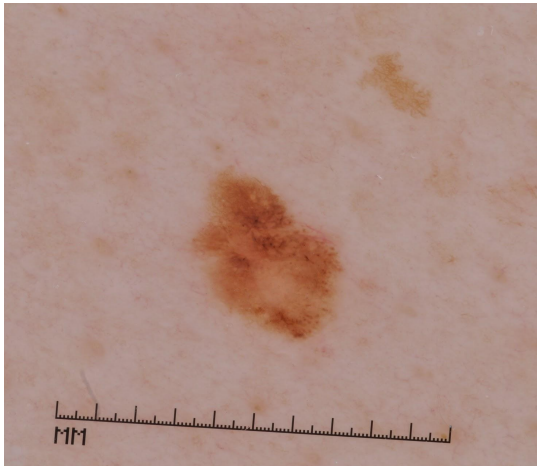
[1] Department of Physical Sciences and Mathematics, College of Arts and Sciences, University of the Philippines Manila

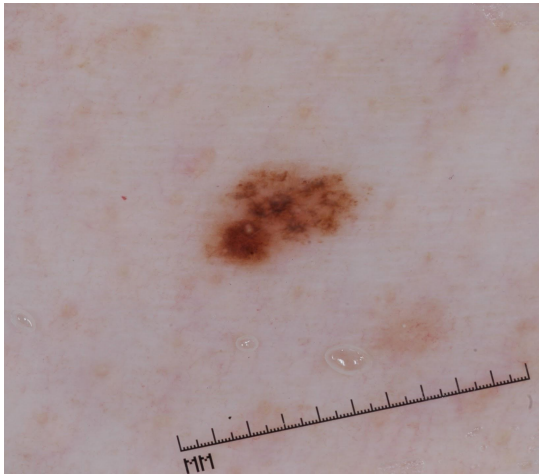
Introduction

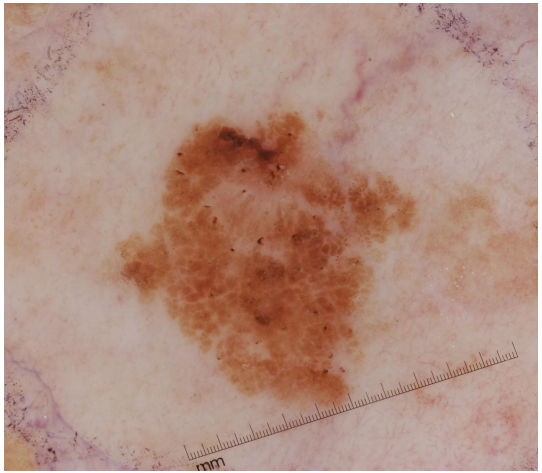
- Melanoma is one the deadliest forms of skin cancer, which causes a tumour in the melanin-forming cells

- Early detection is critical

Objective







- To diagnose and differentiate Melanoma from the two types of benign skin lesion, Nevus and Seborrheic Keratosis

Methodology

Convolutional Neural Network (CNN) Architecture

Sample Images

Transfer Learning

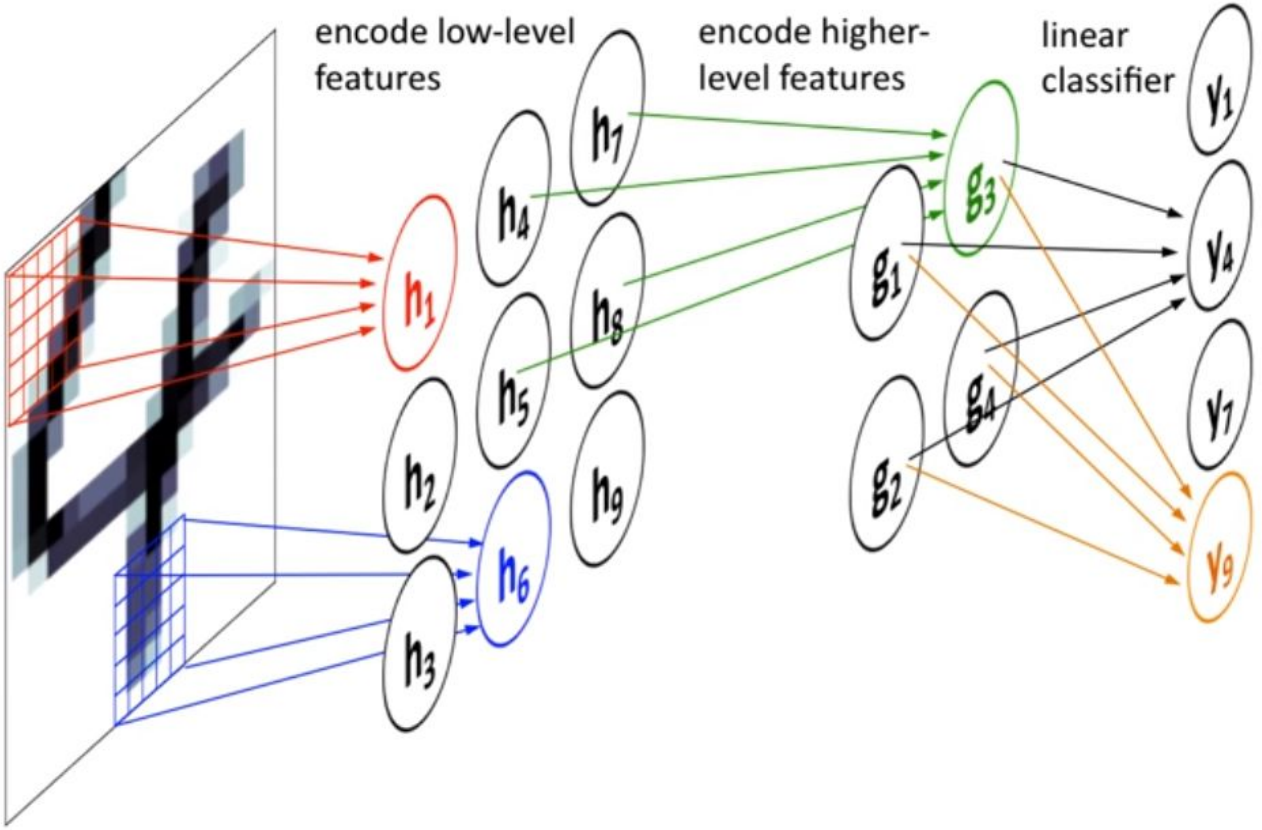
Disease Classification

Convolutional Neural Network (CNN)

Deep learning framework used for automatic detection of melanoma

How?

Convolutional Neural Network (CNN)



Sample Images

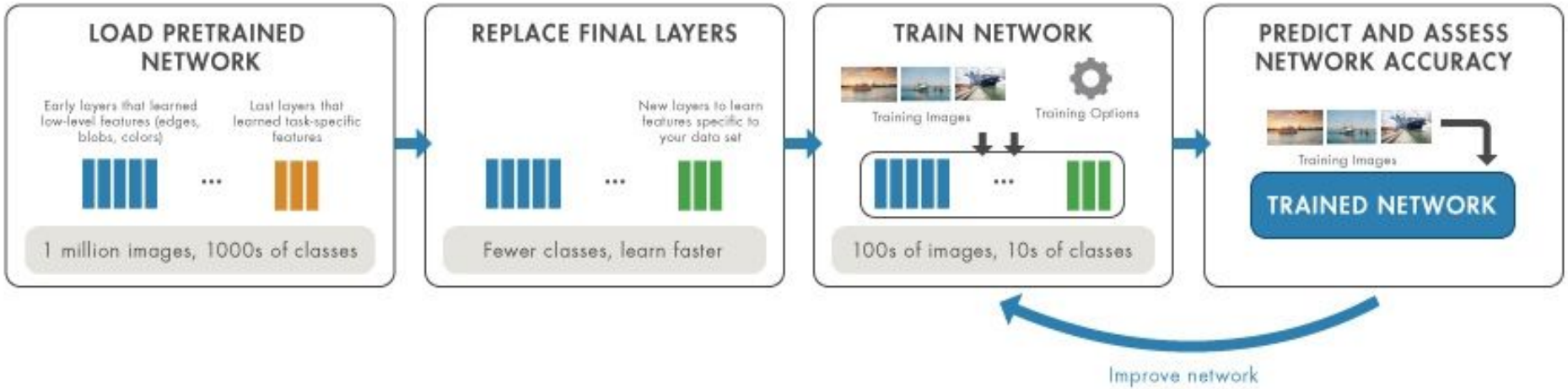
Training	Validation	Testing
374 melanoma	30 melanoma	117 melanoma
254 seborrheic keratosis	42 seborrheic keratosis	90 seborrheic keratosis
1372 benign nevi	78 benign nevi	393 benign nevi
2000	150	600

Source of data: http://challenge2017.isic-archive.com/

Transfer learning

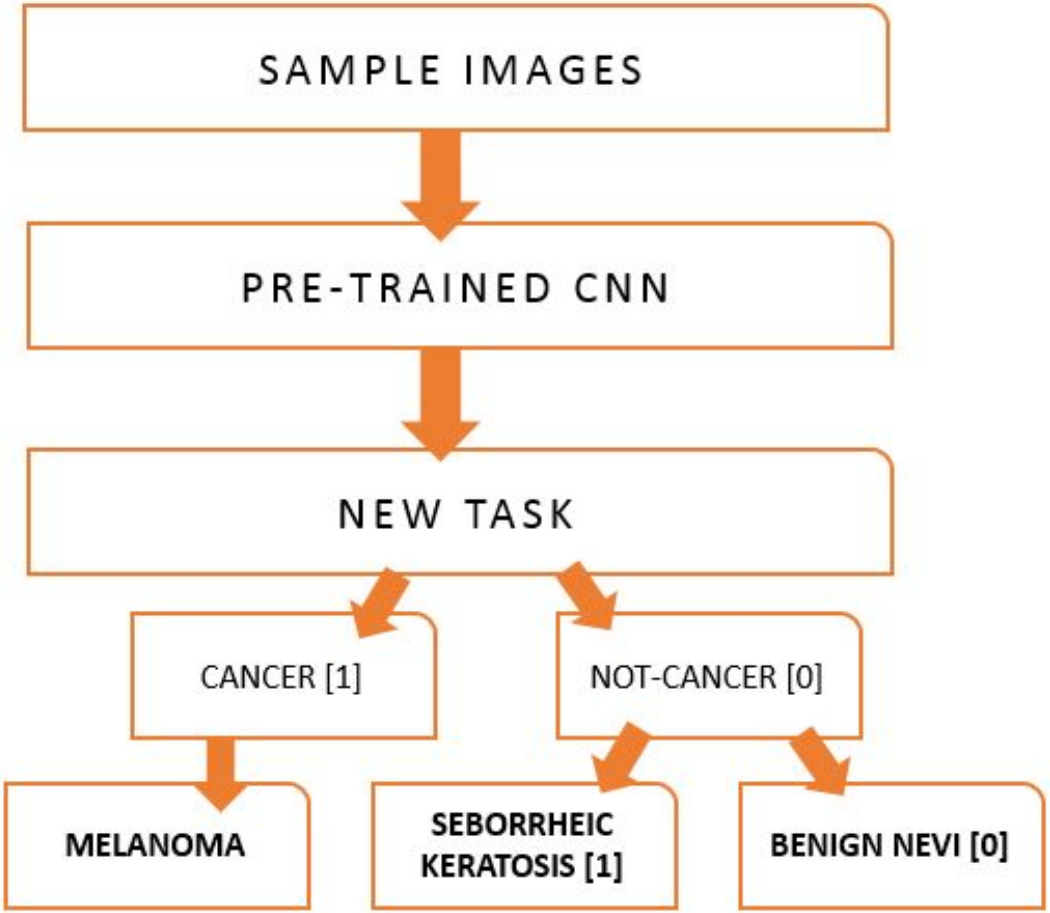
- To reduce training without sacrificing accuracy
- Method allowing the use of neural networks pre-trained on a larger dataset

Transfer Learning



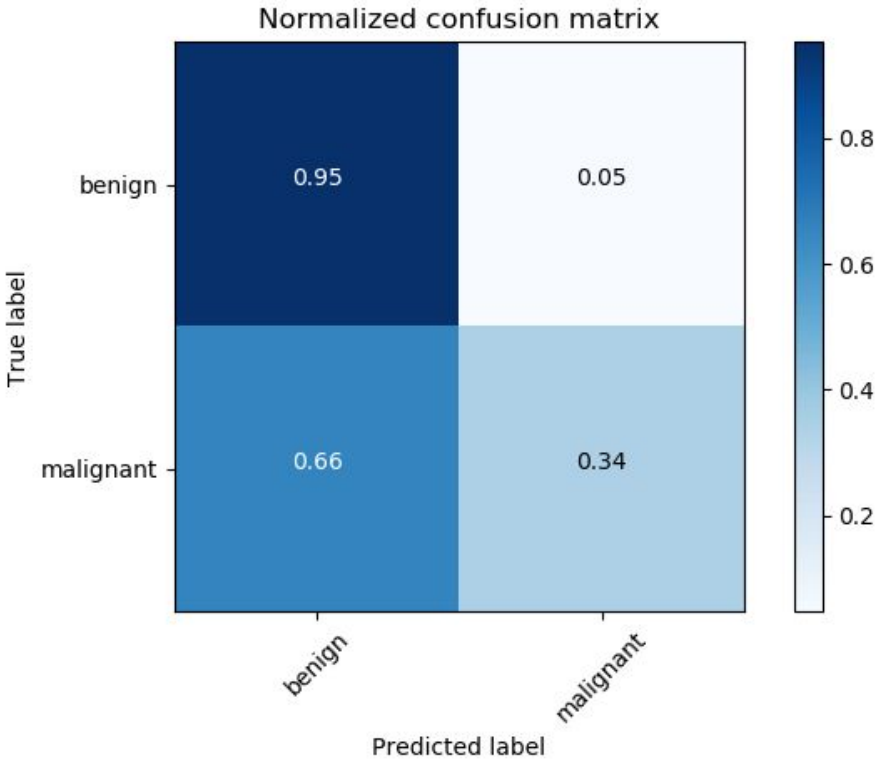
Disease Classification

Disease Classification

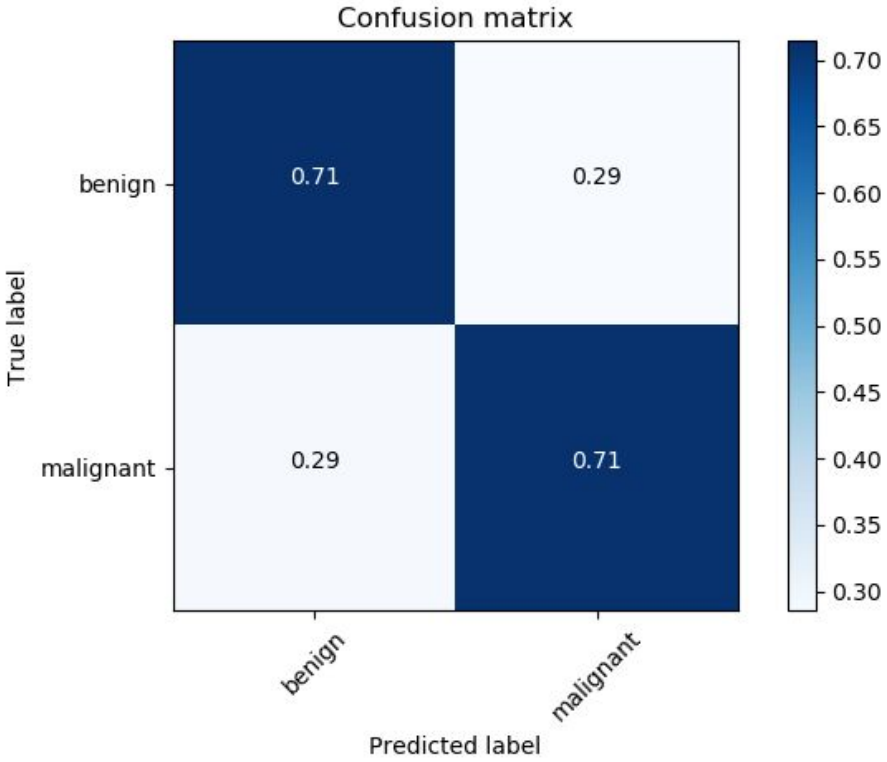


Results & Discussion

Results and Discussion



(a) with threshold = 0.5



(b) with threshold = 0.3

Results and Discussion

Accuracy: 72.5%

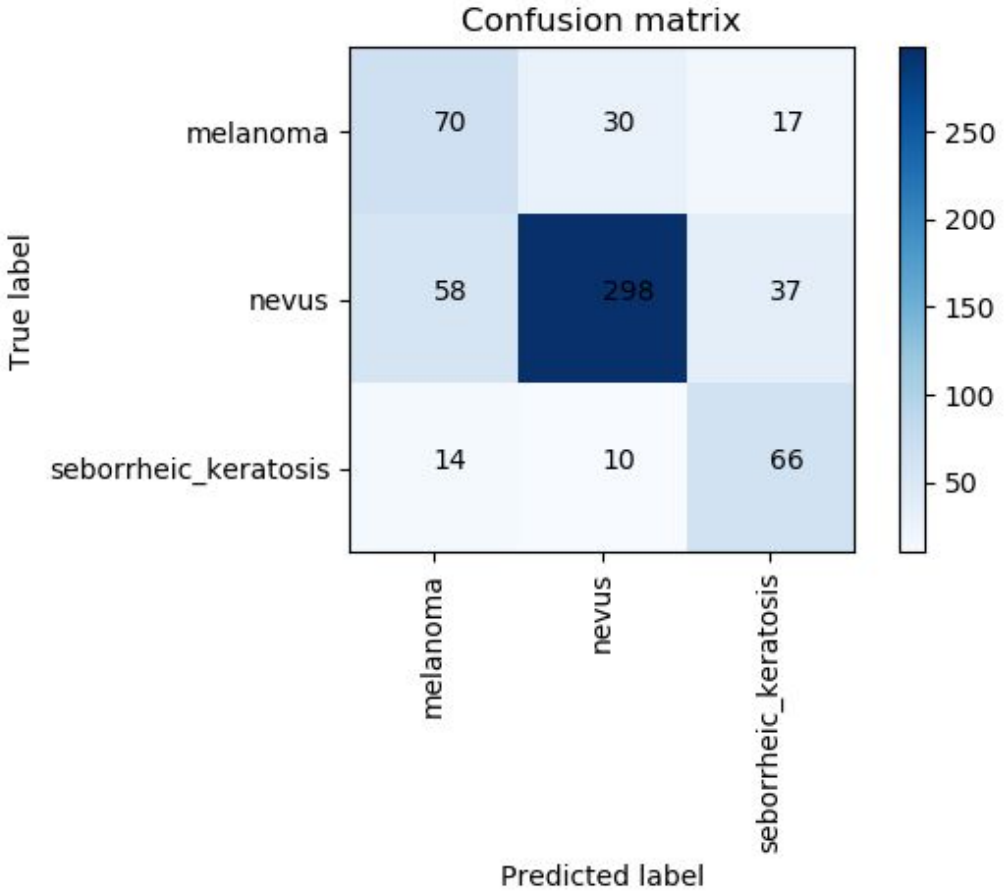
$$\frac{\text{True Melanoma} + \text{True Nevus} + \text{True Seborrheic keratosis}}{\text{total predictions or testing images}}$$

Sensitivity

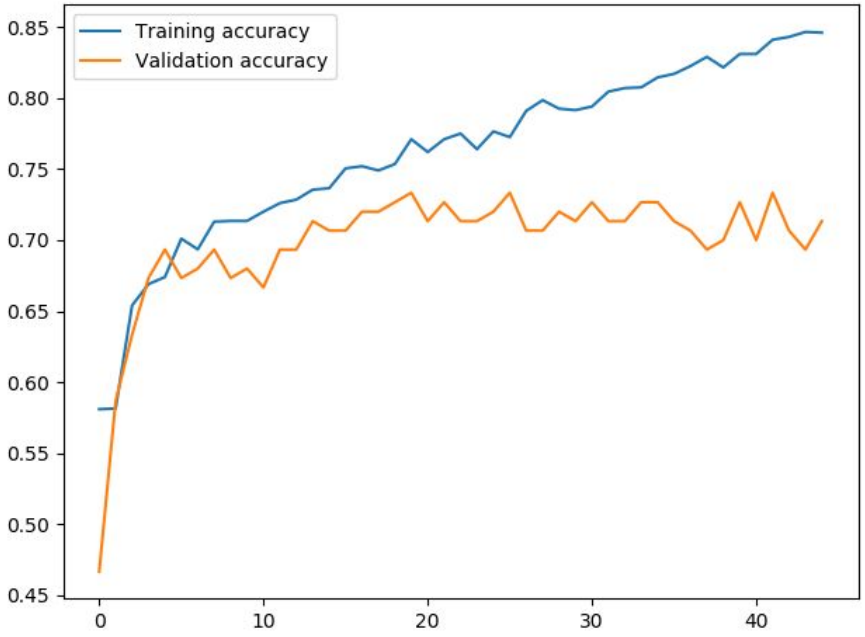
Nevus : 0.80

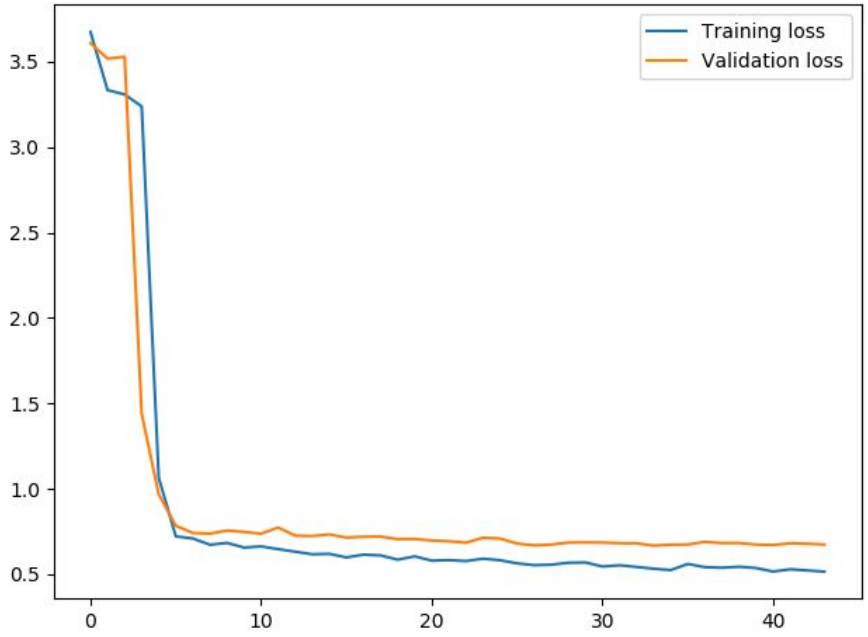
Seborrheic Keratosis : 0.73

Melanoma : 0.47



Results and Discussion





Pre-testing accuracy and loss:

training data (blue) and validation data (orange)

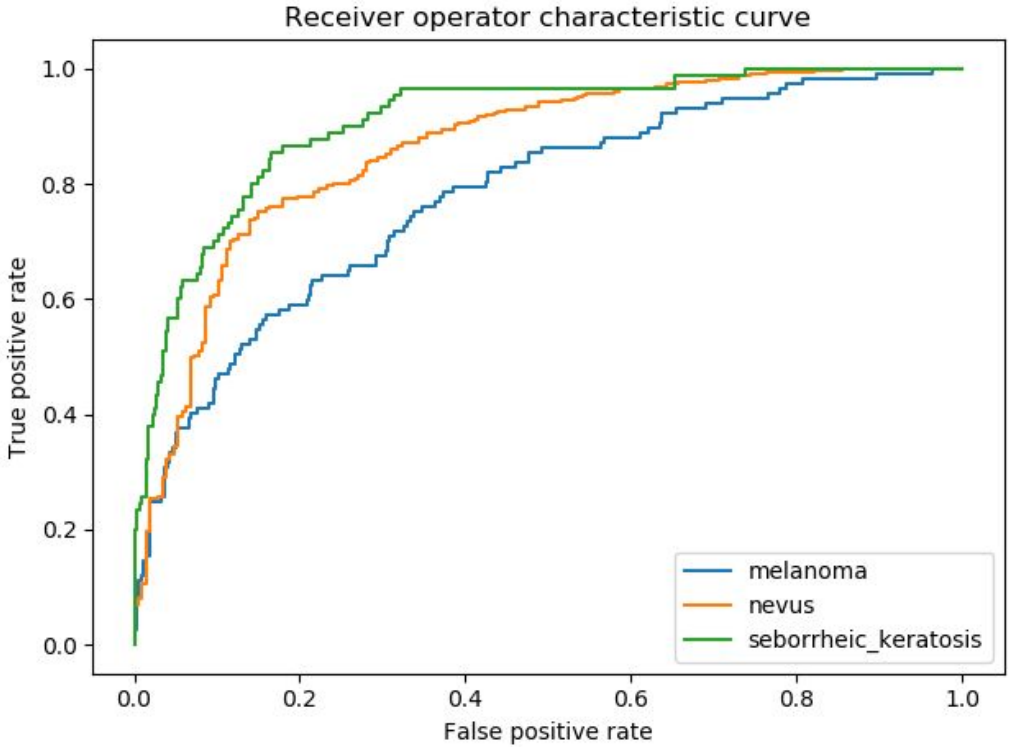
Results and Discussion

Receiver Operating Characteristic (ROC) curve

- seborrheic keratoses

>

nevus and melanoma

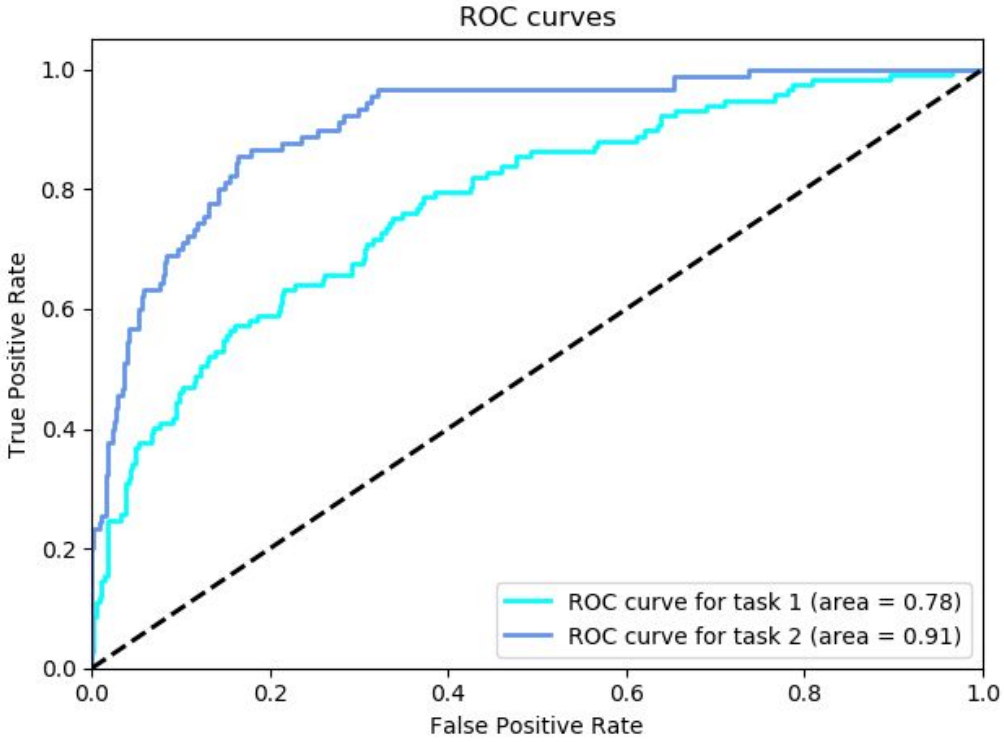


Results and Discussion

ROC curves

- *Task 1* (melanoma vs non-cancerous lesions)
  - 0.78

- *Task 2* (seborrheic keratosis vs nevus class)
  - 0.91



Conclusion

Current findings show that an accuracy rate of 91% was obtained in task 2 which is greater than the accuracy rate of 78% obtained in task 1.

The number of testing images can be a possible factor

The deep learning model can be tested and further developed with a larger dataset to improve its accuracy and performance.