Melanoma Detection Using Capsule Networks

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Melanoma

Deadliest type of skin cancer.

Responsible for 75% of all skin cancer deaths.

Caused by overexposure to UV Radiation.

Dermoscopy

Non-invasive skin imaging technique.

Provides magnified image of given region of skin.

Images assessed by dermatologists to detect melanoma.

Problem Statement

Dermatologist assessment of dermoscopy assessment is slow and costly.

Proposed Solution

Automate the assessment of dermoscopy images for faster and cheaper melanoma detection.

Train a classifier on a database of dermoscopy images having labels $\{$malignant, benign$\}$.

Related Work

Reference	Contribution
Freedberg(1999)[2]	Early detection of melanoma can increase the chances of a patient's survival significantly
Tommasi(2006)[5], Stanley(2007)[4]	First attempts at Melanoma Detection by feature engineering
Codella(2017)[1]	ISIC Dataset
Sabour(2017)[3]	CapsNet Capsule Network Model proposed to overcome shortcomings of CNNs

ISIC Dataset - Malignant

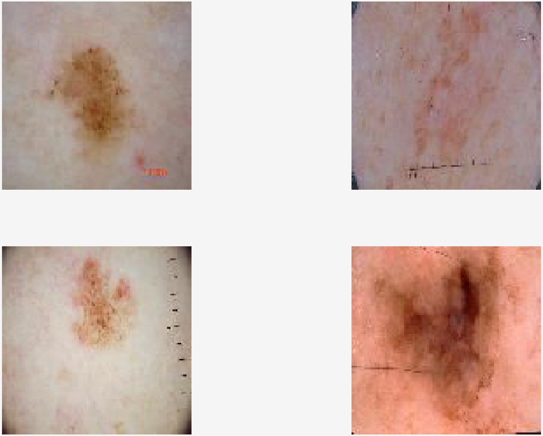

Figure: Examples of malignant skin lesion dermoscopy images

ISIC Dataset - Benign

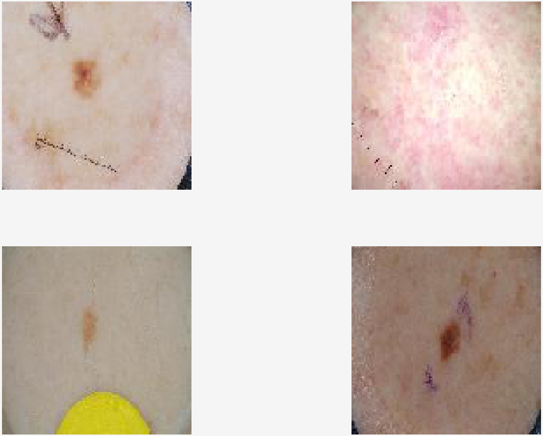

Figure: Examples of benign skin lesion dermoscopy images

Challenges

- ISIC dataset is not balanced (only 7% images for malignant)
- Occlusions in the form of hair, veins, marks on the skin and equipment related noise.
- Variations in size, shape, texture, and color for lesions.

Dataset used in experiments

Derived by balancing the classes in the ISIC dataset.

Consists of 1,083 benign and 1,083 malignant dermoscopy images.

Each RGB image is resized to 32×32.

Model Architecture - CapsNet

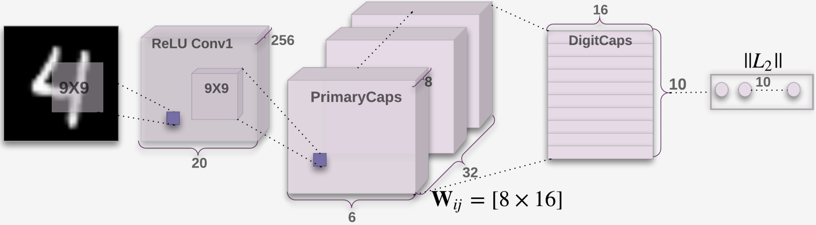

Figure: CapsNet Architecture for digit classification

Results

Table: Comparision of models on test data

Model	Accuracy	Specificity	Sensitivity
Logistic Regression	66.89%	60.70%	90.10%
Capsule Network	74.69%	75.37%	73.98%

Results

CapsNet architecture does not overfit despite the relatively small size of training data.

The model has higher specificity and lower sensitivity than the baseline. So, it has a low false negative rate.

Conclusion

CapsNet architecture can be used for melanoma detection.

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