An approach to classify dermoscopy images using Dynamic Restricted Boltzmann Machine

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Introduction:

Dermoscopy is a noninvasive diagnostic imaging technique which provides 20-70% magnification of skin surface and enables diagnosis of melanoma. However, this process is highly subjective and scarcely reproducible. Hence an automated analysis is required to improve the accuracy of detection. A unique handcrafted feature is not sufficient for precise diagnosis. Therefore, without extracting handcrafted features, machine learning technique can be used to increase the accuracy of classification.

Methods:

In this work, an attempt has been made to analyze dermoscopy images and classify melanoma using Dynamic Restricted Boltzmann Machine (DRBM). The dermoscopy images for analysis are obtained from publically available online PH^2 database which includes 160 benign and 40 malignant 8-bit RGB images. A typical melanoma image is characterized by multiple hypo-pigmented regions with irregular shape and boundary. The proposed framework uses DRBM to identify unknown critical features from the images and classify them. In DRBM the learning rate is adaptive and ten-fold cross validation is used for training and testing the network.

Results and discussions:

The dermoscopy images for analysis are fed as input to DRBM. In the first layer of DRBM, dimensionality reduction takes place where the raw image information is abstracted into 200 features. Visualization of weights from DRBM shows that certain rows have different distribution than other rows which indicates that some critical features are extracted from the original inputs. The DRBM network is trained for 300 epochs and the average reconstruction error is calculated at the end of each epoch. It is observed that the error gradually reduces and saturates after 200 epochs. It is also seen that the weights in the output nodes are distinct for benign and malignant classes which form the basis of the classification.

Conclusions:

In this study, automatic classification of melanoma is performed using DRBM. The learning rate is adapted to identify critical features from the dermoscopy images. It is found that DRBM is able to distinguish between benign and malignant classes effectively with accuracy of 85.5%. Hence it appears that the proposed framework can be used in the automatic classification of melanoma.

Key Words: Dermoscopy, Melanoma, Dynamic Restricted Boltzmann Machine