Skin Lesion Classification Using Weakly-supervised Fine-grained Method

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Key words: Skin lesion classification, Fine-grained, Weakly-supervised

Introduction

Skin cancer is one of the most serious diseases in the world. Melanoma is uncommon but it is a highly malignant tumor. The incidence of melanoma has risen rapidly in the past 30 years. Skin lesions are one of the early symptoms of skin cancers.

However, the survival rate can be greatly improved if melanoma is detected in early stage and given timely treatment. Yet it is difficult to classify skin lesions accurately because some are very similar, like melanoma and nevi.
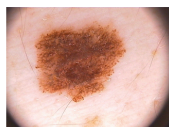
In the paper, we proposed a fine-grained method based network to automatically classify skin lesion images.
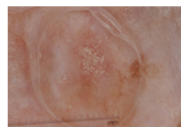
Motivation

- Challenge: Different skin cancers may look quite similar, which is likely for network to make the wrong judgement on similar skin images
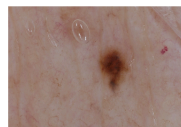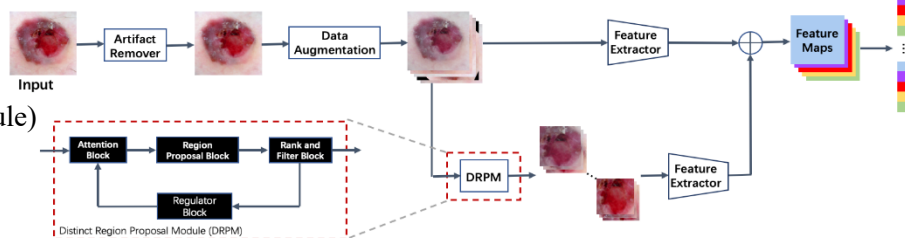

Melanoma   Nevi   Seberrheic Karatosis   Nevi

- Proposal network: Inspired by fine-grained image classification and weakly supervised object detection.
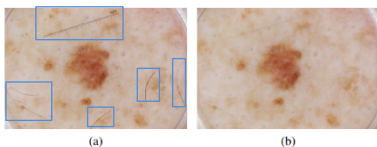
Method

Overall architecture:
- Artifact remover
- Data Augmentation
- DRPM (Distinct Region Proposal Module)

- Artifact remover removes hair, ruler, bubbles and other annotations marked by doctors.

1. Transform into gray-scale image
2. Morphological transformation to remove noise
3. Blackhat operation to highlight the contour of artifacts
4. utilize a threshold operation to extract the artifacts
5. Inpainting the image to restore

- Data augmentation supply the insufficient data samples and avoid problems to a certain extent.
- Augments melanoma and seborrheic keratosis images by four data augmentation methods and makes the number of three classes relatively balanced.

	M	SK	NV
Before	374	254	1372
after	1870	1270	1372

DRPM is designed to localize the most informative regions, which contains 4 blocks.
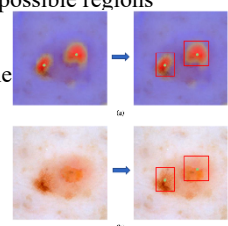- Attention block: highlighted the most informative areas
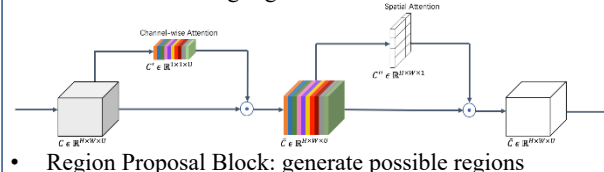
- Region Proposal Block: generate possible regions containing objects
- Rank and Filter Block: rank all the regions by their informativeness

- Regulator Block: network adjustment

result

Method	Extra Data	Ensembles	Melanoma SE	Melanoma SP	Melanoma AUC	Seborrheic Keratosis SE	Seborrheic Keratosis SP	Seborrheic Keratosis AUC	Average AUC
[1], 2017	Y	Y	73.5	85.1	86.8	97.8	77.3	95.3	91.1
[2], 2017	Y	Y	42.7	96.3	87.0	58.9	97.6	92.1	89.6
[3], 2019	Y	N	65.8	89.6	87.5	87.8	86.7	95.8	91.7
[4], 2018	N	Y	40.2	71.9	85.1	71.1	85.1	93.0	89.1
[5], 2019	N	Y	73.5	83.8	85.5	61.1	97.2	93.2	89.4
[6], 2020	N	Y	37.6	96.5	89.1	72.2	97.3	93.5	92.6
[3], 2019	N	N	59.0	89.6	85.9	77.8	93.1	95.1	90.5
WFSG	N	N	75.8	85.3	86.6	64.7	98.0	96.2	91.5
WFSG-Ens	N	Y	76.1	88.4	89.5	73.8	98.3	96.9	93.2

Conclusion

- In this paper, we proposed a fine-grained based, weakly supervised network to solve the hard-recognized skin lesion classification problems. The experiments conducted on ISIC 2017 datasets prove the proposed method is both effective and efficient.

Reference.

[1]. Transfer learning using a multi-scale and multi-network ensemble for skin lesion classification [2]. Classification of skin lesions using an ensemble of deep neural networks [3]. Deep learning for twostep classification of malignant pigmented skin lesions [4]. Deep attention model for the hierarchical diagnosis of skin lesions [5]. The abcd rule of dermatoscopy: high prospective value in the diagnosis of doubtful melanocytic skin lesions [6]. Data augmentation for skin lesion analysis