Fundamentals of Deep Learning
CSE477s

Name: Zainb Maged Arafa Zahran

ID: 1901420

Group: 2

Paper: Automated Detection and Classification of Oral Lesions Using Deep Learning for Early Detection of Oral Cancer

What is the problem statement of the paper?

Oral cancer is a major global health issue accounting for 177,384 deaths in 2018 and it is most prevalent in low- and middle-income countries. Enabling automation in the identification of potentially malignant and malignant lesions in the oral cavity would potentially lead to low-cost and early diagnosis of the disease.

What are the objectives of the paper and do you think the authors managed to achieve these goals?

The objective are:

- Prepare well-annotated images of oral lesions classification which can be used for early diagnosis of the disease.this was achieved by gathering data from many clinics world wide and applying COMPOSITE ANNOTATION to them

- Build a deep learning model capable of classifying lesions , this was achieved by 2 methods:
    1- Image classification achieved an F1 score of 87.07% for identification of images that contained lesions and 78.30% for the identification of images that required referral, which is acceptable F1-score
    2- OBJECT DETECTION achieved an F1 score of 41.18% for the detection of lesions that required referral. This algorithm is faster but on the expense of accuracy

What is the DL method used in this paper?

- IMAGE CLASSIFICATION: Images in data set were classified into (no-lesion , no-referral , refer for other reasons, refer low risk , refer high risk) using ResNet-101 which is a Convolutional Neural Network CNN with a depth of 101 layers

- OBJECT DETECTION:Find where objects are located in a given image and what class they belonged to, using the Faster R-CNN which has 2 stages :

1-region proposal network (RPN) which generated a sparse set of object/region proposals each with an objectness score
2- detection network which classified the region proposals into object classes and background.

What are the other state-of-the-art methods that can be applied to the same problem?

Traditional Machine Learning Algorithms such as Support Vector Machines (SVM), Random Forests, and Gradient Boosting Machines (GBM) may be used for image classification tasks. These methods rely on manually extracted features from images, such as texture, colour, and shape , location.this require domain-specific Knowledge of what are features that contribute to diagnosis of oral Lesions .

Would you apply any of the other methods other than the DL method used in this paper? Explain your answer?

No, I apply a random forest model and train using colour, texture and size extracted features.this is much simpler and straight forward approach that achieve the same results with much less computational power.as the proposed model in the paper is very computationally expensive and the faster R-CNN achieved lower f1 score of 41.18%,
Random forest model achieved high F1-score of 89%

What datasets have been used in this paper? Do you think the result is generalizable for any datasets?

-The dataset , which contained 328,000 images with 80 classes
- I think it is generalizable it was trained with complex dataset .also i tried testing it with different dataset and the results were higher than mentioned in the paper as f1-score was 88% although i had to reduce number of epochs to 3 instead of 100 ,resized images to 64 x 64 and reduce number of batches to 64 instead of 128 due to lack of RAM.

Discuss the results presented in the paper. Compare the results with other state-of-the art methods used to solve this problem.

1- Random Forest classifier

Hyperparameters:

- n_estimators=100
- max_depth=40

The state-of-the art method I choose: using Random Forest after feature extraction achieved F1-score of 89 % in much less training time.

2- ResNet-101 which is a Convolutional Neural which is proposed in the discussed paper some of the hyperparameters where reduced to save RAM

Hyperparameters:

- learning rate =0.001
- momentum=0.9
- weight_decay=0.005
- num_epochs = 3 instead of 100
- batch_size=64 instead of 128

The paper uses F1 score as metric of evaluation where :

1- Image classification achieved an F1 score of 87.07% for identification of images that contained lesions and 78.30% for the identification of images that required referral, which is acceptable F1-score

2- OBJECT DETECTION achieved an F1 score of 41.18% for the detection of lesions that required referral. This algorithm is faster but on the expense of accuracy

These results were confirmed by trying the model on another test set

What would you like to criticise about the paper? Could you suggest any improvements.

I would criticises using CNN model directly without trying Traditional Machine Learning Algorithms such as Support Vector Machines (SVM), Random Forests, … . I would recommend using Random Forest with features extraction first.

Have you implemented the paper using your own code? Do your results agree with the authors? What are the differences and why?

Yes, results agree with authors although it is slightly higher due to using more simple dataset than the original, also i had to reduce some of the hyperparameters due to lack of RAM

Link to repo:

https://github.com/zainbmaged/Project.git