Team : Softsensor_Group

Dr. Vivek Gupta, Prakash Mishra, Ayushi Jain, Yughender Meda, Dhairya Talsania

(Softsensor AI Labs)

I. Data Preprocessing

Conic Dataset [1] have 238 images on which 204 images are used as the training images and 34 images are used as validation images. We have extracted 244*244 size patches with the overlap of random size between 150 to 200 for each image. We introduced mirror padding for edges to resize the patch images to 256*256 size.

We have used Reinhard color Normalization [2] at the patch level to state color variation challenge. We also create the hematoxylin (H component) patches for each patch to utilize H&E staining properties of whole slide image patches. We also implemented some of the data augmentation techniques as rotation, flipping etc. We also introduced some background less images using the instance map label which contains only nuclei of different classes.

II. Methodology

Our framework is inspired by the HOVERNET [3] and Triple U-net [4] where one is using the horizontal and vertical map and other is using the H – component of patches as a separate encoder channel and connected with progressive dense feature aggregation (PDFA) block with actual image encoder. We have described our model as in next step.

A. Model Description

In our model, we have two encoder channels and five decoder channels, some of which are inter-connected with PDFA block. We have used Preact-net as a encoder instead of resnet as a backbone network as it is updated variant of resent for the classification task.

A.1. Encoder channels.

We have two encoder channels as following:

a. RGB image channel: This channel is used to extract the raw image features.

b. Hematoxylin channel: This channel is used to collect the hematoxylin-aware contour feature.

c. PDFA blocks: This block is defined as in the Triple U-net[4] models create to combine the raw image feature to hematoxylin-aware contour features.

A.2. Decoder channels

a. Nuclei pixels segmentation channel.

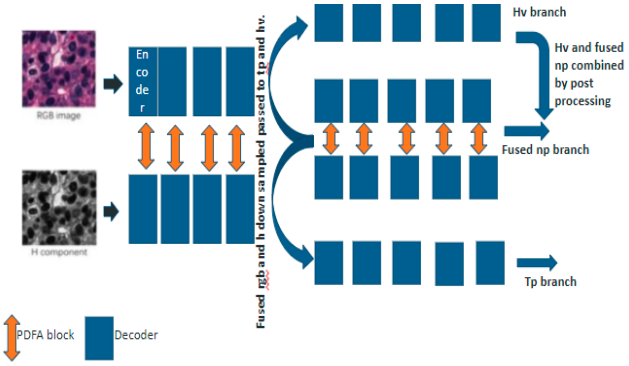
b. Horizontal and vertical map segmentation channel.

c. Nuclei Classification channel.

d. Hematoxylin output channel.

e. Fused NP branch.

The model is described as in following diagram:



III. Post Processing

We are combining nuclei pixel prediction with the horizontal and vertical map result to get the final segmentation result which is similar to Hovernet model [3] post processing. We are discarding the hematoxylin output channel and RGB output channel. These channels are sharing feature extraction information with other channels with the PDFA blocks in training.

For the nuclei composition prediction, we have used the nuclei classification branch prediction with segmentation branch and post-processing as given in HOVERNET [3] model, where the nuclei classification prediction branch is used to get the class for the nuclei and nuclei pixel prediction branch is used to get the counts of nuclei classes.

IV. Results

We have trained multiple models with different pre-processing, hyperparameters and patch samples. We have used PQ and mPQ metric defined as in the Conic challenge to evaluate the models. The results for these models are as given:

Model	PQ	mPQ
Model 1	0.61	0.44
Model 2	0.55	0.06
Model 3	0.32	0.047
Model 4	0.589	0.45
Model 5	0.604	0.507

References

[1] S.Graham, M.Jahanifar1 , Quoc Dang Vu , G. Hadjigeorghiou, T. Leech, D. Snead, S.E Ahmed Raza, F. Minhas, N. Rajpoot, “CoNIC: Colon Nuclei Identification and Counting Challenge 2022,”arXiv preprint arXiv: 2111.14485, 2021.

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