WEAKLY SUPERVISED CLUSTERING BY EXPLOITING UNIQUE CLASS COUNT

INTRODUCTION

The paper proposed a Multiple Instance Learning (MIL) task that utilized a novel weakly supervised clustering architecture based on the Unique Class Count (UCC). The architecture is composed of two key components: (1) A neural network-based model and (2) a clustering framework. The neural net model is given a supervised training at the bag level of the instances where it adjusts its weights to birth a trained model. The trained model is then transferred to the pixel level (within the bags) to cluster the features contained therein and thus generate what is known as a mask since there is no explicit labels provided. The research also proved theoretically and showed graphically the performance of the novel architecture against two already existing models; the K-means and Olaf’s fully supervised U-net. The model comparable to the U-net model as revealed by the Camelyon dataset experiment.

One distinct feature of the proposed model is the addition of a kernel density estimator at the tail end instead of a pooling layer. This makes the input from the preceding layer permutation invariant.

STRENGTH AND WEAKNESS

1. The paper did not contain a clear diagram of the proposed model architecture.
2. The clustering framework is an excellent addition to the UCC model. However, I would humbly propose we swap the UCC model for a U-net model, such that the trained U-net model would be used in the feature clustering framework at the pixel level. This result be another interesting novel model to be researched.

RECOMMENDATION

The work of the novel model on the CAMELYON dataset is very commendable hence I want to propose another scenario that the novel model would be of real-world importance – Plasmodium spp. parasitized red blood cells classification.

This scenario can be formulated as follows. The input is a set of suspected blood film images. Each image contained in a bag would have one of two labels; **ucc1** (red cells are fully normal or fully parasitized) or **ucc2** (image is a mixture of normal red cells and parasitized red cells). Our aim is to segment the pixels (instances) in the image into normal and parasitized. A UCC model would then be trained to predict the UCC labels of individual images in a fully supervised manner; and the trained model would be used to extract features of pixels (instances) inside the images (bags). Then, semantic segmentation masks would be obtained by unsupervised clustering of the pixels (according to the extracted features) into two clusters (normal or parasitized). I was privileged to work on the speciation of the various Plasmodium parasites using the VGG16 model (transfer learning). Efforts to train a model that will detect and semantically segment out parasitized cells in a given blood film image has proven futile. However, with the use of the novel proposed model proposed by the paper, this will materialize faster.