Exeriese 2

Lan Zhang
954517477

1 Problem 1

Solved on 09/30/2019. The seed I used in belowing experiments is 2612.

I implmented ACC, BWT, TBWT and CBWT to compare the result with different factors, inculding loss function, dropout, network depth and optimizer. ACC measures mean performance through all tasks; BWT is the influence on task T_i after the model trained on other tasks; TBWT set an idependent standard for different tasks and calculate the influence on task T_i after training other tasks; CBWT examines a specific task's influence.

$$ACC = \frac{1}{T}\sum_{i=1}^{T} R_{T,i}$$

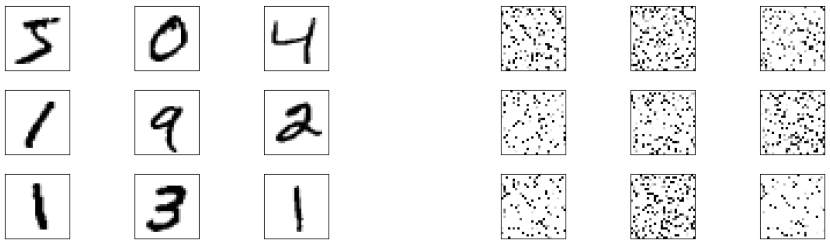
$$BWT = \frac{1}{T-1}\sum_{i=1}^{T-1} R_{T,i} - R_{i,i}$$

$$TBWT = \frac{1}{T-1}\sum_{i=1}^{T-1} R_{T,i} - G_{i,i}$$

$$CBWT(t) = \frac{1}{T-t}\sum_{i=t+1}^{T} R_{i,t} - R_{t,t}$$

where T is the total tasks in one experiment, $R_{i,j}$ is the performace(classification accuracy) of the model on task i after traning on task j, $G_{i,i}$ is the performance of a model only trained on task i.

Each experiment has 10 tasks. I applied a fixed random permutation to the pixels to generate different images as new tasks. Figure 1 is an example of permuating images.



(a) Original images (b) Permuted images

Figure 1: Permutation

33rd Conference on Neural Information Processing Systems (NeurIPS 2019), Vancouver, Canada.

1.1 Loss Function

I implemented four loss function. The formula of Negative Log-Likelihodd(NLL) is:

$$NLL\_Loss(\hat{y}) = -log(\hat{y})$$

where $\hat{y}$ is the predicted class of the model.

I implemented L1 loss, L2 Loss and a hybird loss.

$$L1\_Loss(y, \hat{y}) = |\hat{y} - y|$$
$$L2\_Loss(y, \hat{y}) = \sqrt{(\hat{y} - y)^2}$$
$$Hybird\_Loss = (y, \hat{y}) = L1\_Loss(y, \hat{y}) + L2\_Loss(y, \hat{y})$$

Figure 2 is the four matrix with different loss function. Obvisily, different loss functions influence the model on forgetting. L1 loss is better on resisting forgetting compared to other loss function s on this model.

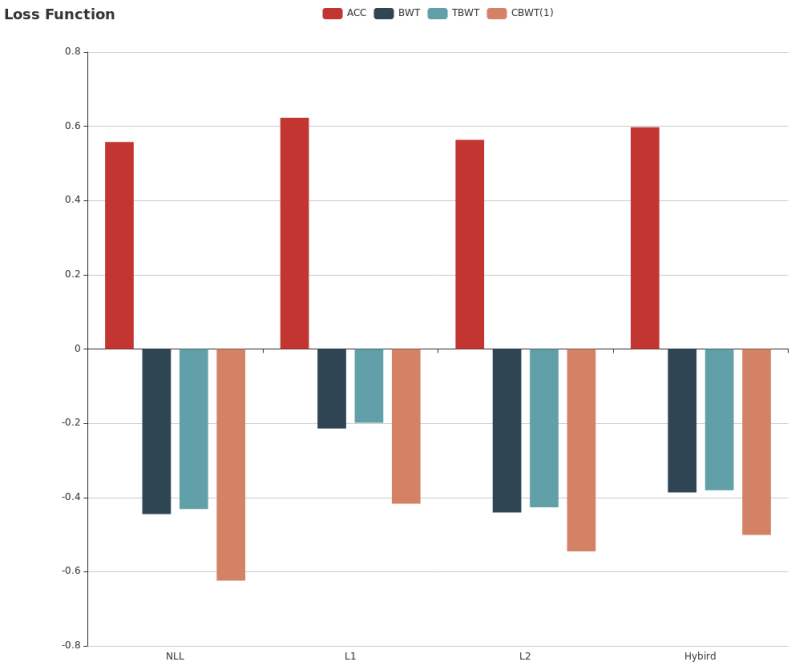


Figure 2: Loss Function

1.2 Dropout

I trid four dropout probablity(0.0, 0.2, 0.4, 0.6) in this experiment. Shown as Figure 3, dropout can reduce forgetting influence.

1.3 Depth

I trid three models with different depth(2,3,4) in this experiment. Shown as Figure 4, the more complex the model is, the larger informantion loss has.

1.4 Optimizer

I used three optimizer(Adam, SGD, RMSprop) with the same learning rate. Figur 5 is the result of this experiment. The model can't converge with SGD optimizer. It seems optimizer doesn't affect as much as network depth and dropout probablity on forgeting information.

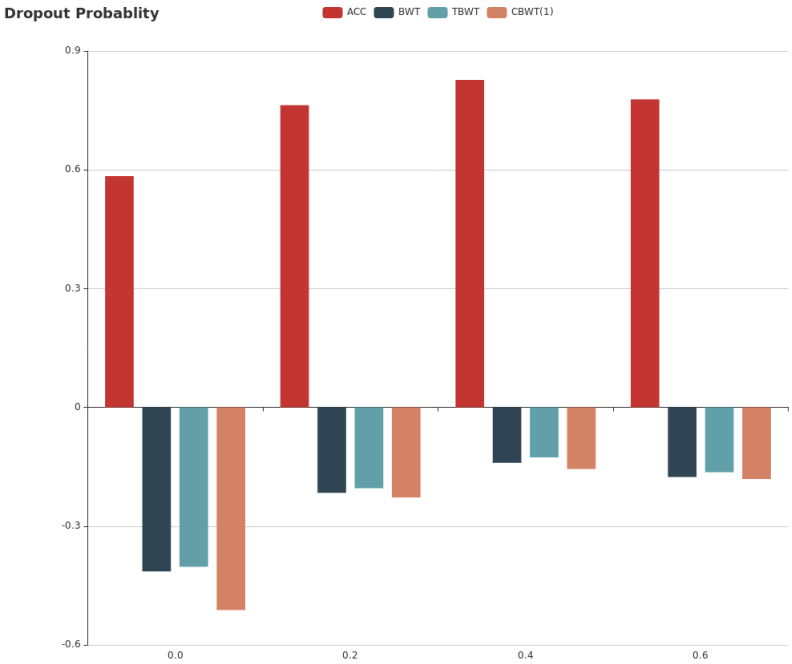


Figure 3: Dropout Probablity

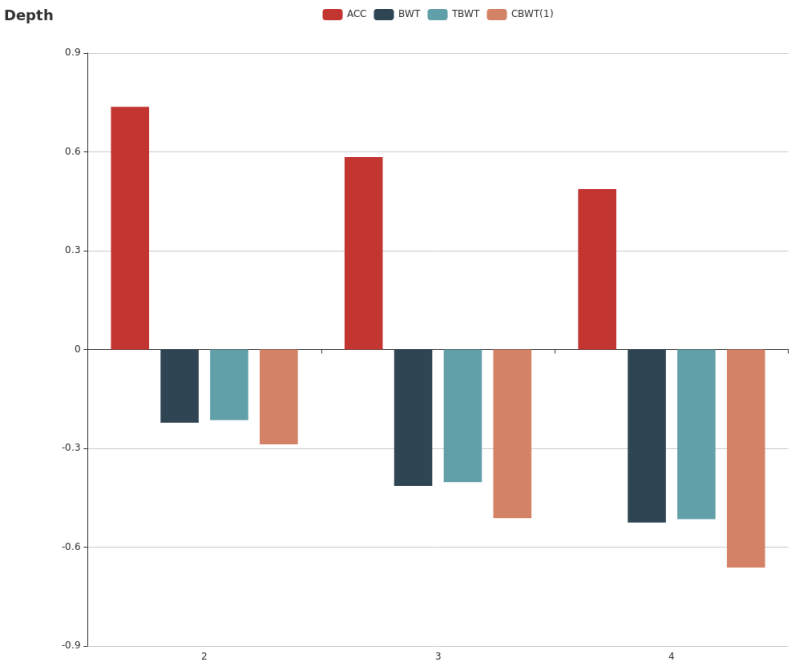


Figure 4: Depth

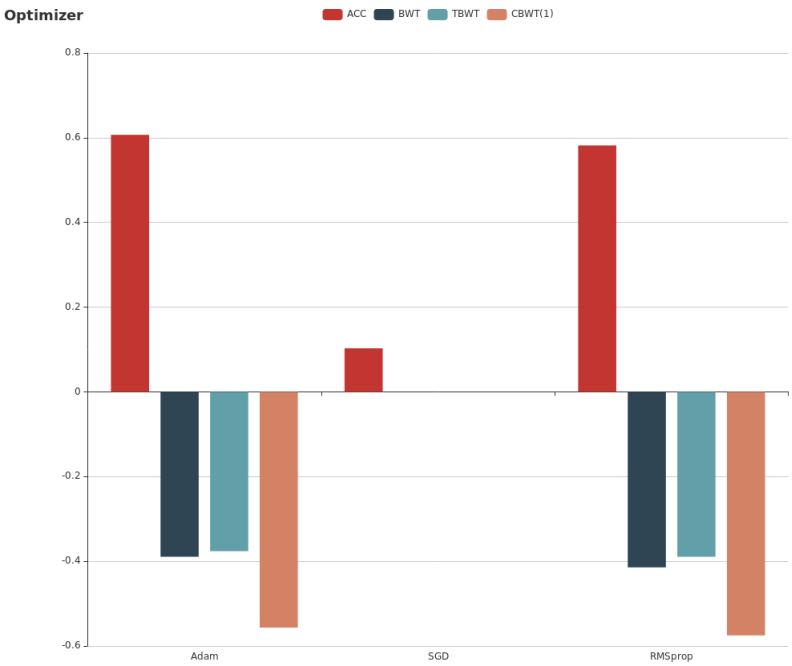
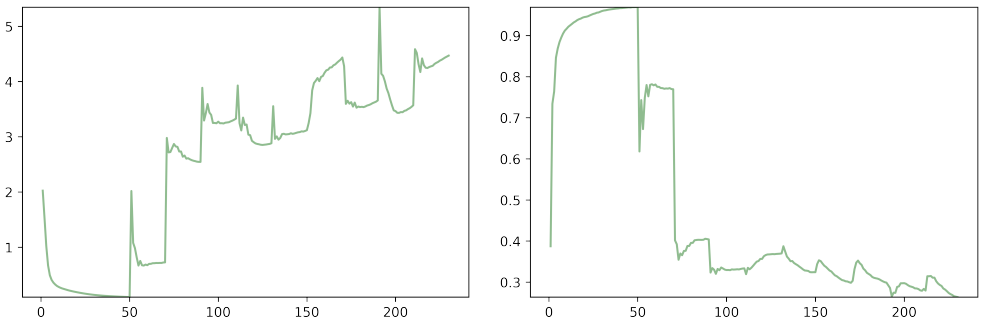


Figure 5: Optimizer

1.5 Validation Results

Figure 6 show the accuracy and loss on original test dataset during training 10 tasks.



(a) Loss (b) Accuracy

Figure 6: Validation Results