CPT_S 580 HW3

Yang Zhang

11529139

1. Since the happening of the mistake is depends on the if there is a mistake on the previous decision step. We can conduct the following:

    At step 1 there are epsilon * T mistakes

       Step2 there are epsilon * (T-1) mistakes

       …

       StepsT there are epsilon * 1 mistakes

    In total, there are epsilon * (T + (T-1) + (T-2) + .. + 1) mistakes

    Therefore the total number of mistakes grows quadratically O(epsilon * T^2)

2.
```
Input: D = Training examples
Initialization: Lforward = {L0, …, Ln-1} for n search
steps, Lexact = Lagg = {},
for iter from 0 to s:
   Hiter = beta* H* + (1-beta)* H_hatiter
   HAiter = beta* H* + (1-beta)* HA_hatiter
   HSEARN_iter = (iter == 0)? H* : beta*H_hatiter + (1-
beta)* HSEARN_iter-1
     for each training example di in D:
       for each search step tj in di:
         compute classification example a = (fn, yn)
         do exploration from tj to tj+1
         compute the cost from tj+1 to tlast
         generate example b = (fn, yn, cost)
         add b to Lagg
         if iter == 0:
            add a to Lexact
         else:
            add a to Lexact if H*(fn) != Hiter(fn)
         add a to Lj
   H_hatiter = Classifier_Learner(Lexact)
   HA_hatiter = Classifier_Learner(Lagg)
```

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    H_Forward = Classifier_Learner(L_forward)
```

Exact Imitation: return H_hat_0
Forward Training: return classifier set $L_{forward}$
SEARN: return current H_hat_{iter}
DAgger: return the best H_hat_{iter}
AggreVaTe: return the best HA_hat_{iter}

3. **Method 1**: Apply active learning, that is manually recover the missing labels.

   Method 2: Removes the missing steps, for example if the training example with the labels (a, b, c, d, ?, f), covert the labels into (a, b, c, d, f) by removing the missing one

   Method 3: Regenerate the training example with all the possible actions. For example, replace labels (a, b, ?) with {(a, b, a), (a, b, b), …, (a, b, z)}

4. (a)
   Classifier settings: weka.function.MultilayerPerceptron Learning Rate 0.01, hide layer 0, iteration 50

   Nettalk testing Recurrent error: 0.243

   Nettalk testing oracle error: 0.197

   Ocr testing Recurrent error: 0.245

   Ocr testing oracle error: 0.212

   (b)

Nettalk Training Recurrent Error

beta(0.5) — beta(0.6) — beta(0.7) — beta(0.8) — beta(0.9) — beta(1.0)

Nettalk Testing Recurrent Error

beta(0.5) — beta(0.6) — beta(0.7) — beta(0.8) — beta(0.9) — beta(1.0)

Ocr Training Recurrent Error

beta(0.5)   beta(0.6)   beta(0.7)   beta(0.8)   beta(0.9)   beta(1.0)

Ocr Testing Recurrent Error

beta(0.5)   beta(0.6)   beta(0.7)   beta(0.8)   beta(0.9)   beta(1.0)