

Learning Multi-Step Predictive State Representations - Appendix

Abstract

This appendix contains pseudocode for the algorithms presented in the main paper, and more details on the experiments.

Pseudocode of the encoding function

The pseudocode is given in Algorithm 1, using the following notation:

bestEncoding: A map from indices i of the query string x to the optimal encoding of $x[i:]$.

minEncoding: A map from indices i of the query string x to $|bestEncoding[i]|$

opsEnding: A map from indices i of x to the set of strings in Σ' : $\{s \in \Sigma', x[i - |s| : i] == s\}$

Algorithm 1 Encoding Algorithm

INPUT: x

OUTPUT: $\kappa(x)$

```
1: procedure DPENCODE
2:    $bestEncoding[] \leftarrow String[|x| + 1]$ 
3:    $minEncoding[] \leftarrow Int[|x| + 1]$ 
4:    $opsEnding[] \leftarrow String[|x| + 1][]$ 
5:    $bestEncoding[0] = x[0]$ 
6:    $minEncoding[0] = 0$ 
7:   for  $i$  in  $[1, |x|]$  do
8:      $opsEnding[i] \leftarrow \{s \in \Sigma', x[i - |s| : i] == s\}$ 
9:   end for
10:  for  $i$  in  $[1, |x|]$  do
11:     $bestOp \leftarrow null$ 
12:     $m \leftarrow 0$ 
13:    for  $s \in opsEnding[i]$  do
14:       $t \leftarrow minE[i - |s|] + 1$ 
15:      if  $bestOp == null$  or  $t < m$  then
16:         $m \leftarrow t$ 
17:         $bestOp \leftarrow s$ 
18:      end if
19:    end for
20:     $minEncoding[i + 1] \leftarrow m$ 
21:     $bestEncoding[i + 1] \leftarrow bestEncoding[i - |bestOp|] + bestOp$ 
22:  end for
23:  return  $bestEncoding[|x|]$ 
24: end procedure
```

Experiments

The figures below depict the Double Loop and Pacman environments used in the experiments.

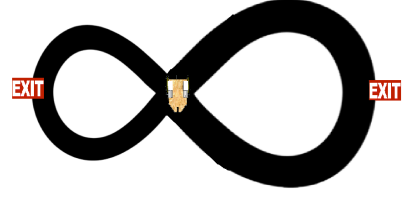


Figure 1: Double Loop Environment

Algorithm 2 Base Selection Algorithm

INPUT: $Train, Sub_M$

OUTPUT: Σ'

```

1: procedure BASE SELECTION
2:    $\Sigma' \leftarrow \{s, s \in \Sigma\}$ 
3:    $bestEncoding \leftarrow null$ 
4:   for each obs in Train do
5:      $bestEncoding[obs] \leftarrow |obs|$ 
6:   end for
7:    $i \leftarrow 0$ 
8:   while  $i < numOps$  do
9:      $bestOp \leftarrow null$ 
10:     $m \leftarrow 0$ 
11:    for each  $s \in Sub_M$  do
12:       $c \leftarrow 0$ 
13:      for each obs in Train do
14:         $c \leftarrow c + DPEncode(obs) -$ 
 $prevBestE(obs)$ 
15:      end for
16:      if  $c > m$  then
17:         $bestOp \leftarrow obs$ 
18:         $m \leftarrow c$ 
19:      end if
20:    end for
21:     $\Sigma' \leftarrow \Sigma' \cup bestOp$ 
22:    for each obs in Train do
23:       $bestEncoding \leftarrow DPEncode(obs, \Sigma')$ 
24:    end for
25:     $i \leftarrow i + 1$ 
26:  end while
27:  return  $\Sigma'$ 
28: end procedure

```

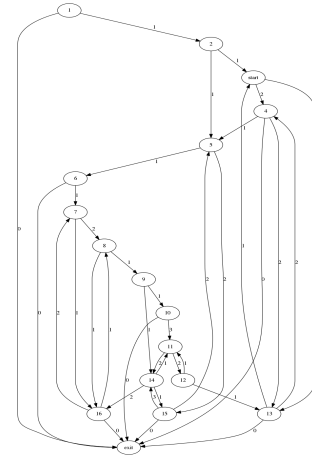


Figure 2: Graph of Pacman Labyrinth