

LTL:  $G(p_1 \rightarrow X p_2) \wedge (p_3 \wedge p_4)$

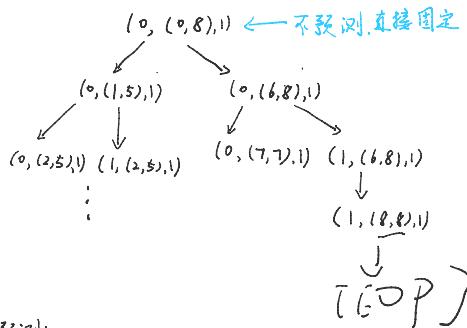
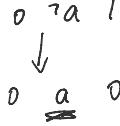
Trace:  $(p_1 \wedge p_3); (p_1 \wedge p_4)^w$   $O: (p_1 \wedge p_3); 1: (p_1 \wedge p_4)^w$

LTL pre:  $\& G \rightarrow p_1 X p_2 \wedge p_3 \wedge p_4$

证明树: 路径生成 LTL 子公式 是否满足  
节点: 四元组  $(\text{suffix}, (\text{left}, \text{right}), \{0, 1\})$

例:  $(0, (2, 5), 1)$  表示路径  $(p_1 \wedge p_3)$ ;  $(p_1 \wedge p_4)^w$  满足公式  $p_1 \rightarrow X p_2$   
 $(1, (6, 8), 1)$  表示路径  $(p_1 \wedge p_4)^w$  满足公式  $p_3 \wedge p_4$

儿子同时成立  $\rightarrow$  父结点成立

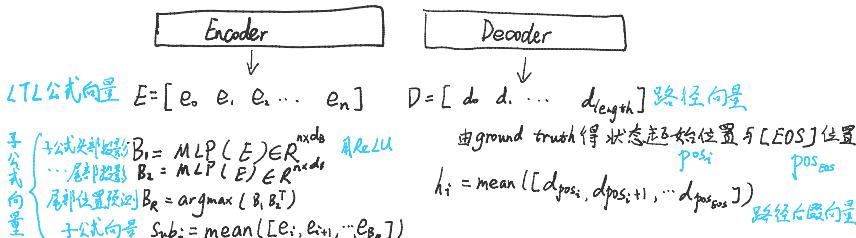


边预测:

每个节点的父节点 attention

每个结点最多两个儿子 loss

最小生根权



$$h_{node}(i, j, \{0, 1\}) = \text{MLP}(h_{node}(i, j, \{0, 1\})) \in \mathbb{R}^2 \quad \text{证明树中出现概率}$$

训练时

$$\text{hedge}(i, j) = \text{concat}(h_{node}(i), h_{node}(j), h_{node}(i) - h_{node}(j)) \quad \text{边向量}$$

$$\text{Edge}(i) = \text{MLP}(\text{hedge}(i, j))$$

每个节点选择的儿子节点

预测时

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function Search(suffix, (left, right), flag)
    hedge 只算 {suffix} X {((left, right), (left+1, B_R(left+1))), (B_R(left+1)+1, right))} X {0, 1}
    取 top 2 中 Node 预测为 1 的点 Next
    递归 Next
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Ground Truth

根节点:  $(0, (0, LTL \text{ length}-1), 1)$

若当前节点为  $(\text{suffix}, (\text{left}, \text{right}), \text{flag})$

儿子节点:

and:  $(\text{suffix}, (\text{left}_1, \text{right}_1), \text{flag})$ ,  $(\text{suffix}, (\text{left}_2, \text{right}_2), \text{flag})$   
 $\text{flag} = \text{true}$ : 两个  
 $\text{flag} = \text{false}$ : 任一个  $\text{false}$

or:  $(\text{suffix}, (\text{left}_1, \text{right}_1), \text{flag})$   
 $\text{flag} = \text{true}$ : 任一个  $\text{true}$   
 $\text{flag} = \text{false}$ : 两个

not:  $(\text{suffix}, (\text{left}+1, \text{right}), \neg \text{flag})$

$\rightarrow$  ①  $(\text{suffix}, (\text{left}_1, \text{right}_1), \text{true})$ ,  $(\text{suffix}, (\text{left}_2, \text{right}_2), \text{flag})$   
 ②  $(\text{suffix}, (\text{left}_1, \text{right}_1), \text{false})$

③  $(\text{suffix}, (\text{left}_1, \text{right}_1), \text{true})$  } 直接定位?  
 ④  $(\text{suffix}, (\text{left}_1, \text{right}_1), \text{false})$

F: ①  $(\text{suffix}, (\text{left}_1+1, \text{right}_1), \text{true})$   
 ②  $(\text{suffix}+1, (\text{left}_1, \text{right}_1), \text{true})$   
 ③  $(\text{suffix}, (\text{left}_1+1, \text{right}_1), \text{false})$   
 ④  $(\text{suffix}+1, (\text{left}_1, \text{right}_1), \text{false})$

X:  $(\text{suffix}+1, (\text{left}_1+1, \text{right}_1), \text{flag})$

U: ①  $(\text{suffix}, (\text{left}_1, \text{right}_1), \text{true})$   
 $(\text{suffix}+1, (\text{left}_1, \text{right}_1), \text{true})$   
 ②  $(\text{suffix}, (\text{left}_2, \text{right}_2), \text{true})$   
 ③  $(\text{suffix}, (\text{left}_1, \text{right}_1), \text{false})$   
 ④  $(\text{suffix}, (\text{left}_2, \text{right}_2), \text{true})$   
 $(\text{suffix}+1, (\text{left}_1, \text{right}_1), \text{false})$  } 直接定位?

R: