Items and Inference rules for 3d grammars

Theory Group

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1 Items Semantics

Items in 3D grammars are designated as [X,i,j,k,l]. In this form the tree rooted at X licenses the string begining at i and following through j-1 to the left of the spine of the tree, and the string begining with k and following through l-1 to the right of the spine of the tree. The range (-1,-1) is used to denote the absence of a licensed string on that side of the spine, and the special case [X,i,-1,-1,j] is used when the root licenses one entire chunk from i through j-1 encompassing both sides of the spine.

2 Axioms

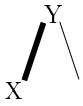
There are 13 Axioms of the parse of this grammar, one for each terminal in the string.

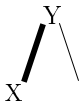
1. $[S_2^4, 5, 6, -1, -1]$
2. $[S_1^4, -1, -1, 9, 10]$
3. $[S_0^4, 4, 5, -1, -1]$
4. $[S_2^3, 6, 7, -1, -1]$
5. $[S_1^3, -1, -1, 10, 11]$
6. $[S_0^3, 3, 4, -1, -1]$
7. $[S_2^1, 7, 8, -1, -1]$
8. $[S_1^1, -1, -1, 11, 12]$
9. $[S_0^1, 2, 3, -1, -1]$

10. $[S_2^2, 1, 2, -1, -1]$
11. $[S_1^2, -1, -1, 12, 13]$
12. $[S_0^2, 0, 1, -1, -1]$
13. $[S_0^0, 8, -1, -1, 9]$

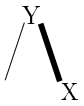
3 Inference Rules

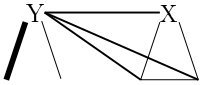
Note: there are other special case inference rules which are not outlined here.

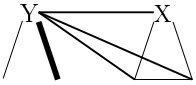
1. $\frac{[X,i,j,-1,-1][Y,-1,-1,k,l]}{[Y,i,j,k,l]}$, 

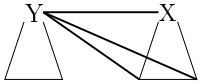
2. $\frac{[X,i,j,k,m][Y,-1,-1,m,l]}{[Y,i,j,k,l]}$, 

3. $\frac{[X,-1,-1,k,l][Y,i,j,-1,-1]}{[Y,i,j,k,l]}$, 

4. $\frac{[X,m,j,k,l][Y,i,m,-1,-1]}{[Y,i,j,k,l]}$, 

5. $\frac{[X,i,j,m,l][Y,-1,-1,k,m]}{[Y,i,j,k,l]}$, 

6. $\frac{[X,i,m,k,l][Y,m,j,-1,-1]}{[Y,i,j,k,l]}$, 

7. $\frac{[X,i,m,n,l][Y,m,j,k,n]}{[Y,i,j,k,l]}$, 

4 Inferences

1. $\frac{\left[S_2^4,5,6,-1,-1\right]\left[S_1^4,-1,-1,9,10\right]}{\left[S_1^4,5,6,9,10\right]}$ (1)
2. $\frac{\left[S_1^4,5,6,9,10\right]\left[S_0^4,4,5,-1,-1\right]}{\left[S_0^4,4,6,9,10\right]}$ (4)

3. $$\frac{\left[S_0^4,4,6,9,10\right]\left[S_2^3,6,7,-1,-1\right]}{\left[S_2^3,4,7,5,10\right]} \quad (6)$$

4. $$\frac{\left[S_2^3,4,7,5,10\right]\left[S_1^3,-1,-1,10,11\right]}{\left[S_1^3,4,7,9,11\right]} \quad (2)$$

5. $$\frac{\left[S_1^3,4,7,9,11\right]\left[S_0^3,3,4,-1,-1\right]}{\left[S_0^3,3,7,9,11\right]} \quad (4)$$

6. $$\frac{\left[S_0^3,3,7,9,11\right]\left[S_2^1,7,8,-1,-1\right]}{\left[S_2^1,3,8,9,11\right]} \quad (6)$$

7. $$\frac{\left[S_2^1,3,8,9,11\right]\left[S_1^1,-1,-1,11,12\right]}{\left[S_1^1,3,8,9,12\right]} \quad (2)$$

8. $$\frac{\left[S_2^2,1,2,-1,-1\right]\left[S_1^2,-1,-1,12,13\right]}{\left[S_1^2,1,2,12,13\right]} \quad (1)$$

9. $$\frac{\left[S_1^2,1,2,12,13\right]\left[S_0^2,0,1,-1,-1\right]}{\left[S_0^2,0,2,12,13\right]} \quad (4)$$

10. $$\frac{\left[S_1^1,3,8,9,12\right]\left[S_0^1,2,3,-1,-1\right]}{\left[S_0^1,2,8,9,12\right]} \quad (4)$$

11. $$\frac{\left[S_0^2,0,2,12,13\right]\left[S_0^1,2,8,9,12\right]}{\left[S_0^1,0,8,9,13\right]} \quad (7)$$

12. $$\frac{\left[S_0^1,0,8,9,13\right]\left[S_0^0,8,-1,-1,9\right]}{\left[S_0^0,0,-1,-1,13\right]} \quad (7)$$