

# 句法结构分析（parsing）示例

詹卫东

<http://ccl.pku.edu.cn/doubtfire>

# 简单句法分析算法示例

张三是县长派来的  
苍蝇是瞎子打死的  
主意是董永想出来的  
.....  
N V N V V 的

词典：  
张三： N  
县长： N  
是： V  
派： V  
来： V  
的： de

规则：  
(1)  $S \rightarrow NP VP$   
(2)  $NP \rightarrow N$   
(3)  $NP \rightarrow CS$  的  
(4)  $CS \rightarrow NP V'$   
(5)  $VP \rightarrow V NP$   
(6)  $V' \rightarrow V V$

# 自顶向下分析法示例-1

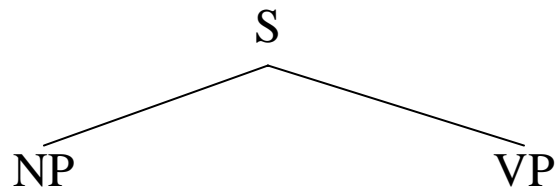
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

查词典

N          V          N          V          V          de  
|          |          |          |          |          |  
张三      是      县长      派      来      的

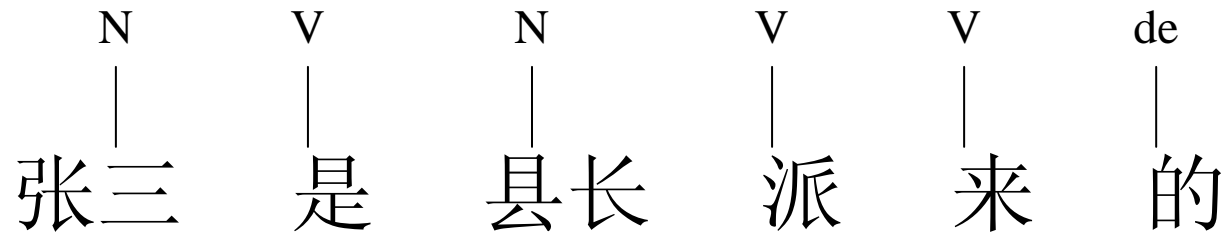
# 自顶向下分析法示例-2

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



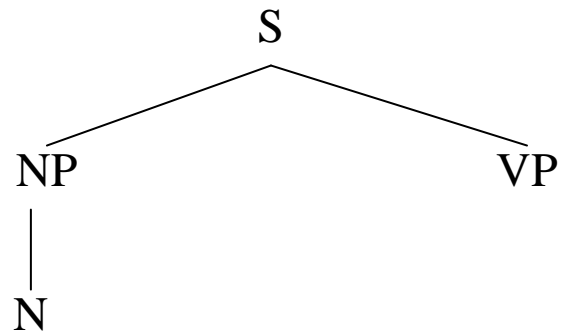
使用规则1:

$S \rightarrow NP VP$



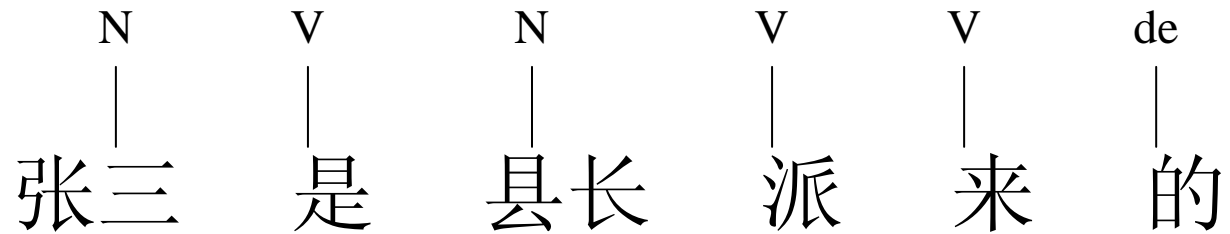
# 自顶向下分析法示例-3

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



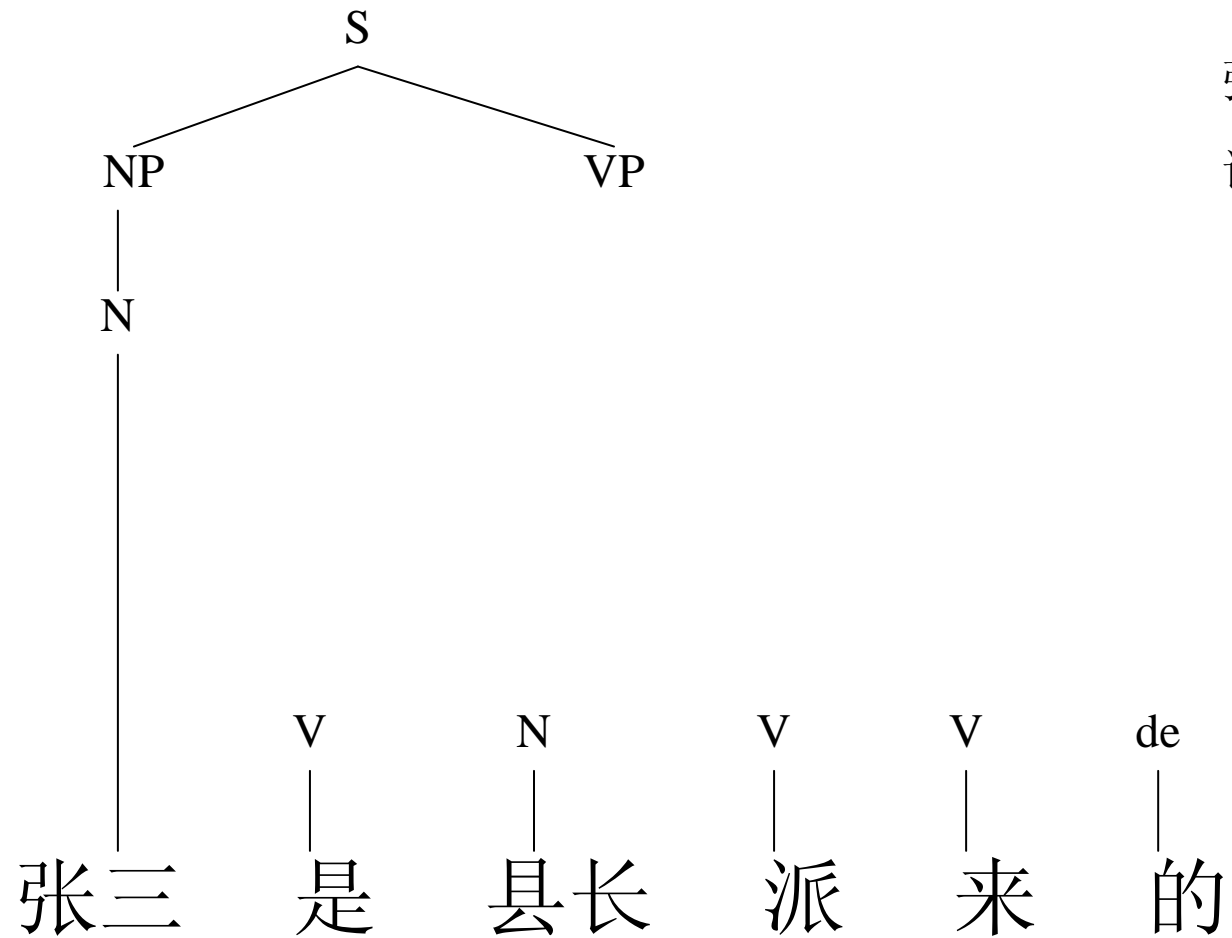
使用规则2:

$NP \rightarrow N$



# 自顶向下分析法示例-4

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



张三: N

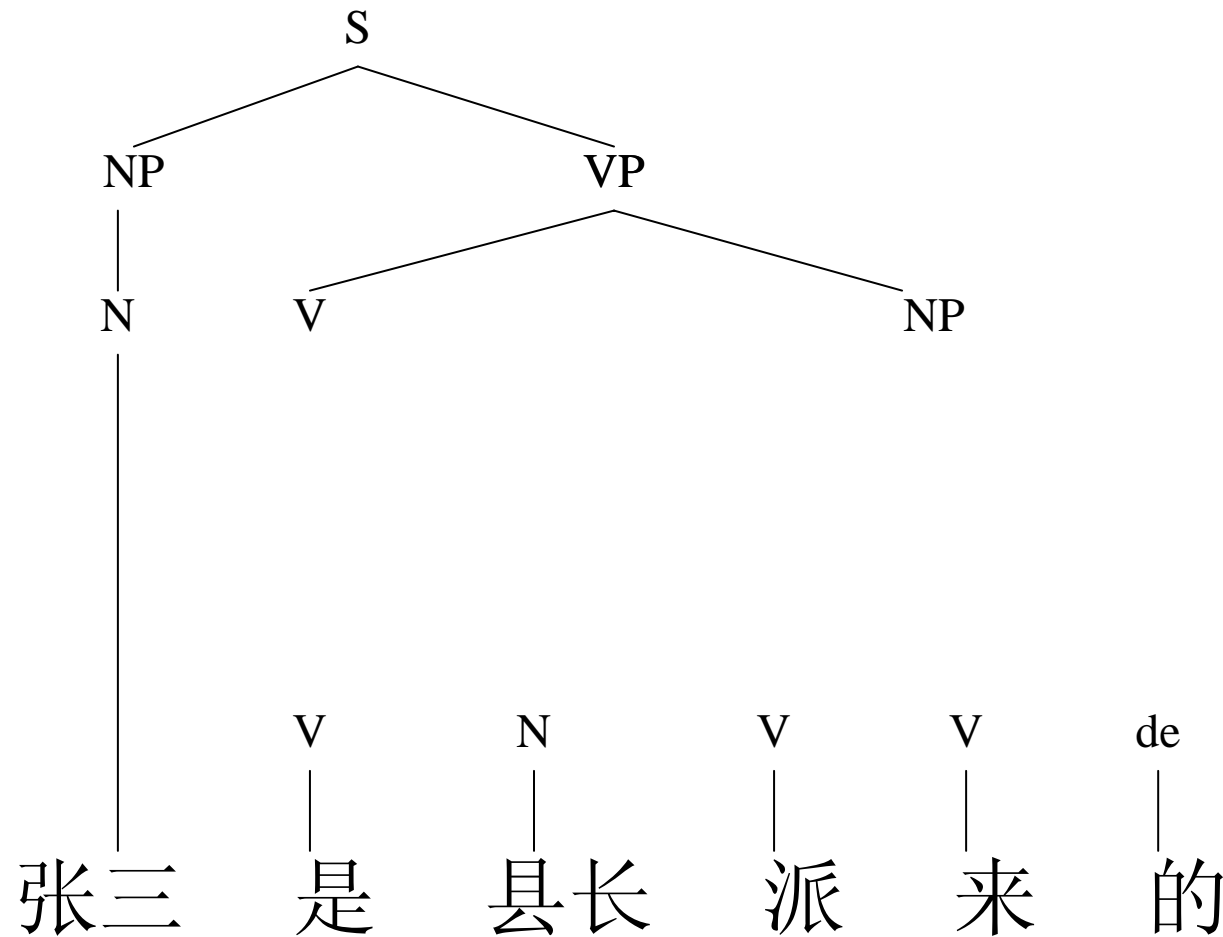
词典匹配成功

# 自顶向下分析法示例-5

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

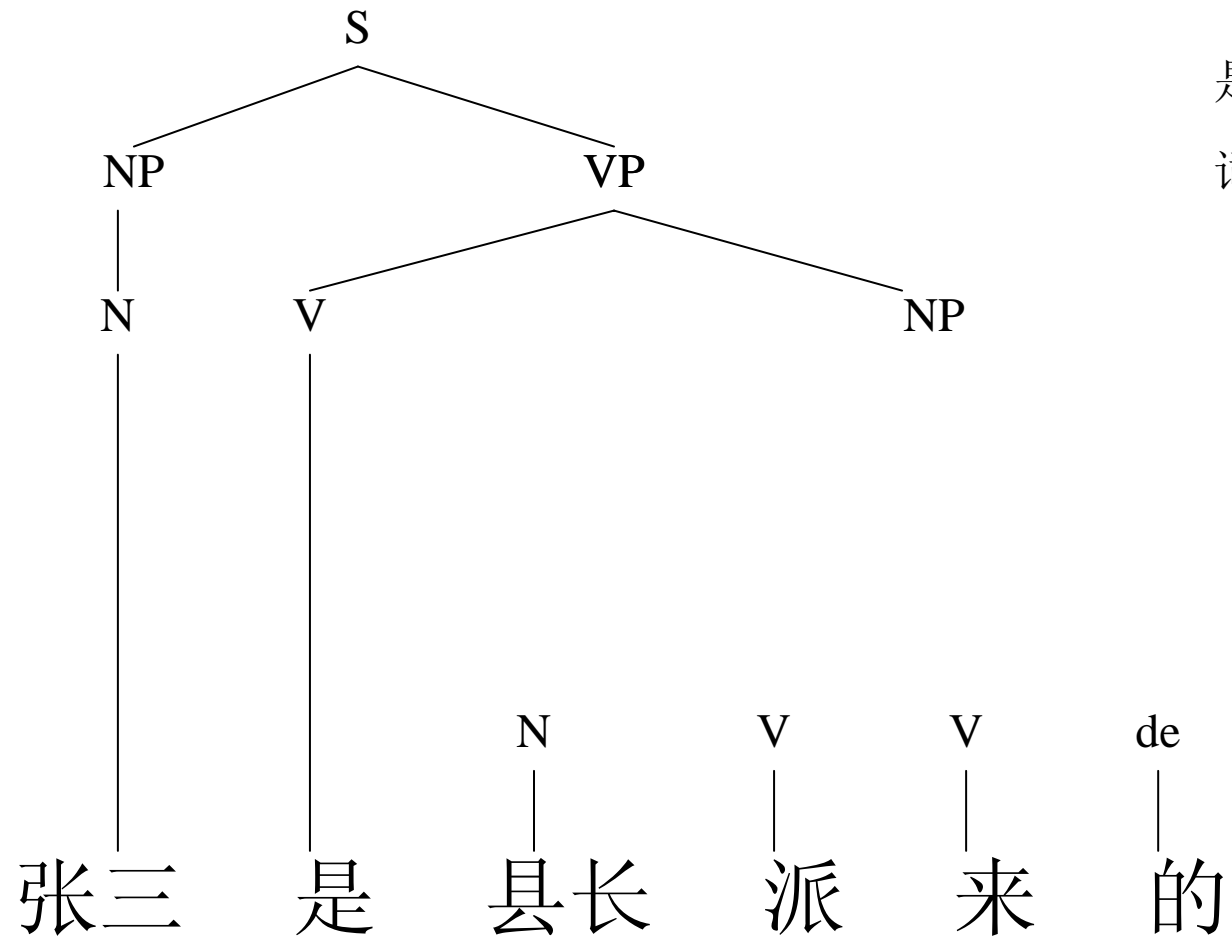
使用规则5:

$VP \rightarrow V NP$



# 自顶向下分析法示例-6

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



是: V

词典匹配成功

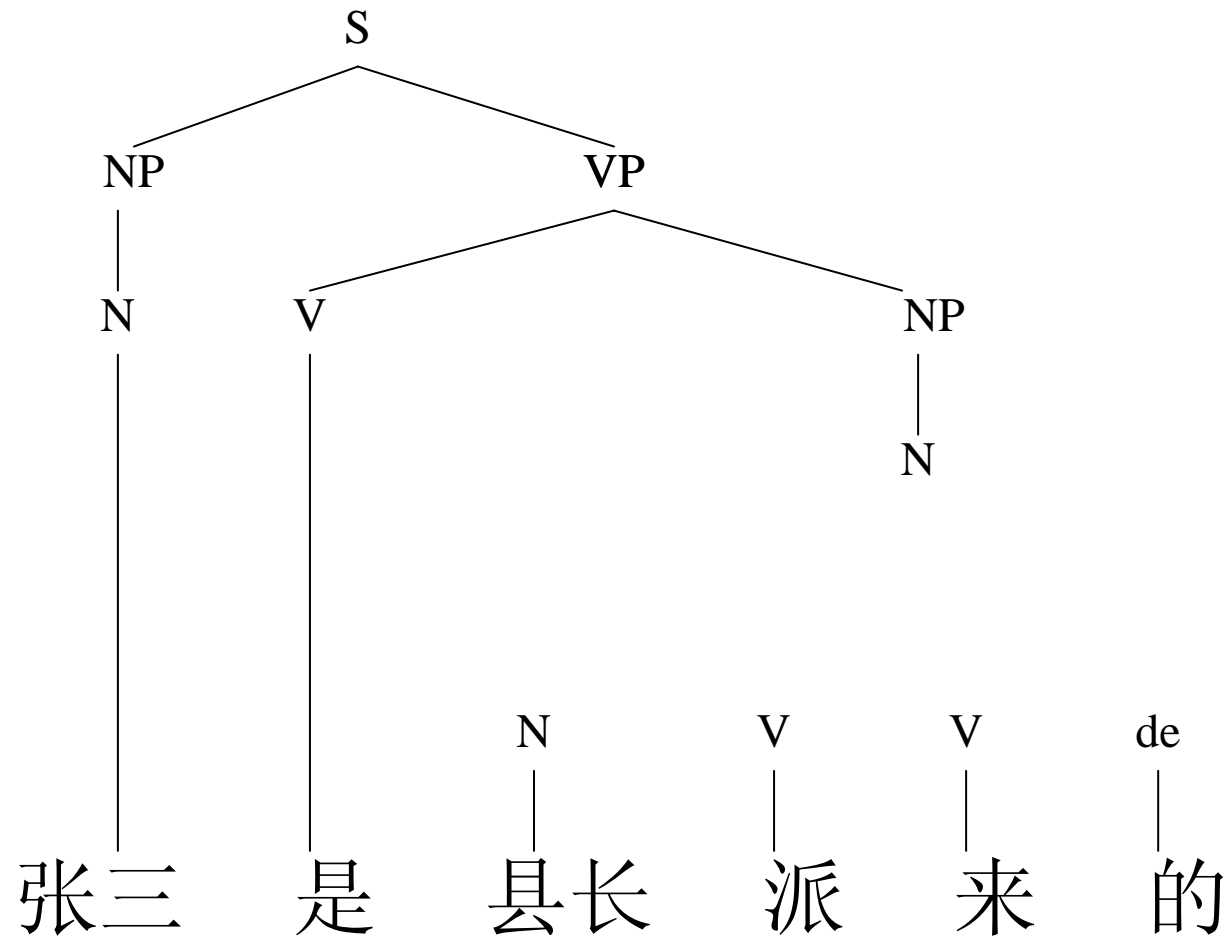


# 自顶向下分析法示例-7

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

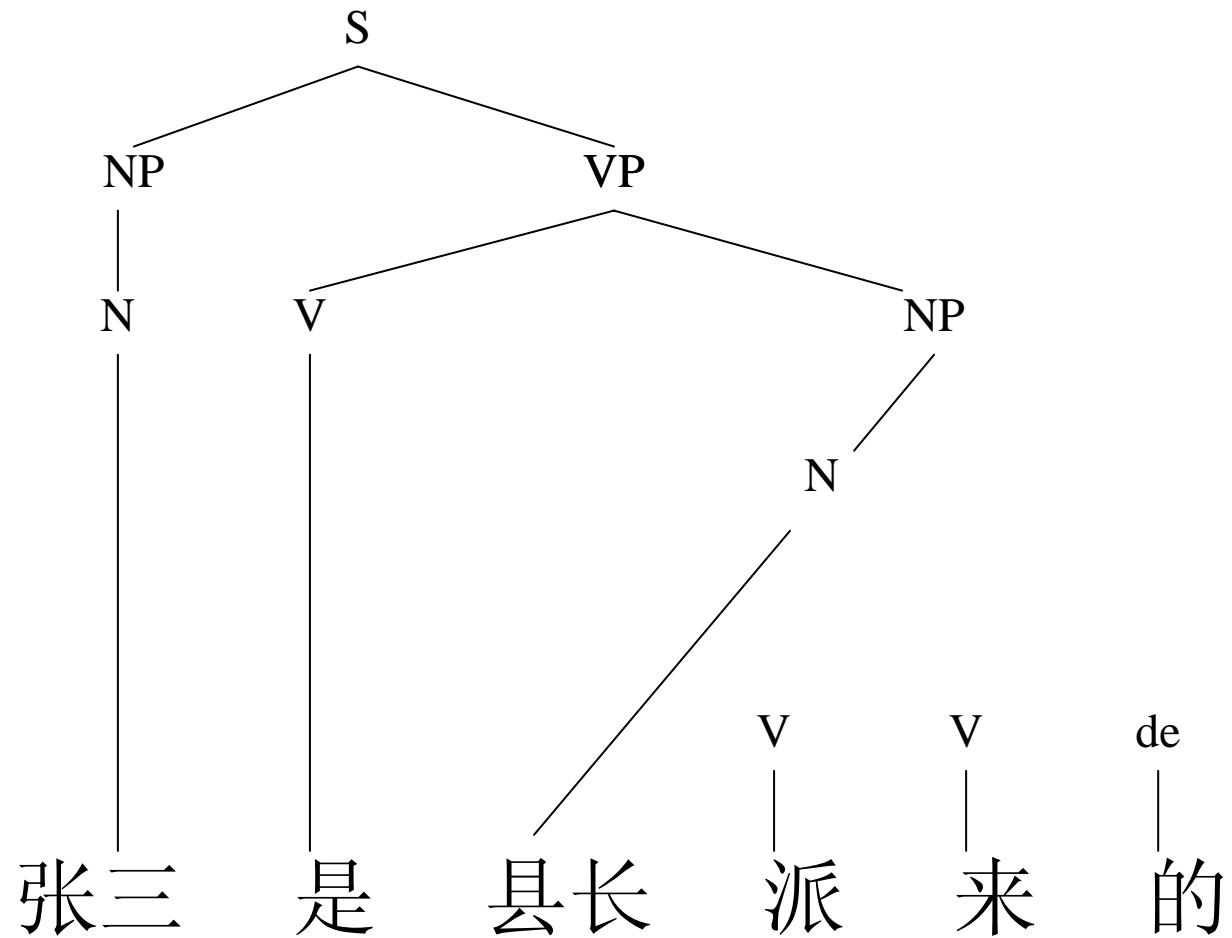
使用规则2:

$NP \rightarrow N$



# 自顶向下分析法示例-8

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

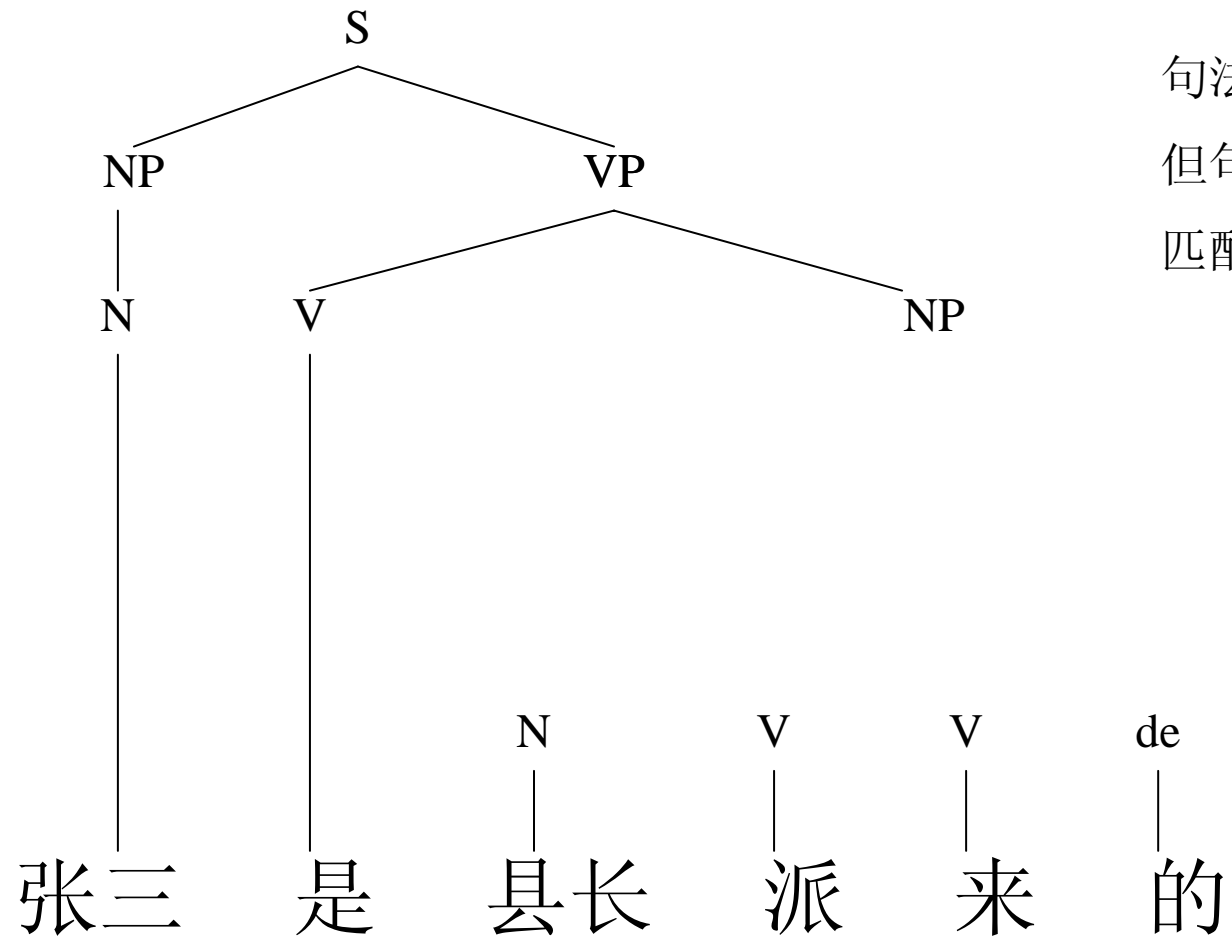


县长: N

词典匹配成功

# 自顶向下分析法示例-9

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



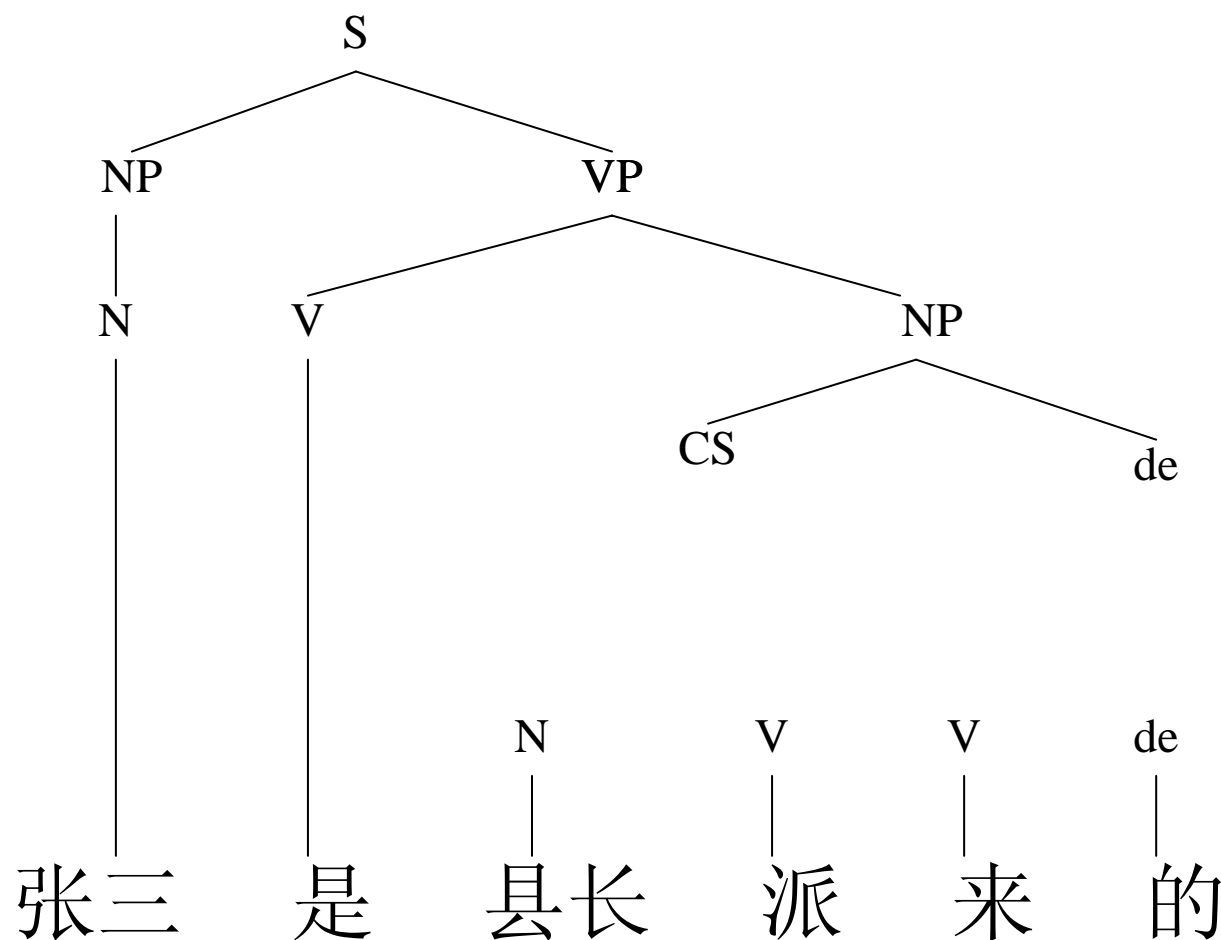
句法树扩展完毕，  
但句子没有完全  
匹配成功，回溯

# 自顶向下分析法示例-10

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则3:

$NP \rightarrow CS$  de

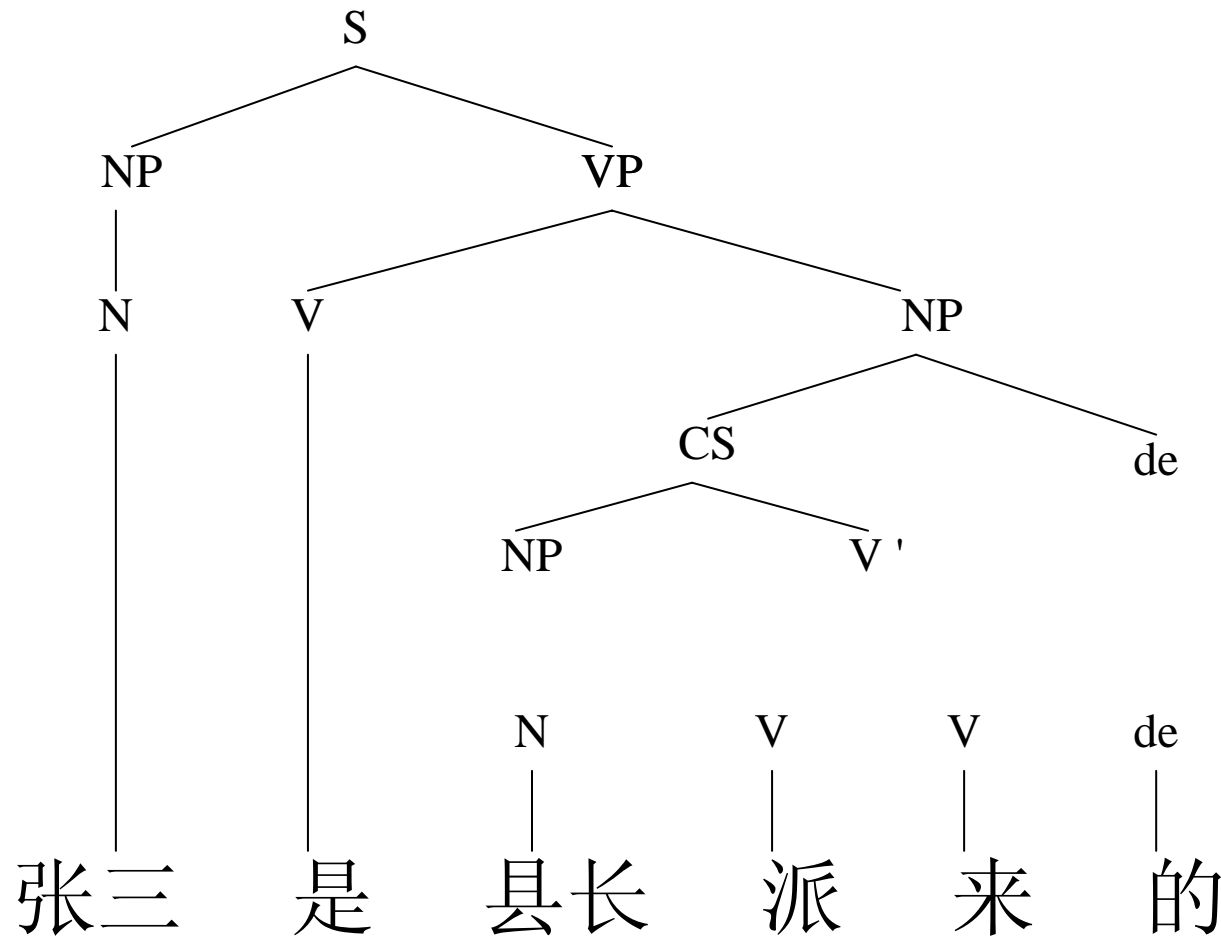


# 自顶向下分析法示例-11

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则4:

$CS \rightarrow NP V'$

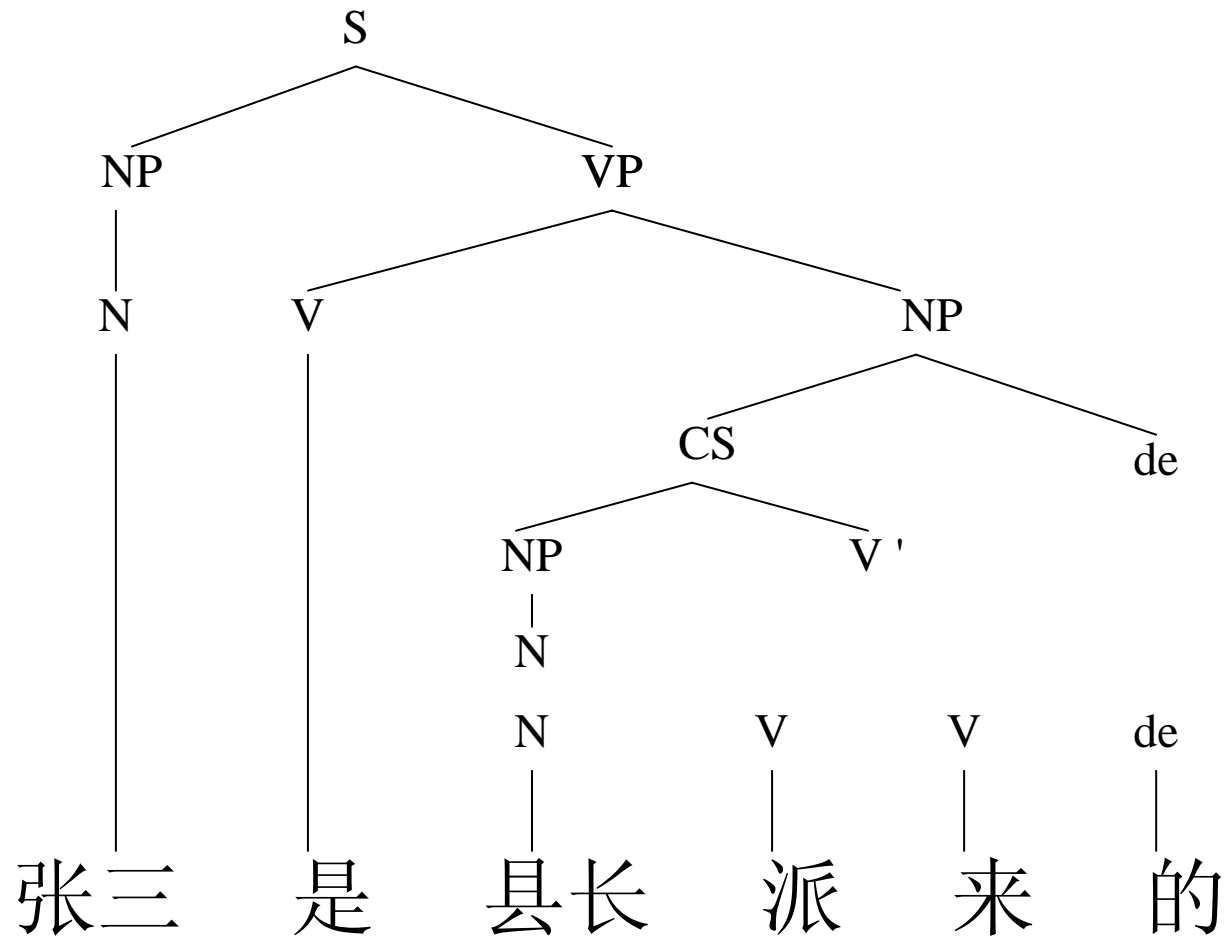


# 自顶向下分析法示例-12

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

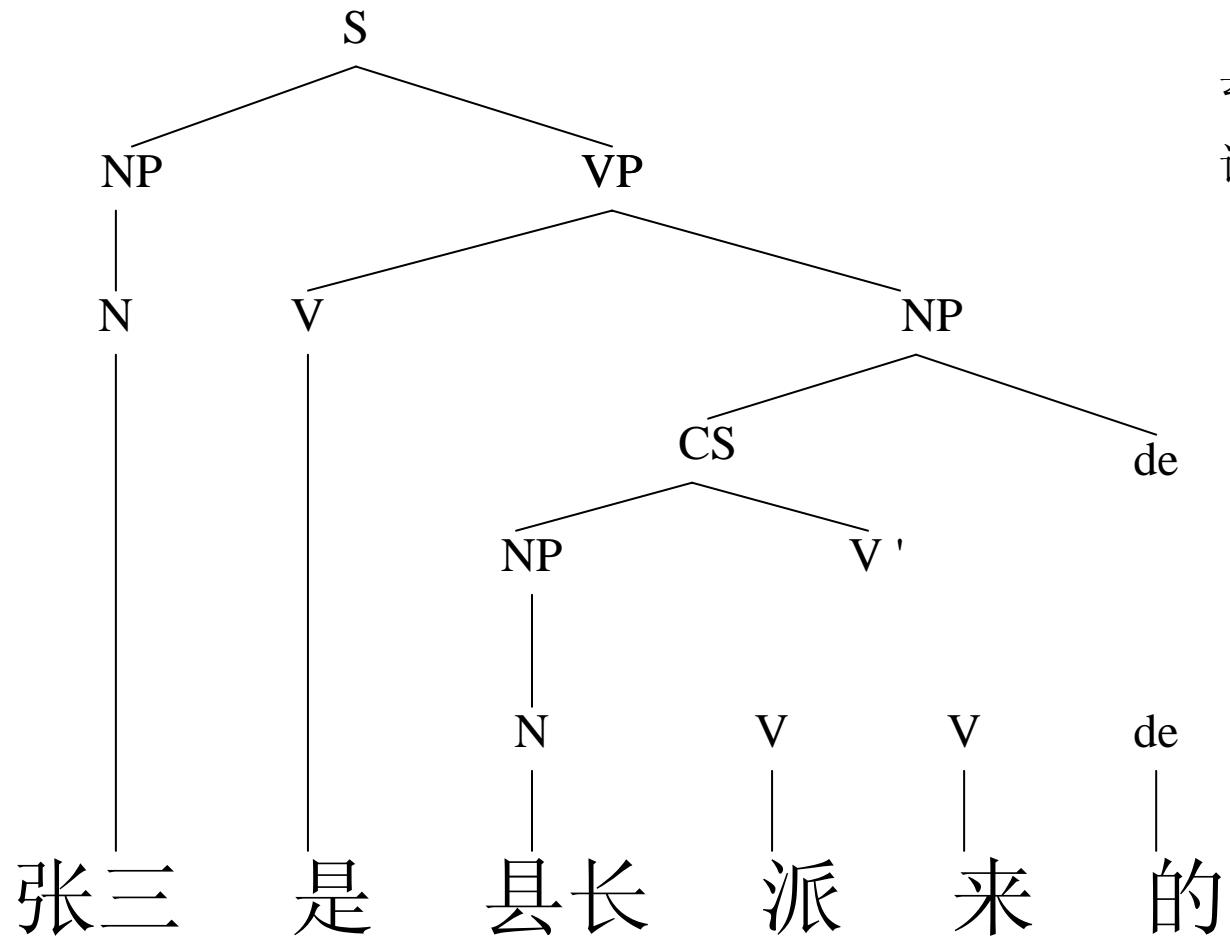
使用规则2:

$NP \rightarrow N$



# 自顶向下分析法示例-13

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

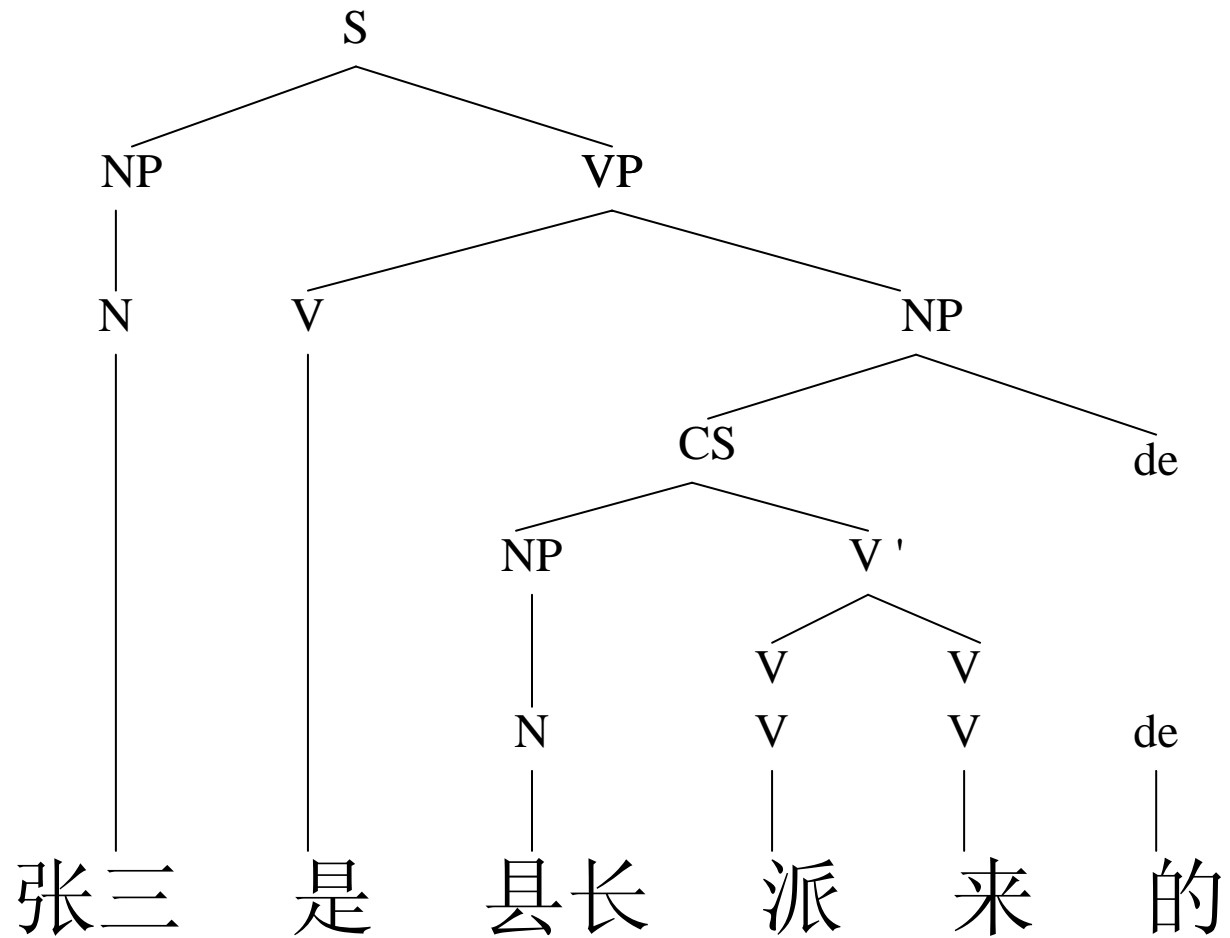


县长: N

词典匹配成功

# 自顶向下分析法示例-14

- (1)  $S \rightarrow NP \ VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS \ 的$
- (4)  $CS \rightarrow NP \ V'$
- (5)  $VP \rightarrow V \ NP$
- (6)  $V' \rightarrow V \ V$



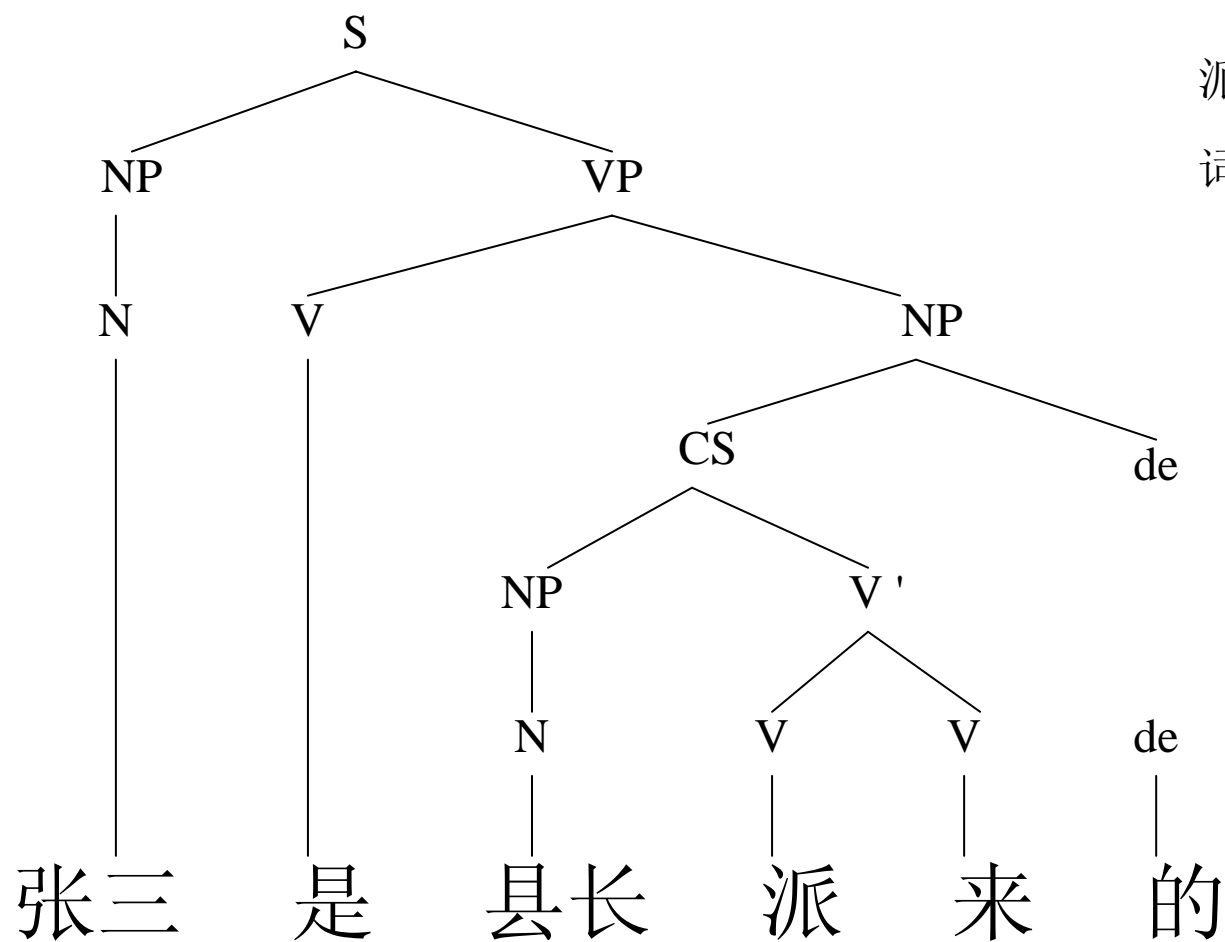
使用规则6:

$V' \rightarrow V \ V$



# 自顶向下分析法示例-15

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



派: V 来: V

词典匹配成功

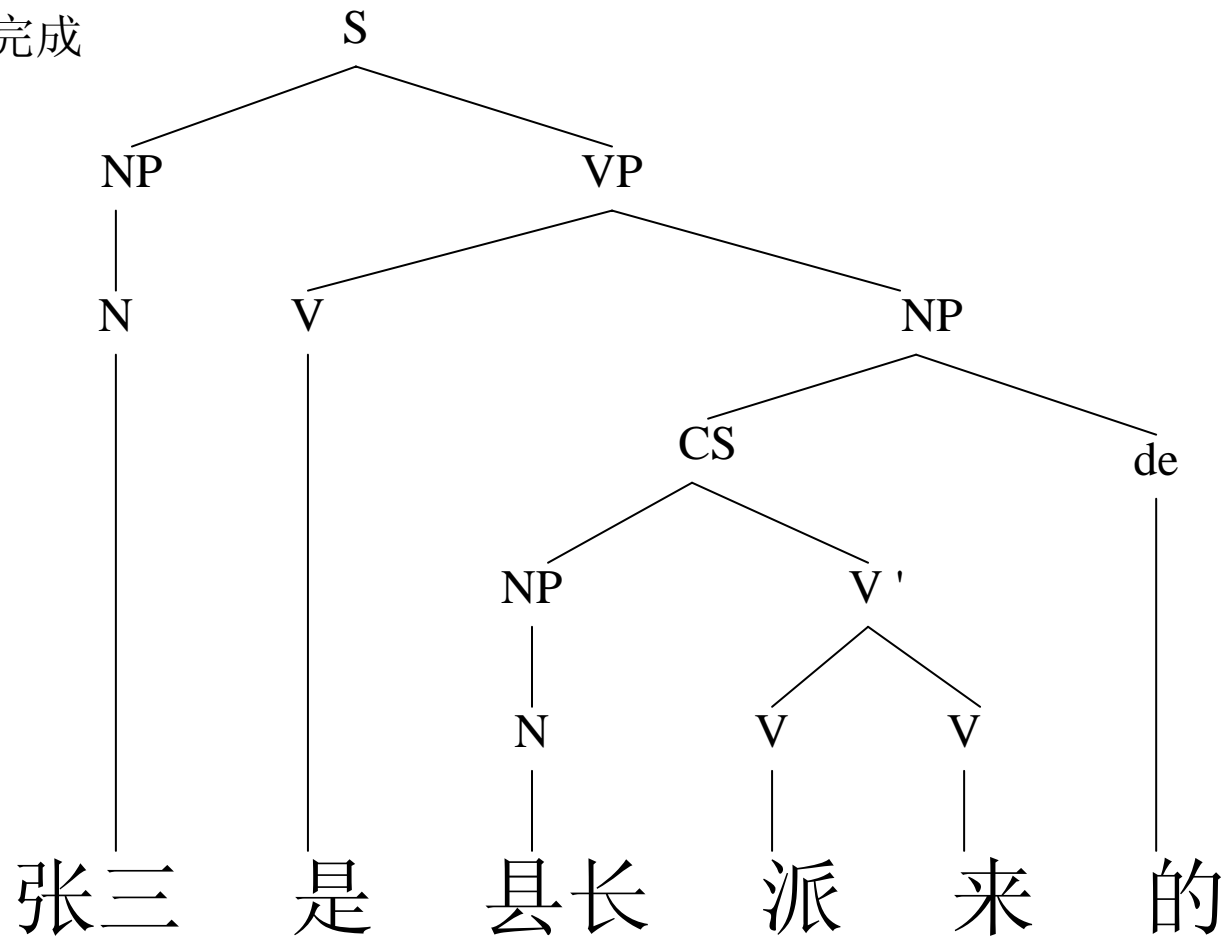
# 自顶向下分析法示例-16

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

句法树扩展完毕

恰好句子匹配完成

分析成功



的: de

词典匹配成功

# 自底向上分析法示例-1

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

查词典

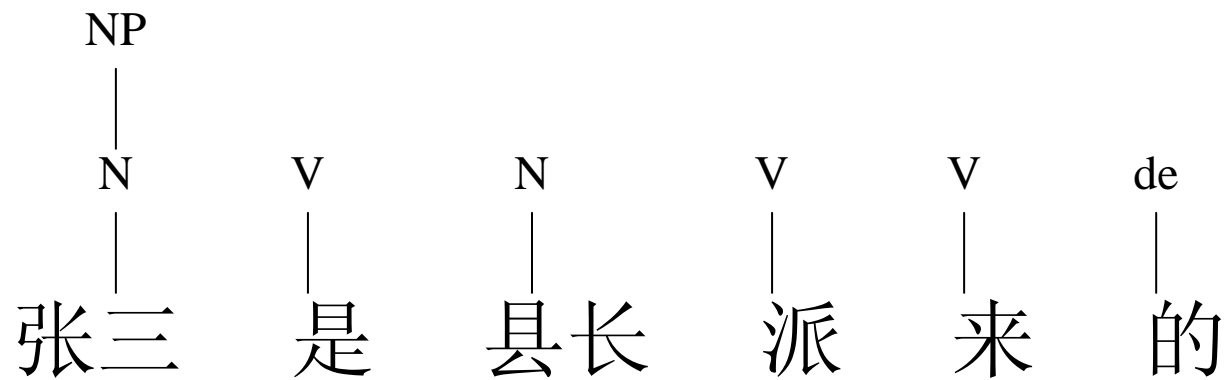
N          V          N          V          V          de  
|          |          |          |          |          |  
张三      是      县长      派      来      的

# 自底向上分析法示例-2

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则2:

$NP \rightarrow N$

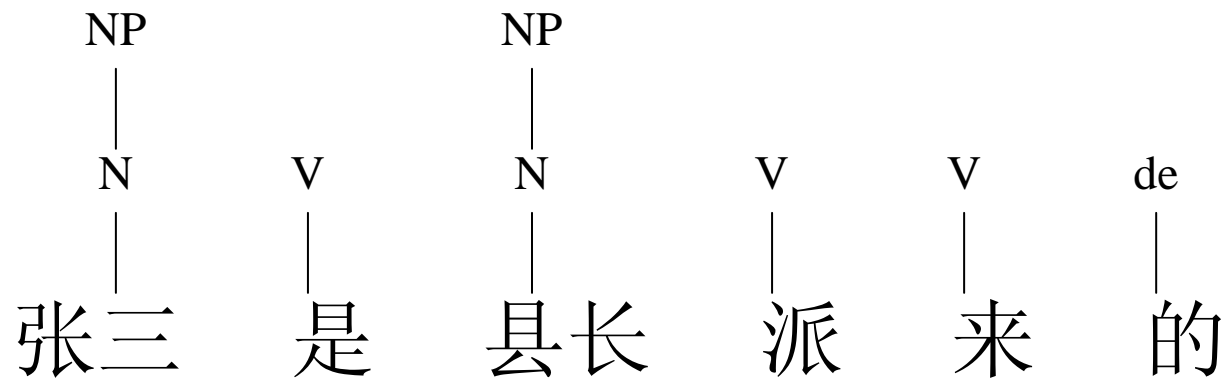


# 自底向上分析法示例-3

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则2:

$NP \rightarrow N$

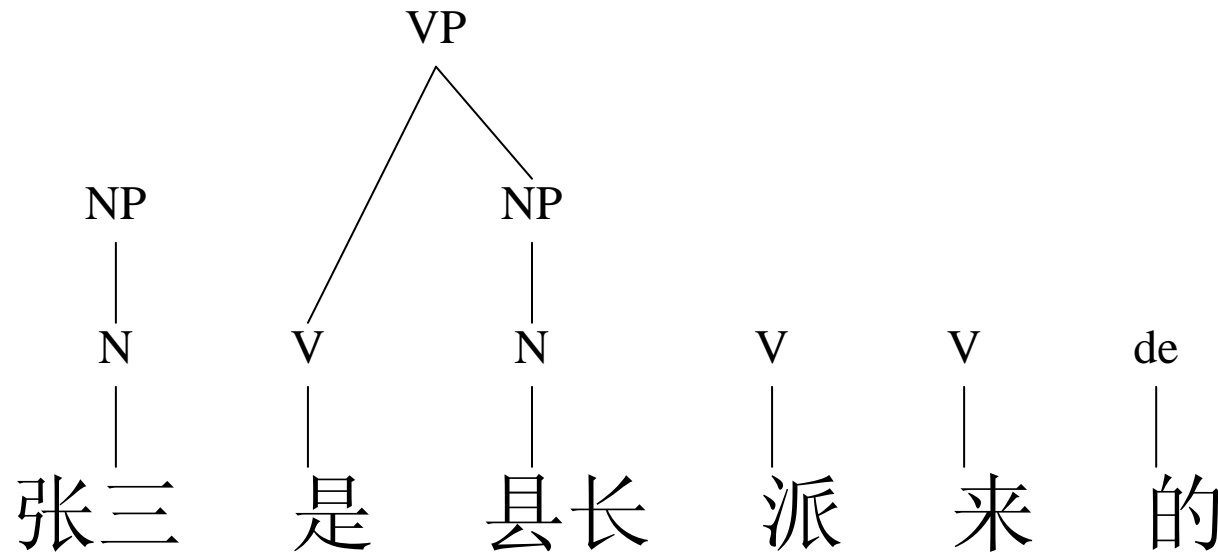


# 自底向上分析法示例-4

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则5:

$VP \rightarrow V NP$

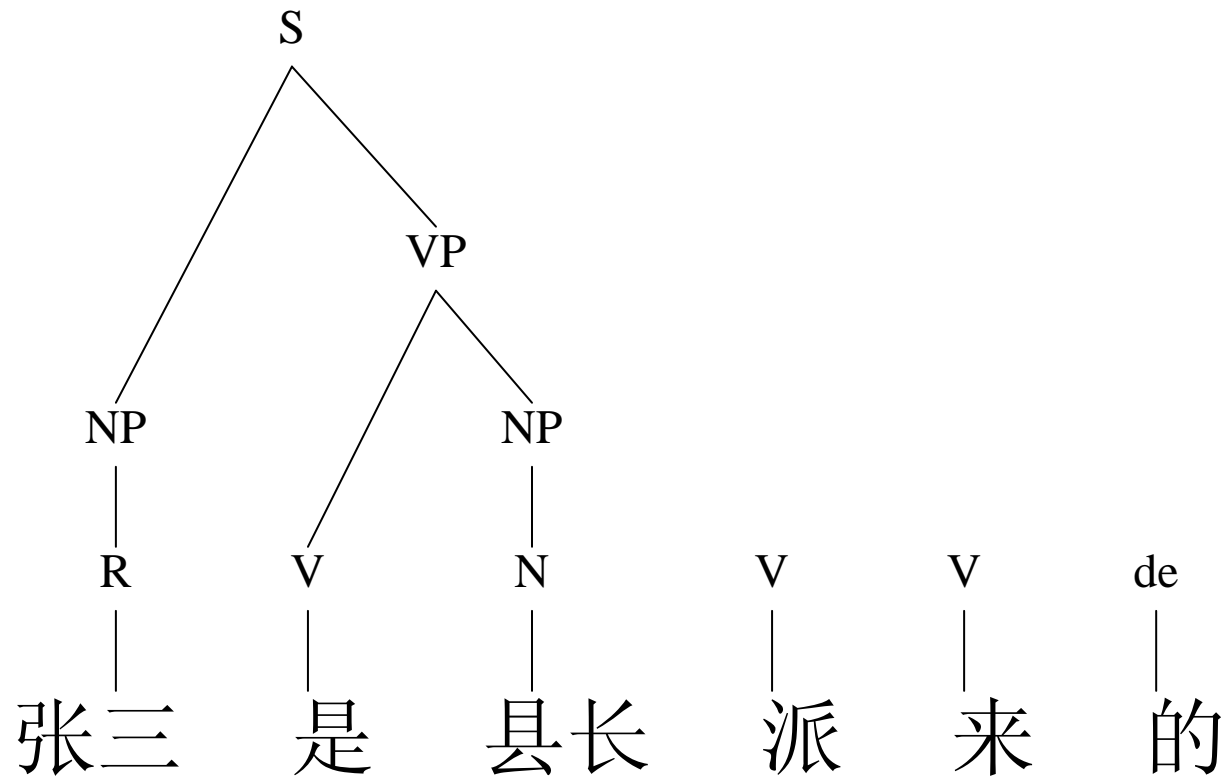


# 自底向上分析法示例-5

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则1:

$S \rightarrow NP VP$

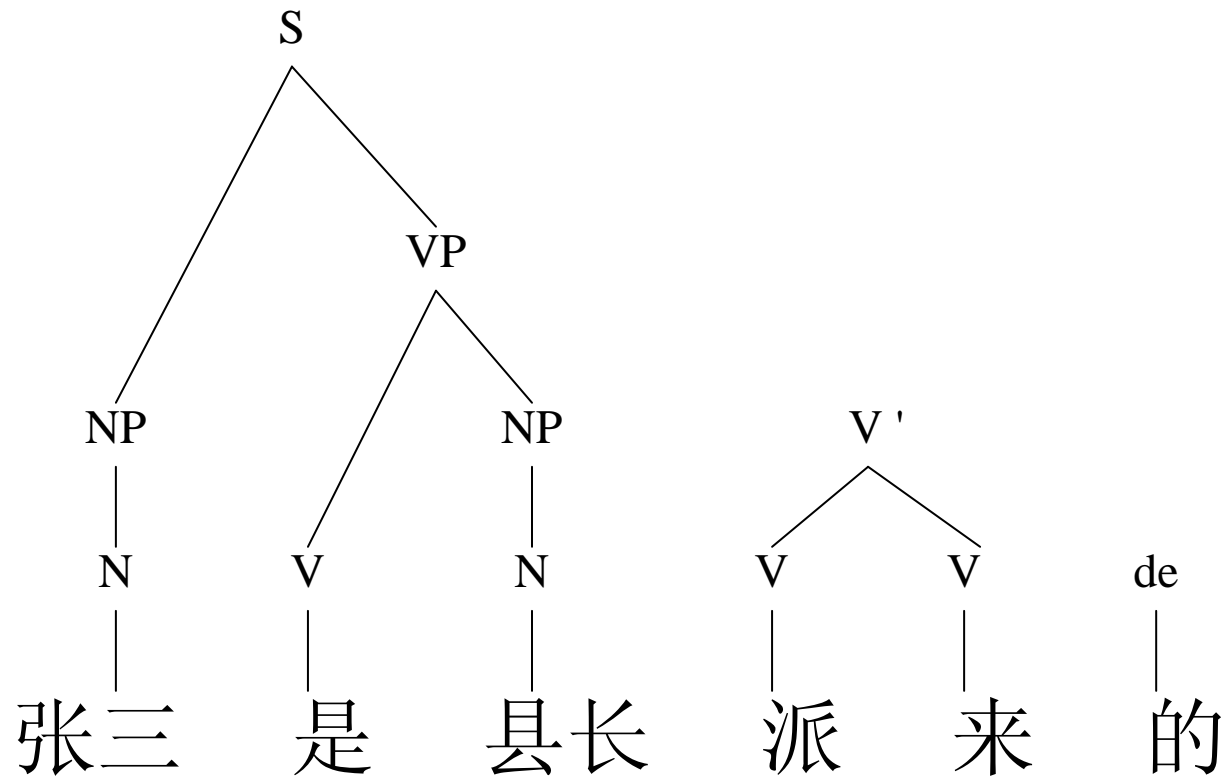


# 自底向上分析法示例-6

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则6:

$V' \rightarrow V V$



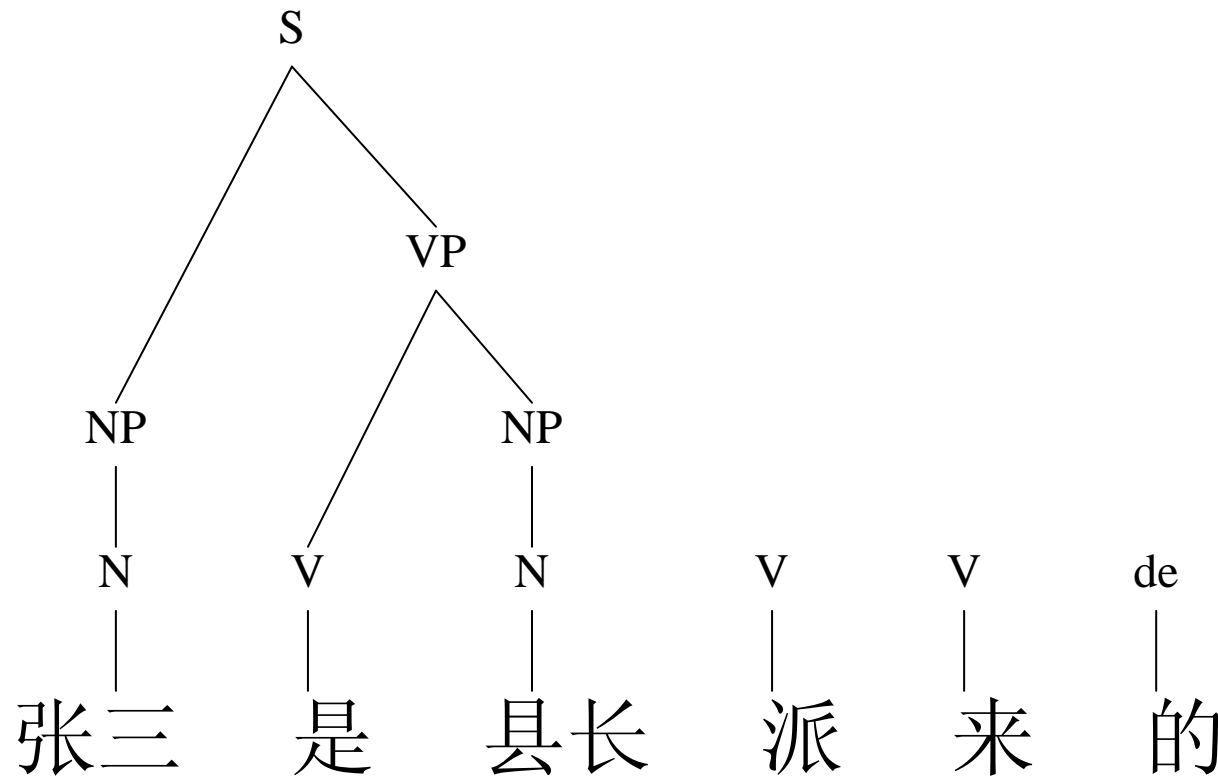


# 自底向上分析法示例-7

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

无规则可用

回溯

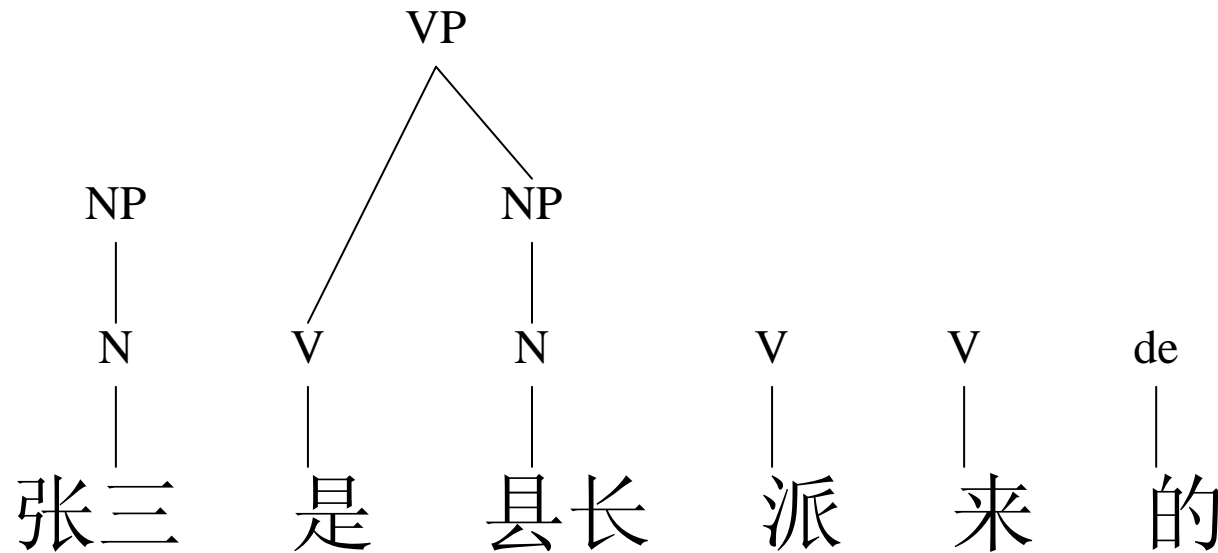


# 自底向上分析法示例-8

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

无规则可用

回溯

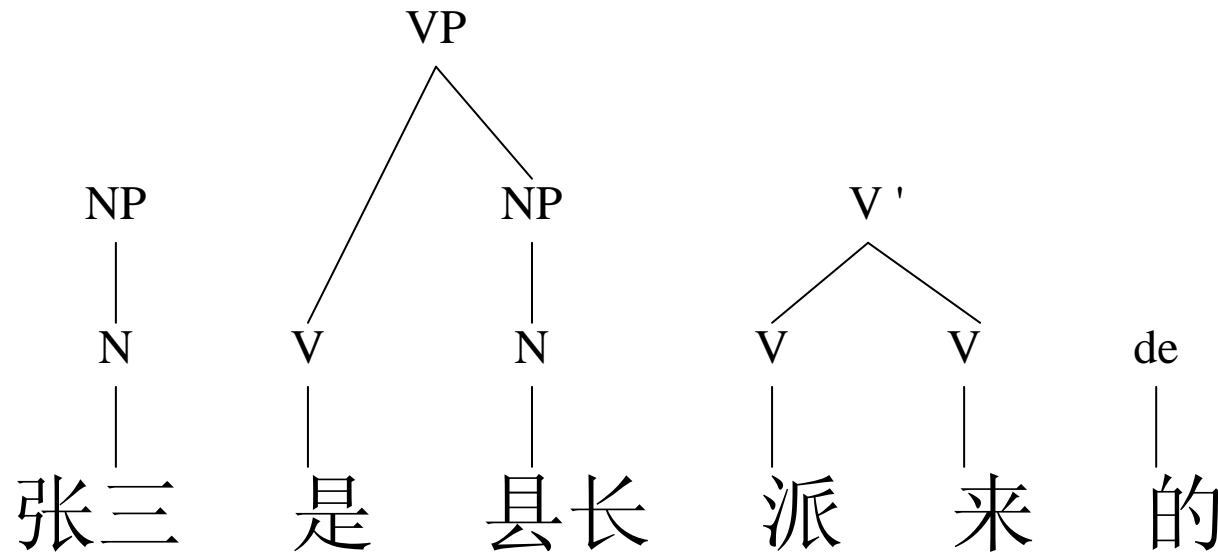


# 自底向上分析法示例-9

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则6:

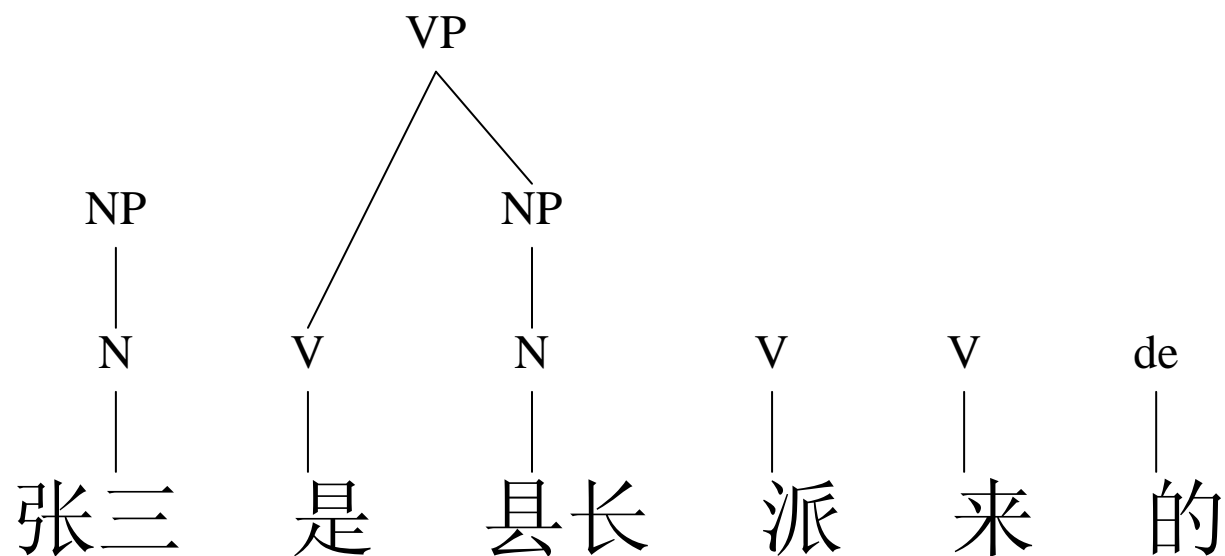
$V' \rightarrow V V$



# 自底向上分析法示例-10

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

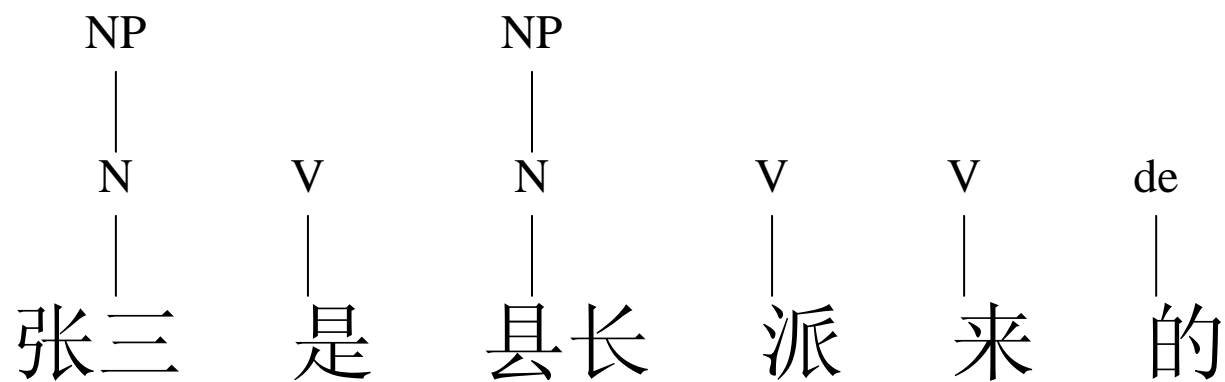
无规则可用，  
回溯



# 自底向上分析法示例-11

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

无规则可用，  
回溯

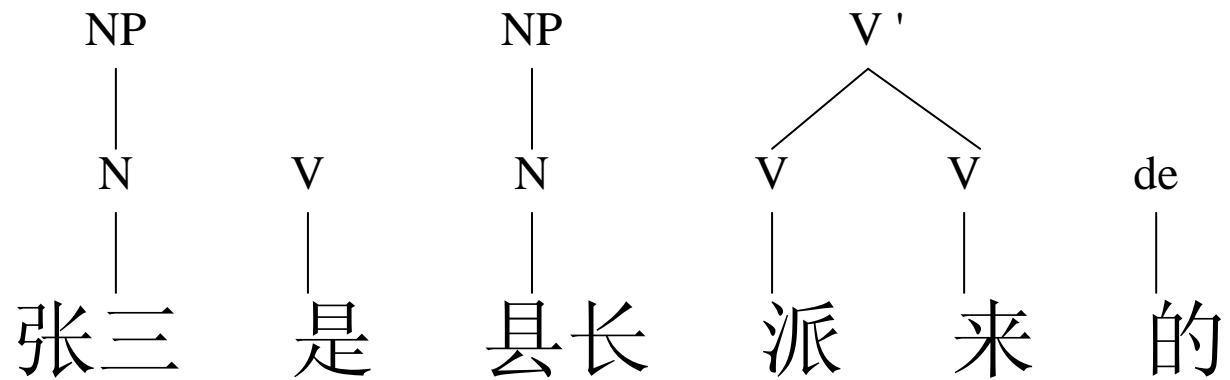


# 自底向上分析法示例-12

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则6:

$V' \rightarrow V V$

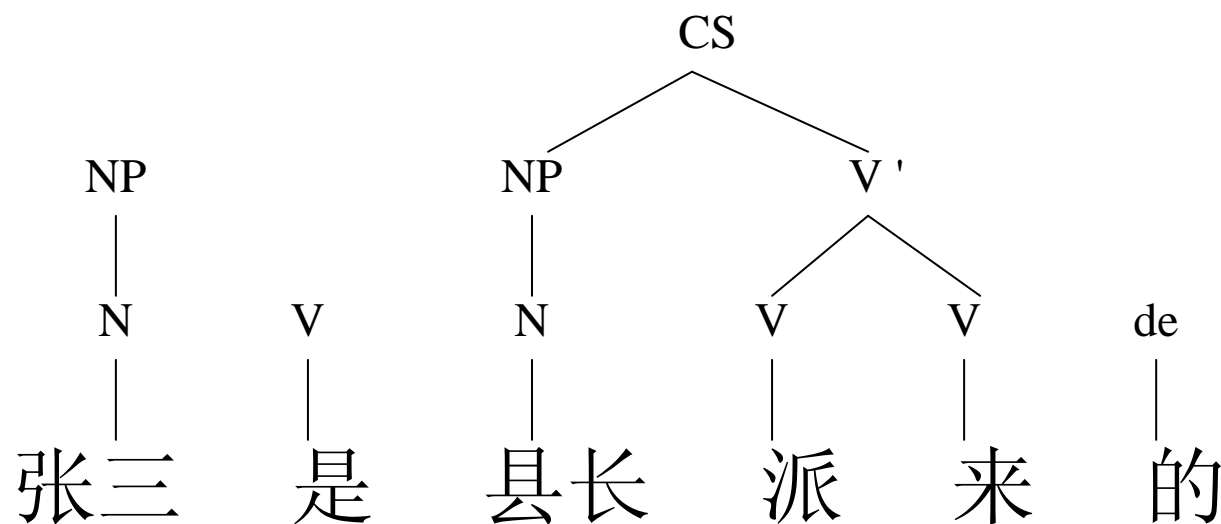


# 自底向上分析法示例-13

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则4:

$CS \rightarrow NP V'$

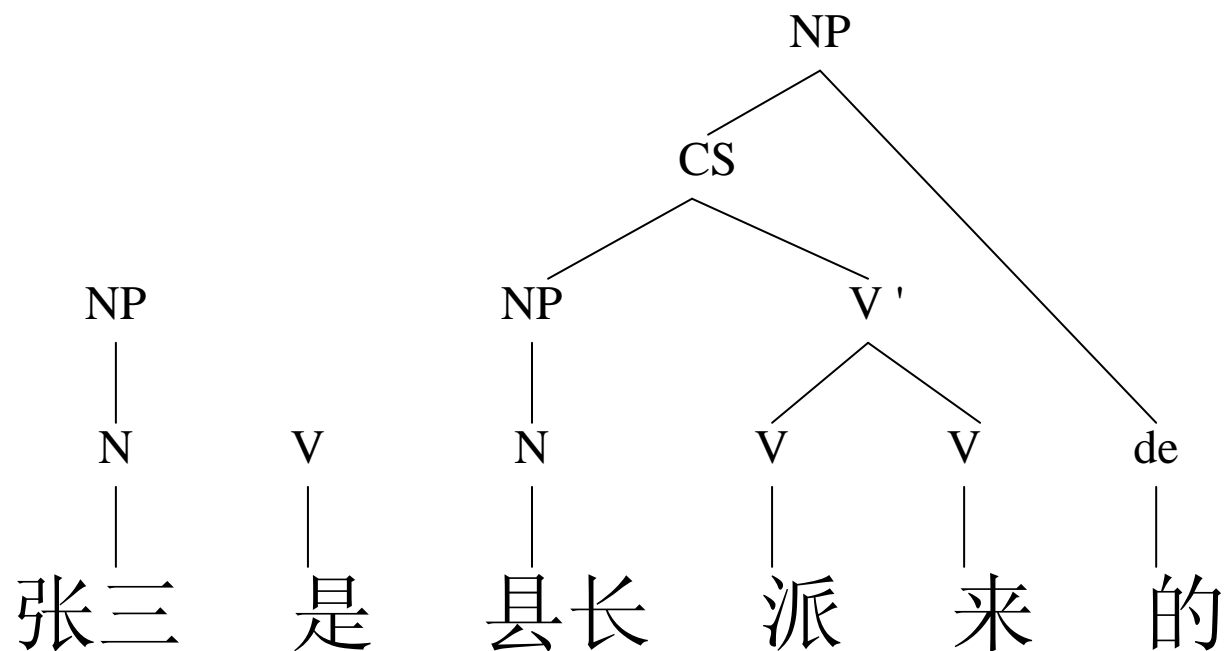


# 自底向上分析法示例-14

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则3:

$NP \rightarrow CS$  de



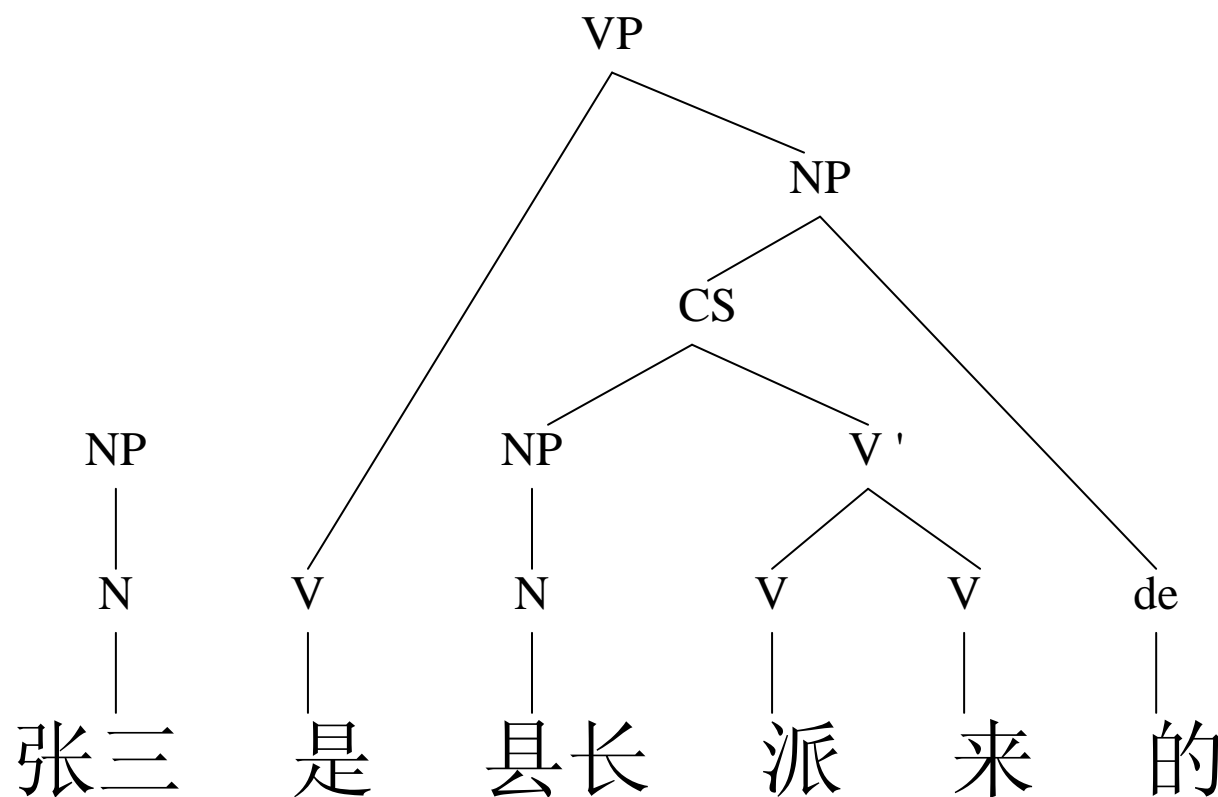


# 自底向上分析法示例-15

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

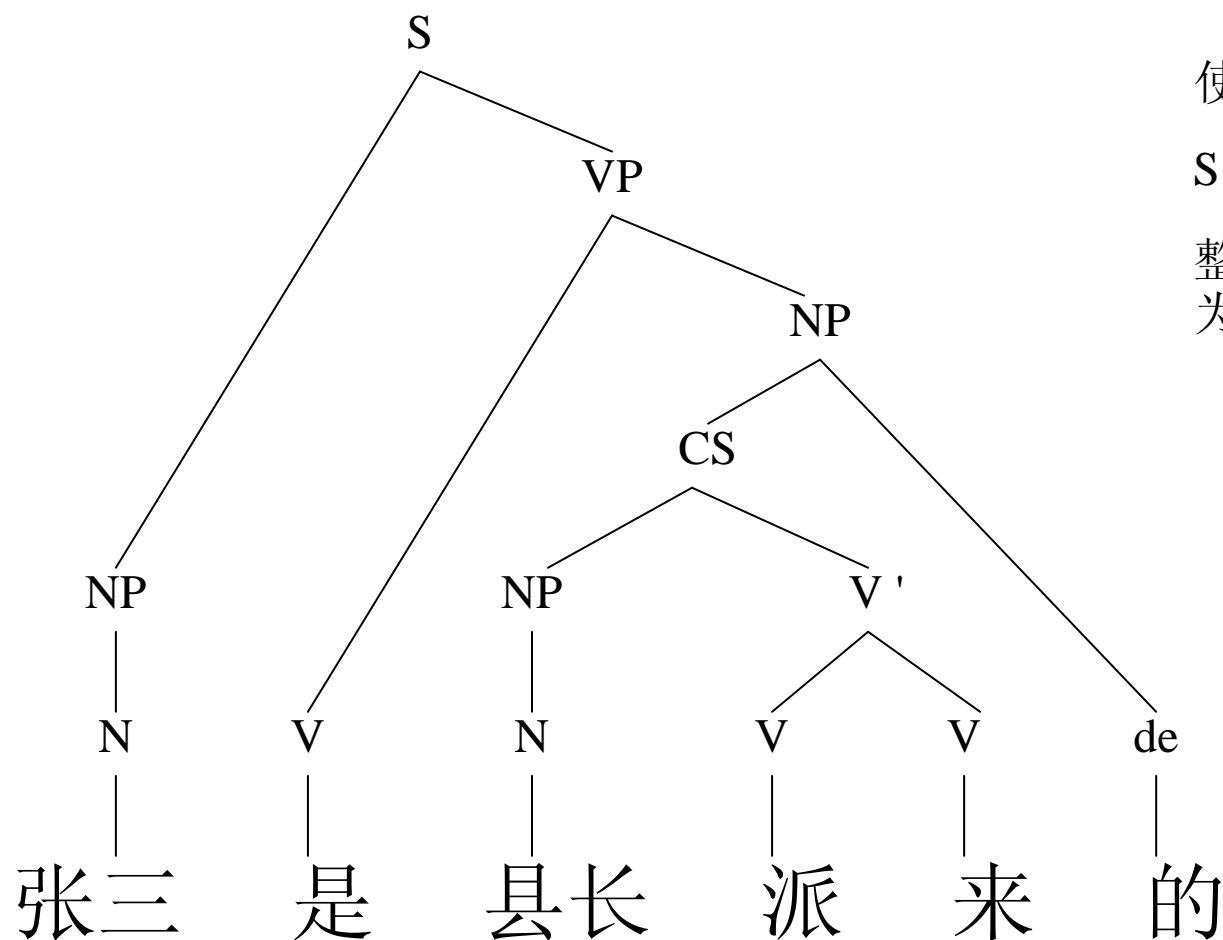
使用规则5:

$VP \rightarrow V NP$



# 自底向上分析法示例-16

- (1)  $S \rightarrow NP \ VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS \text{ 的}$
- (4)  $CS \rightarrow NP \ V'$
- (5)  $VP \rightarrow V \ NP$
- (6)  $V' \rightarrow V \ V$



使用规则1:

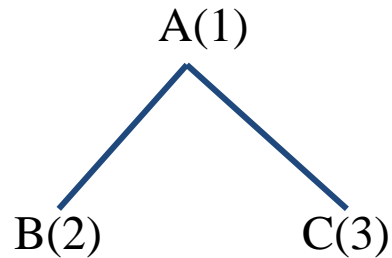
$S \rightarrow NP \ VP$

整个句子归结为S, 分析成功

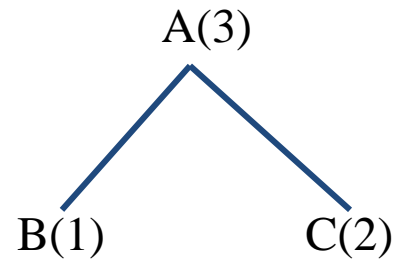
# 左角分析法—概述

- 左角分析法是一种自顶向下和自底向上相结合的方法
- “左角(Left Corner)”是指一个句法树中左下角的那个符号

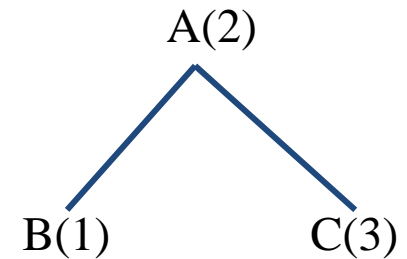
自顶向下分析法



自底向上分析法



左角分析法



# 左角分析法示例-1

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

查词典

N            V            N            V            V            de  
|            |            |            |            |            |  
张三        是        县长        派        来        的

## 左角分析法示例-2

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则:

$NP \rightarrow N$

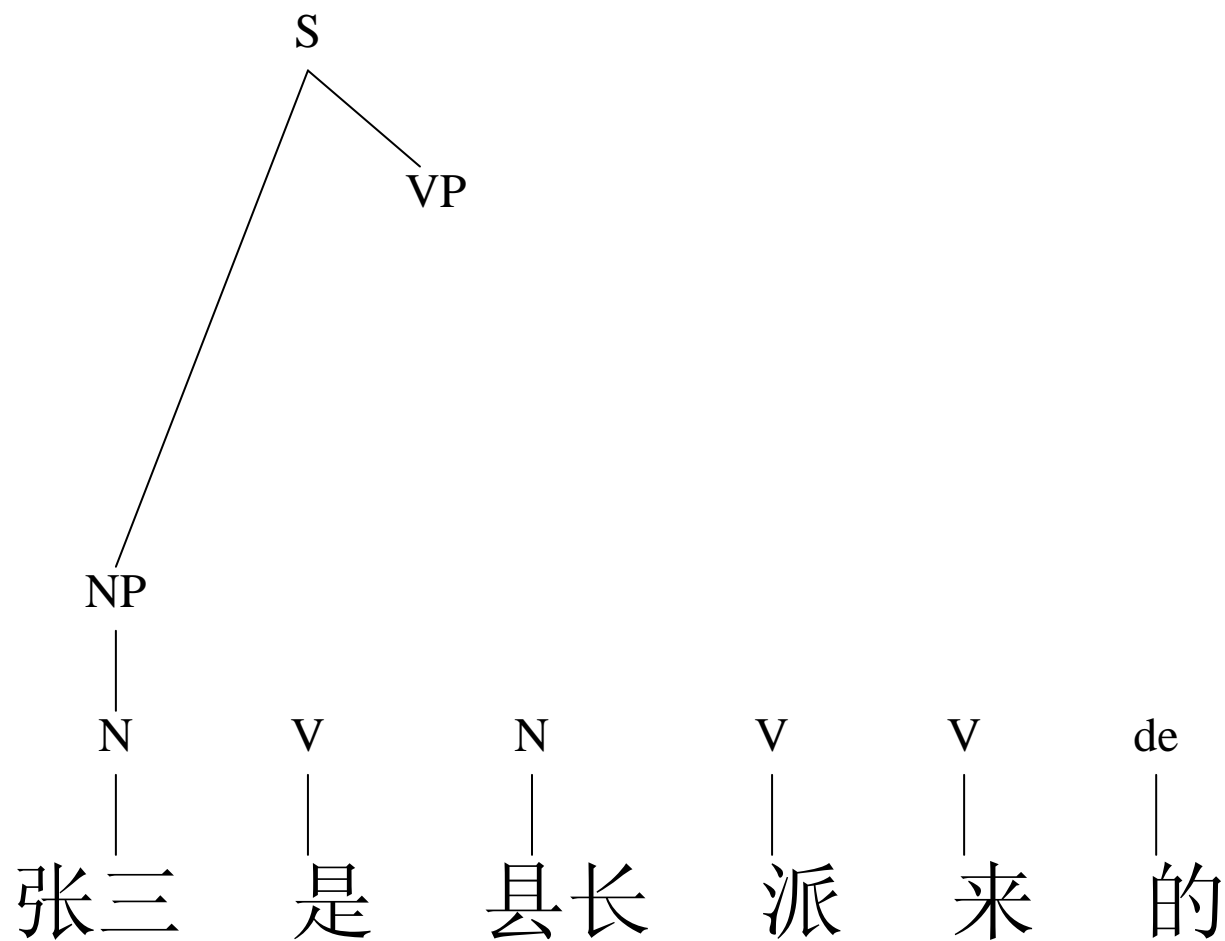


# 左角分析法示例-3

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则:

$S \rightarrow NP VP$

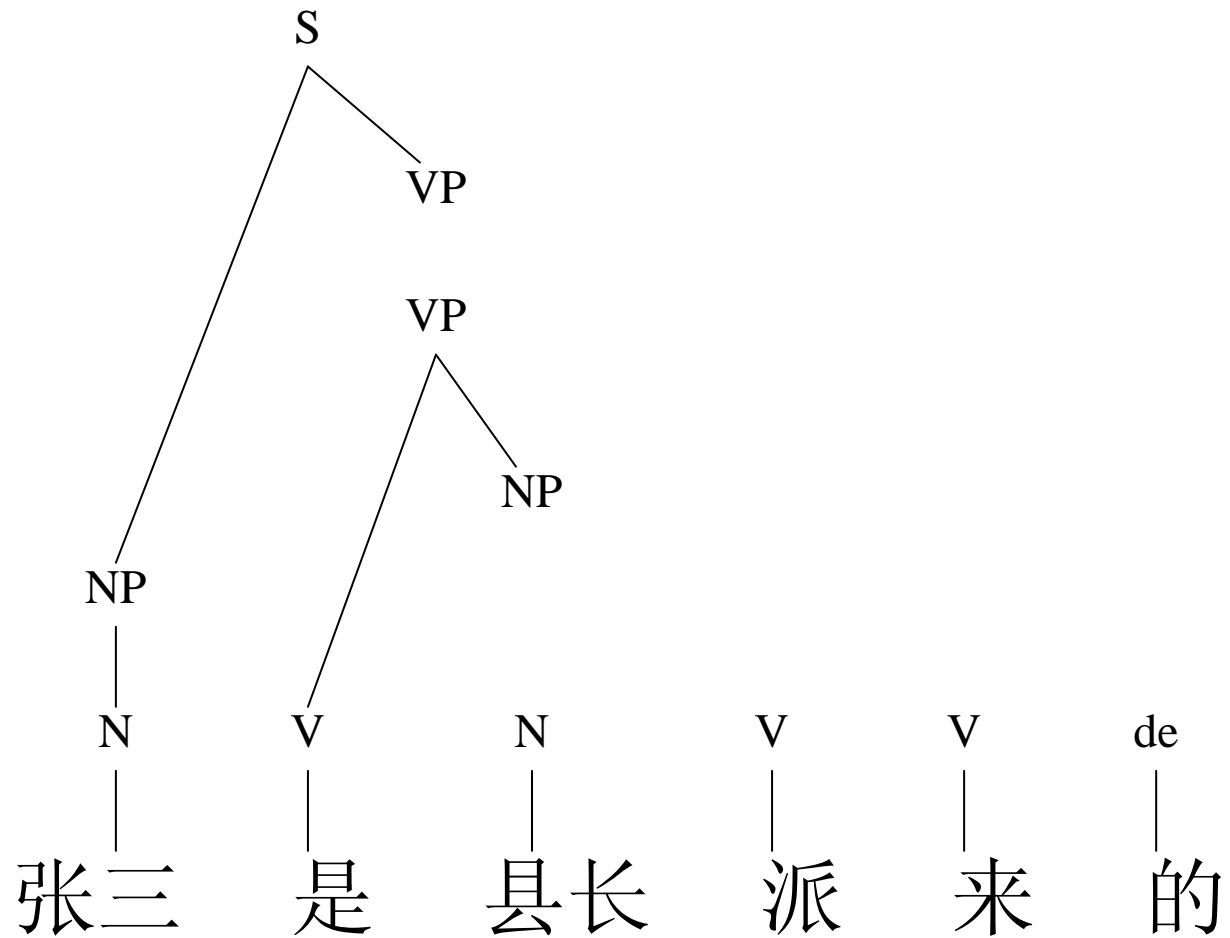


# 左角分析法示例-4

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则:

$VP \rightarrow V NP$

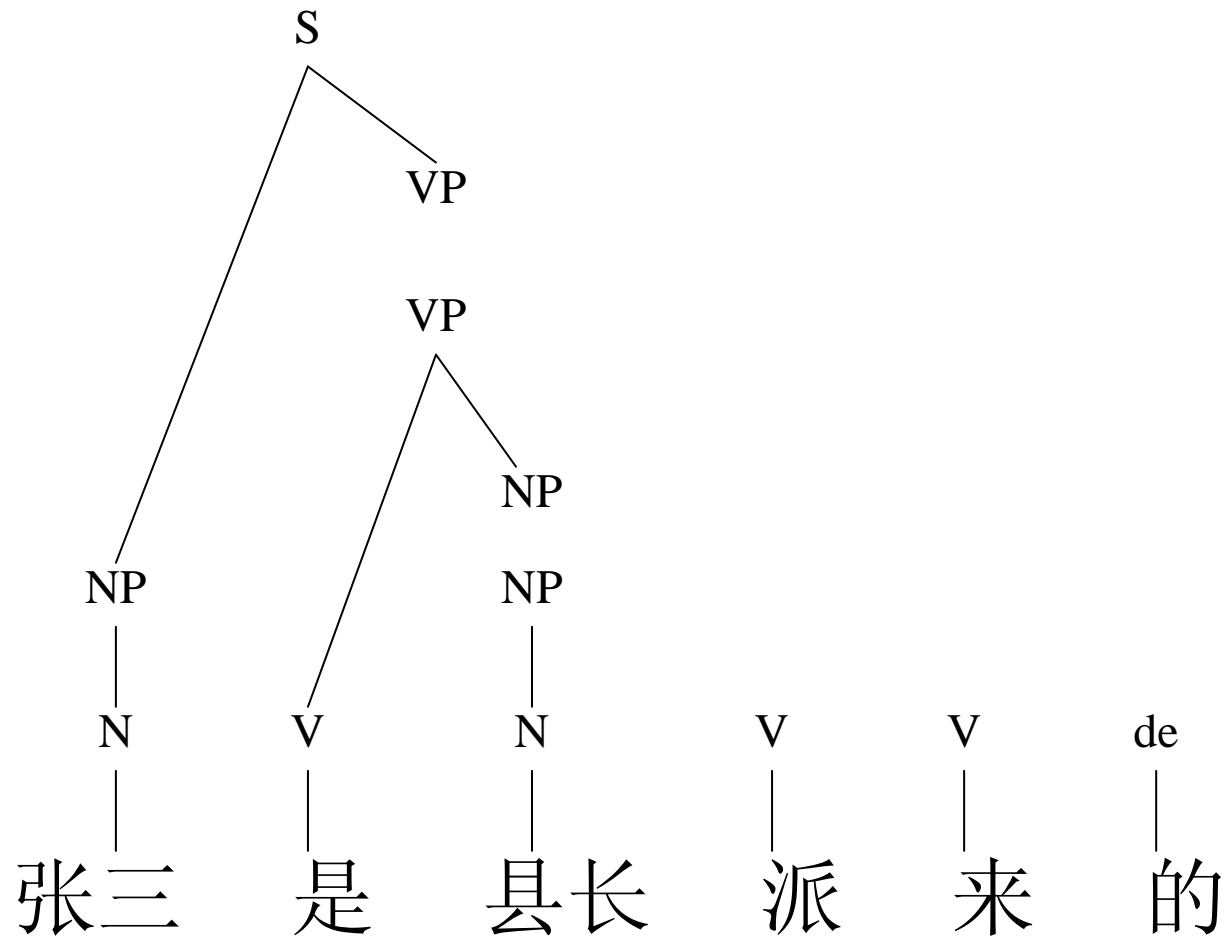


# 左角分析法示例-5

- (1)  $S \rightarrow NP \ VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS \text{ 的}$
- (4)  $CS \rightarrow NP \ V'$
- (5)  $VP \rightarrow V \ NP$
- (6)  $V' \rightarrow V \ V$

使用规则:

$NP \rightarrow N$

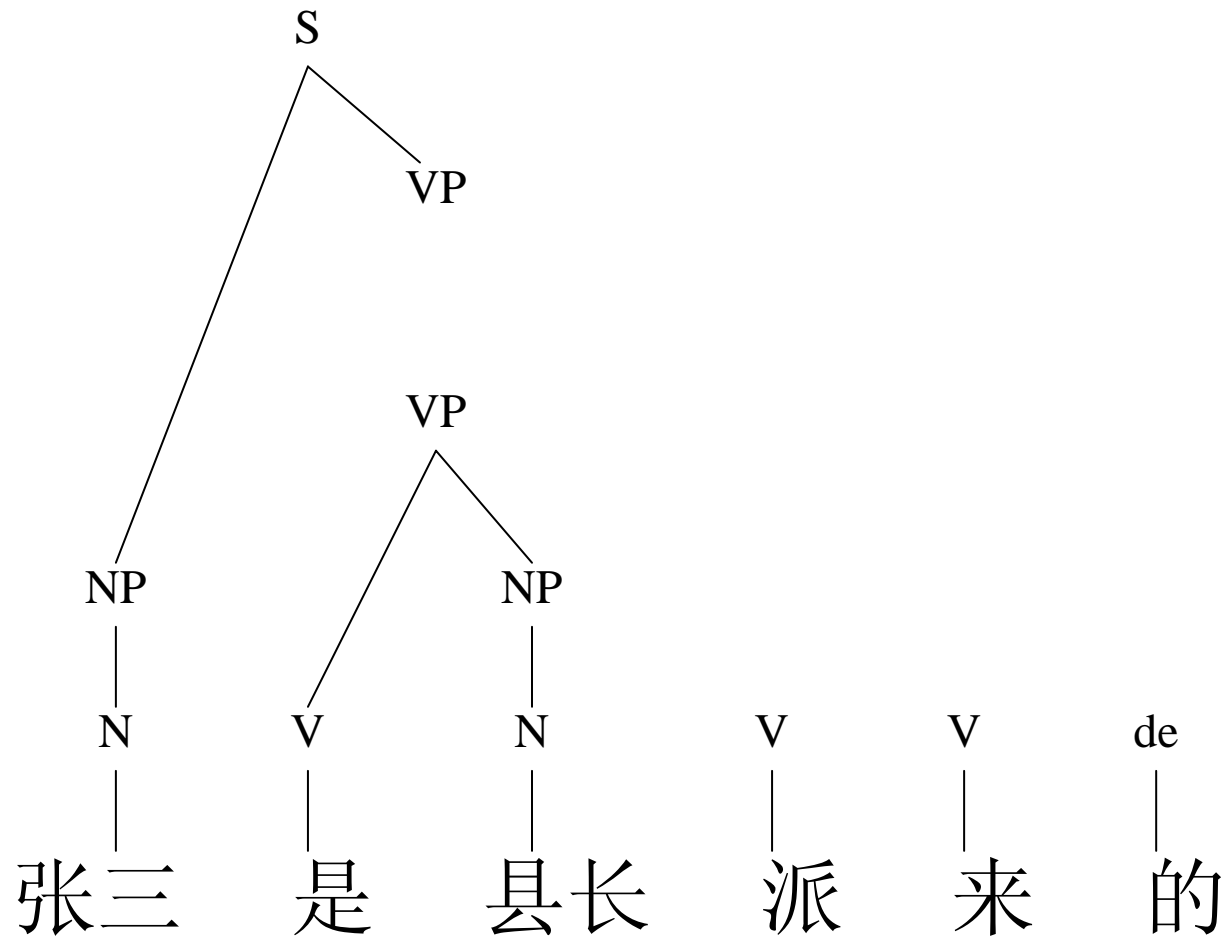




# 左角分析法示例-6

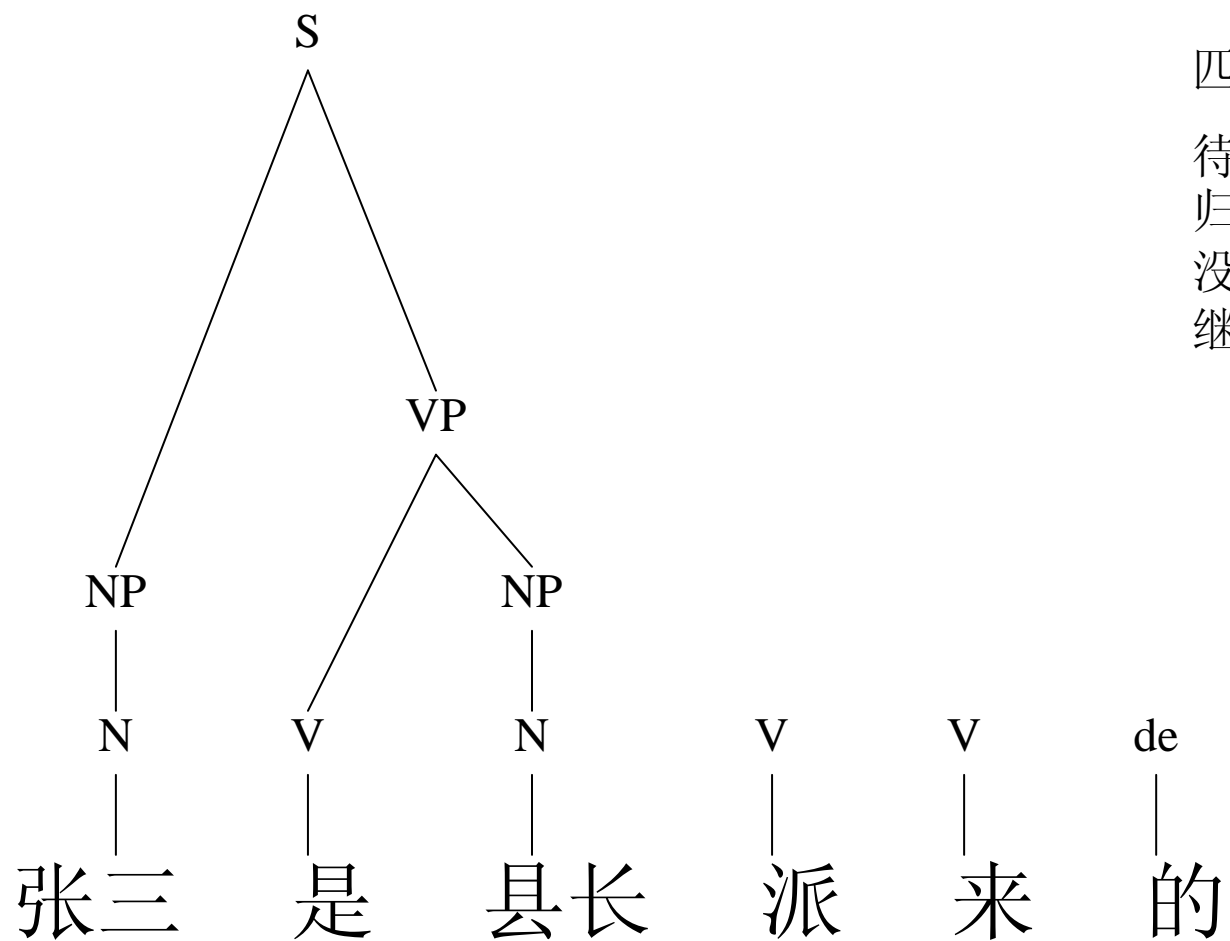
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

匹配成功



# 左角分析法示例-7

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



匹配成功

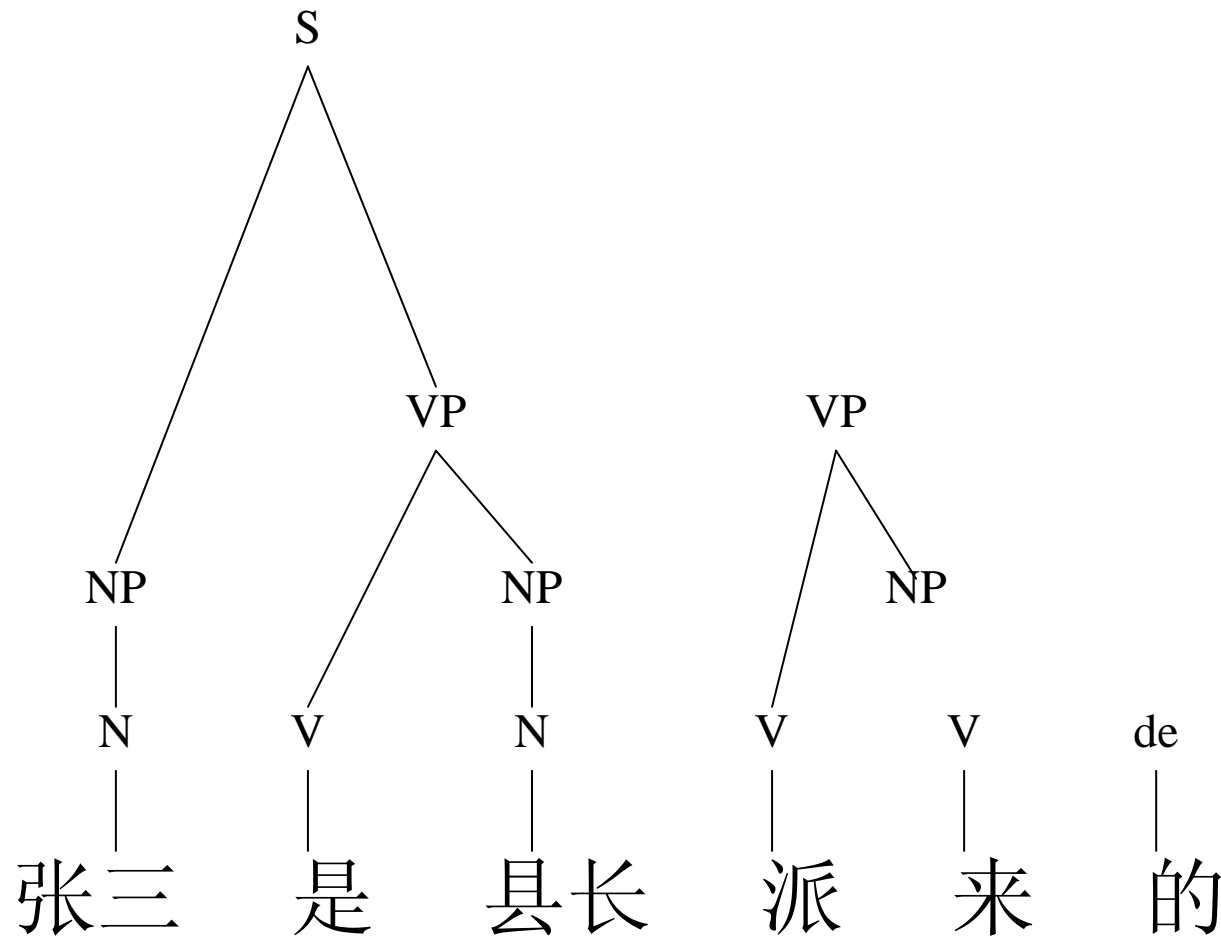
待分析字符串  
归结为S，但  
没有分析完，  
继续扫描

# 左角分析法示例-8

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则:

$VP \rightarrow V NP$

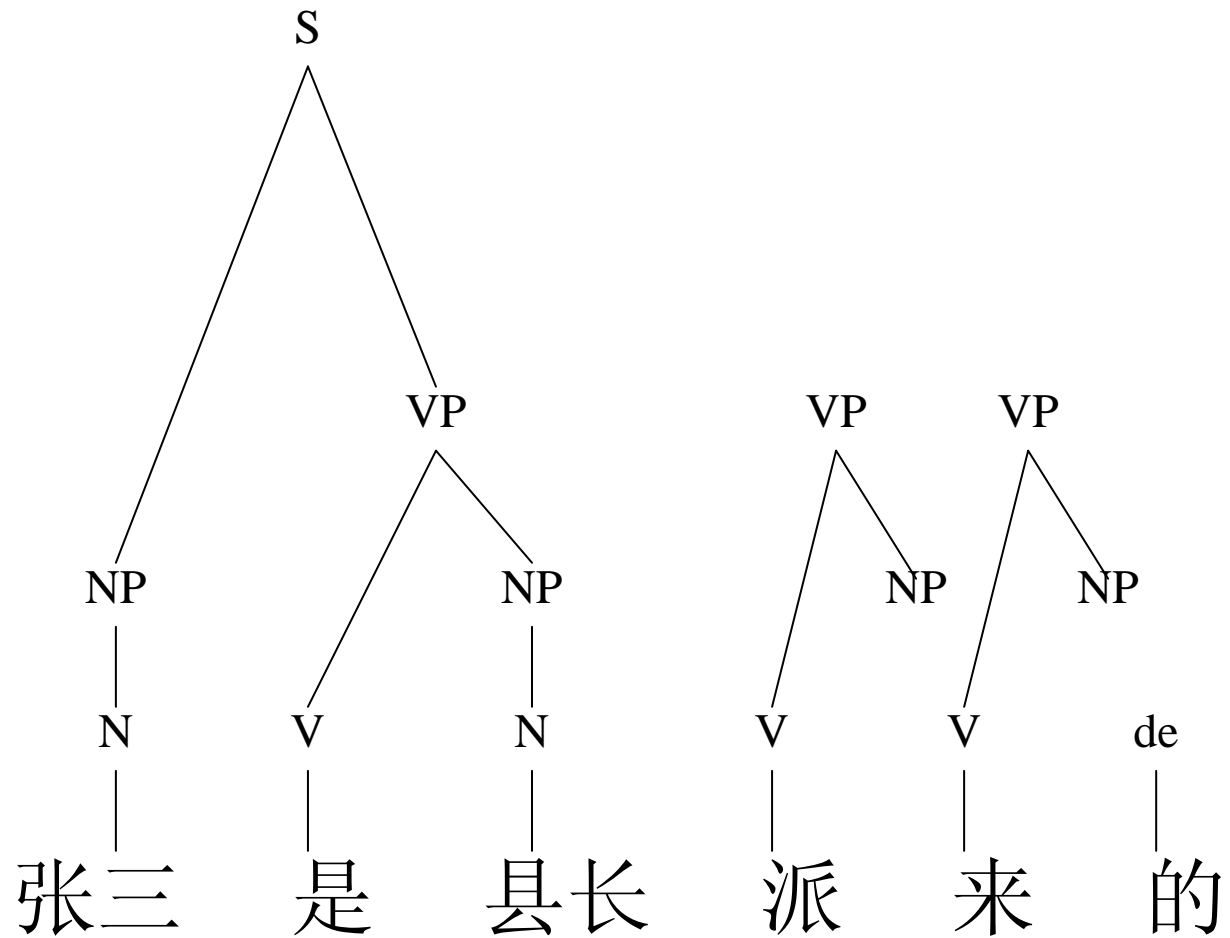


# 左角分析法示例-9

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则:

$VP \rightarrow V NP$

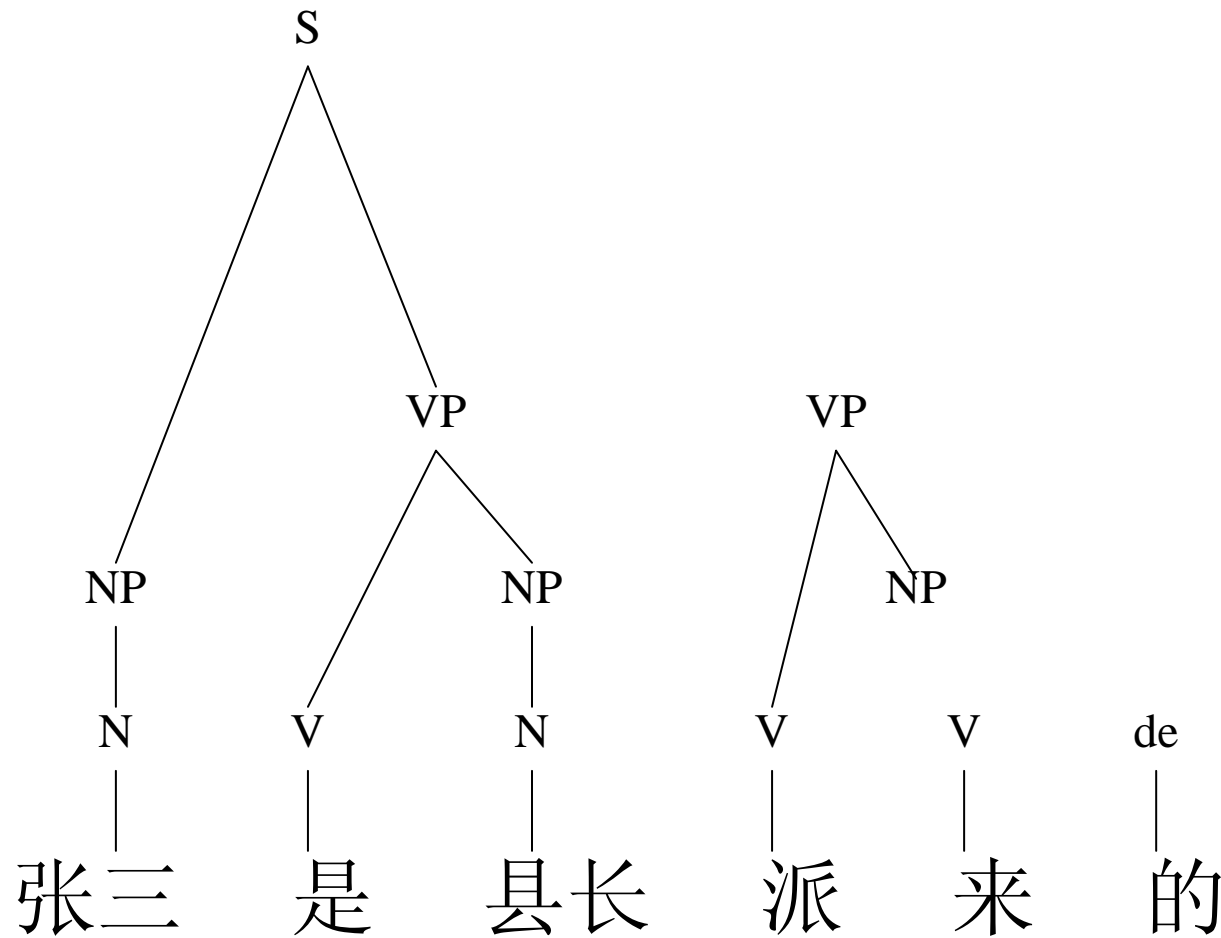


# 左角分析法示例-10

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

无规则可用

回溯

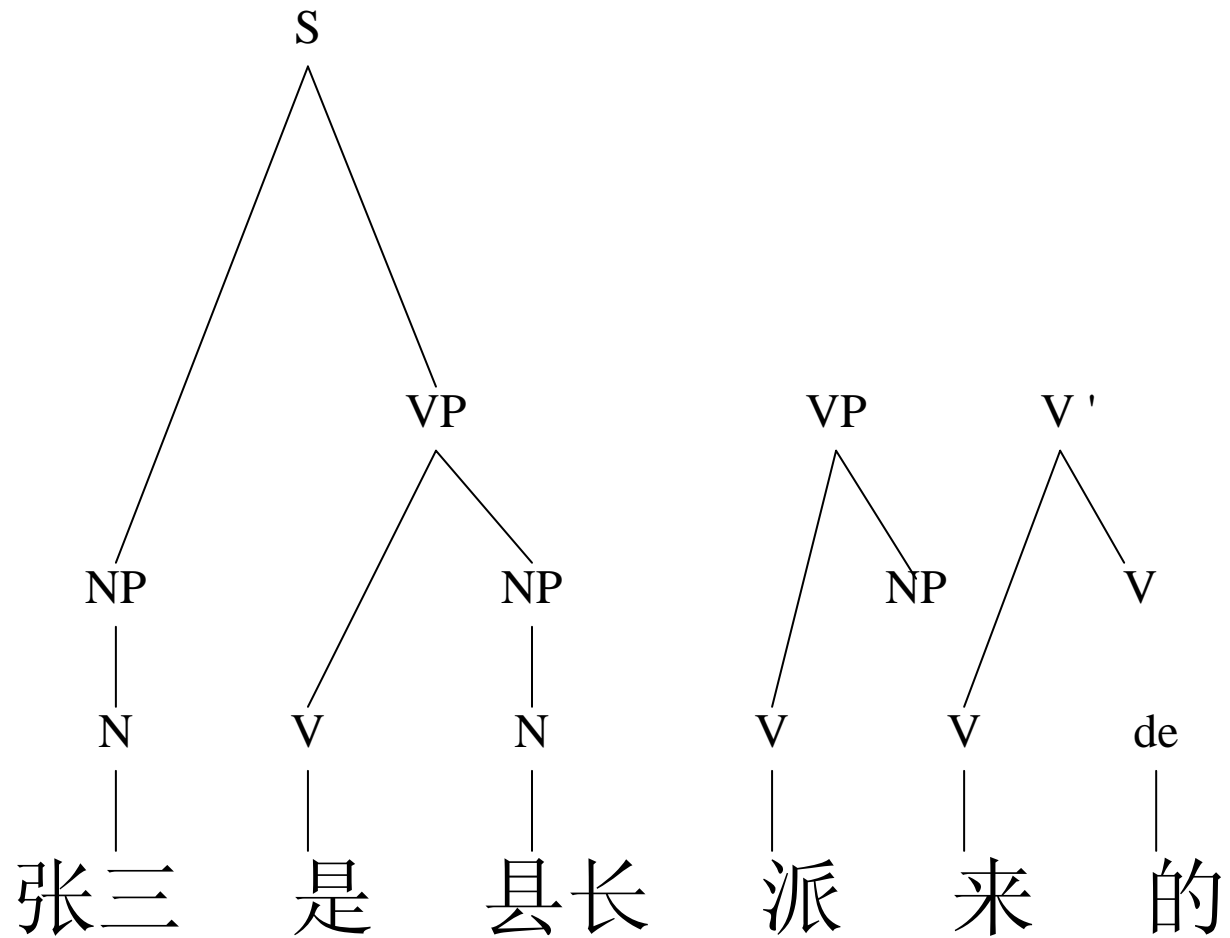


# 左角分析法示例-11

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

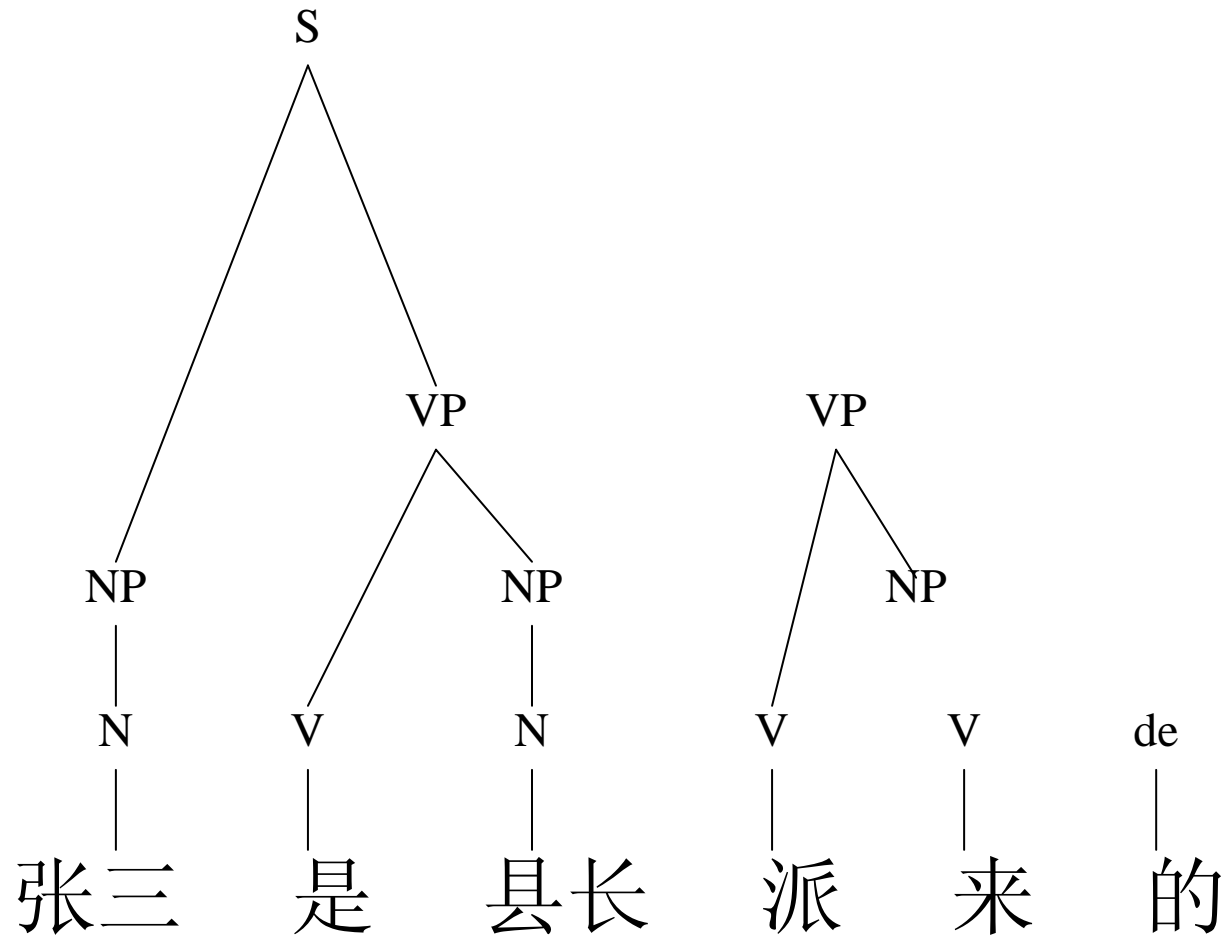
使用规则

$V' \rightarrow V V$



# 左角分析法示例-12

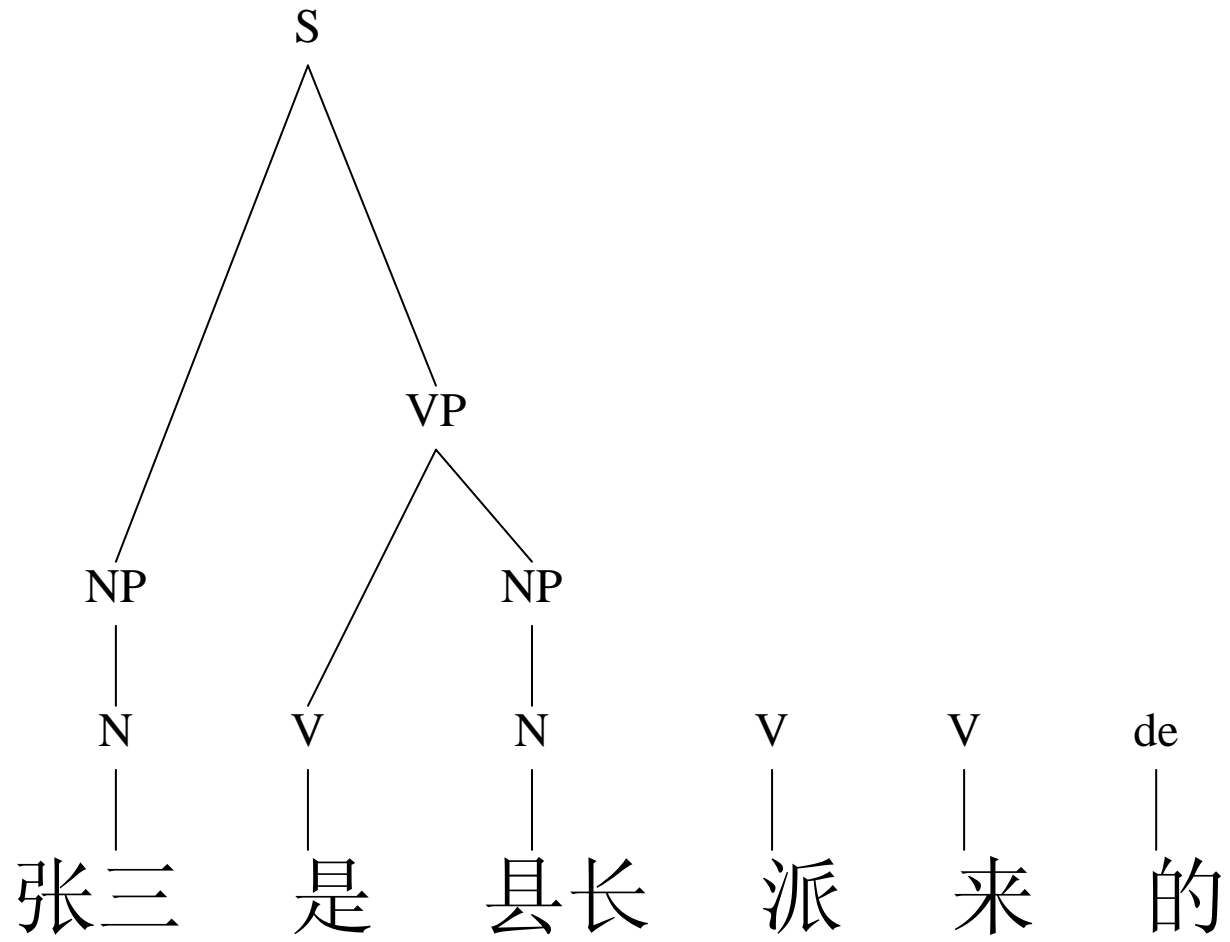
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



无规则可用  
回溯

# 左角分析法示例-13

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

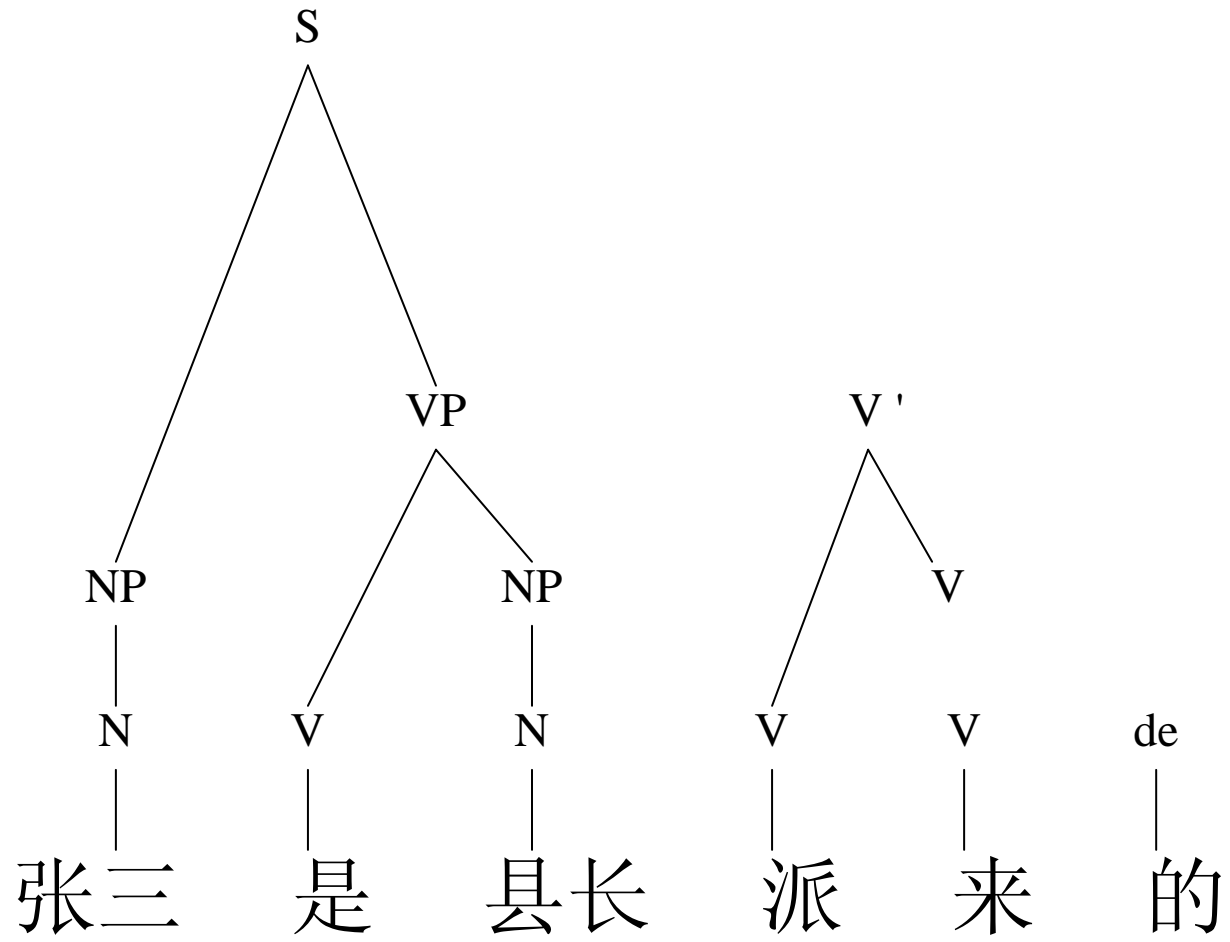


无规则可用  
回溯



# 左角分析法示例-14

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

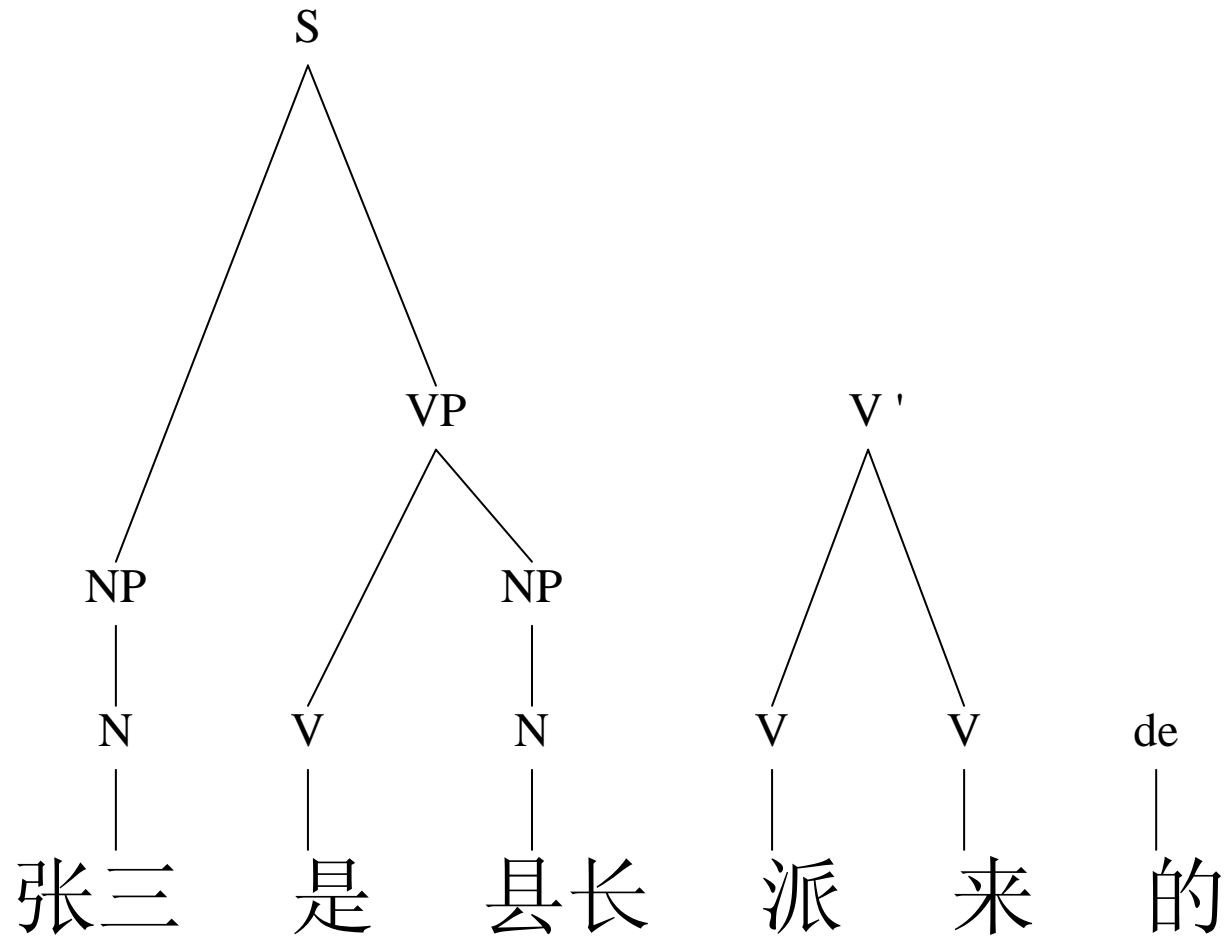


使用规则

$V' \rightarrow V V$

# 左角分析法示例-15

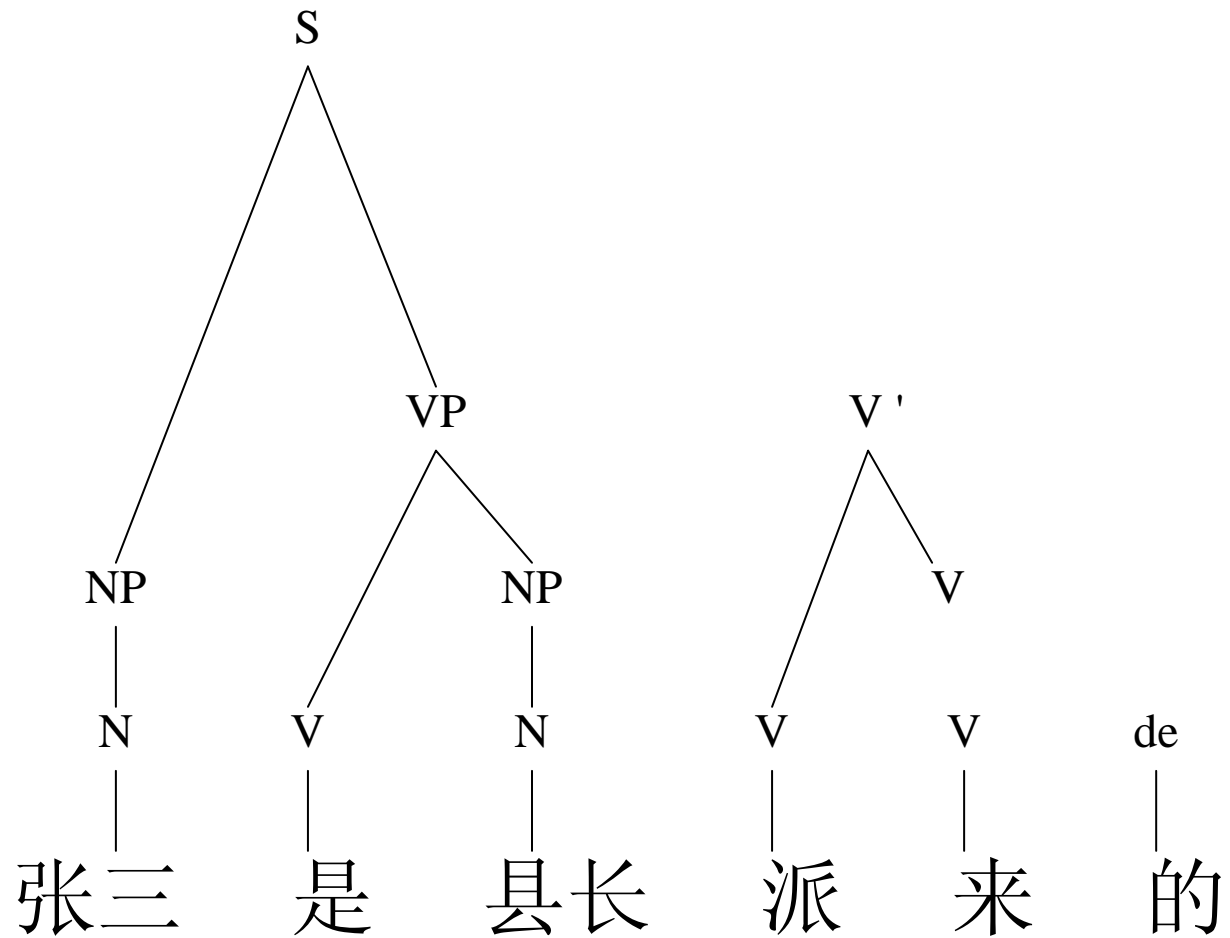
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



匹配成功

# 左角分析法示例-16

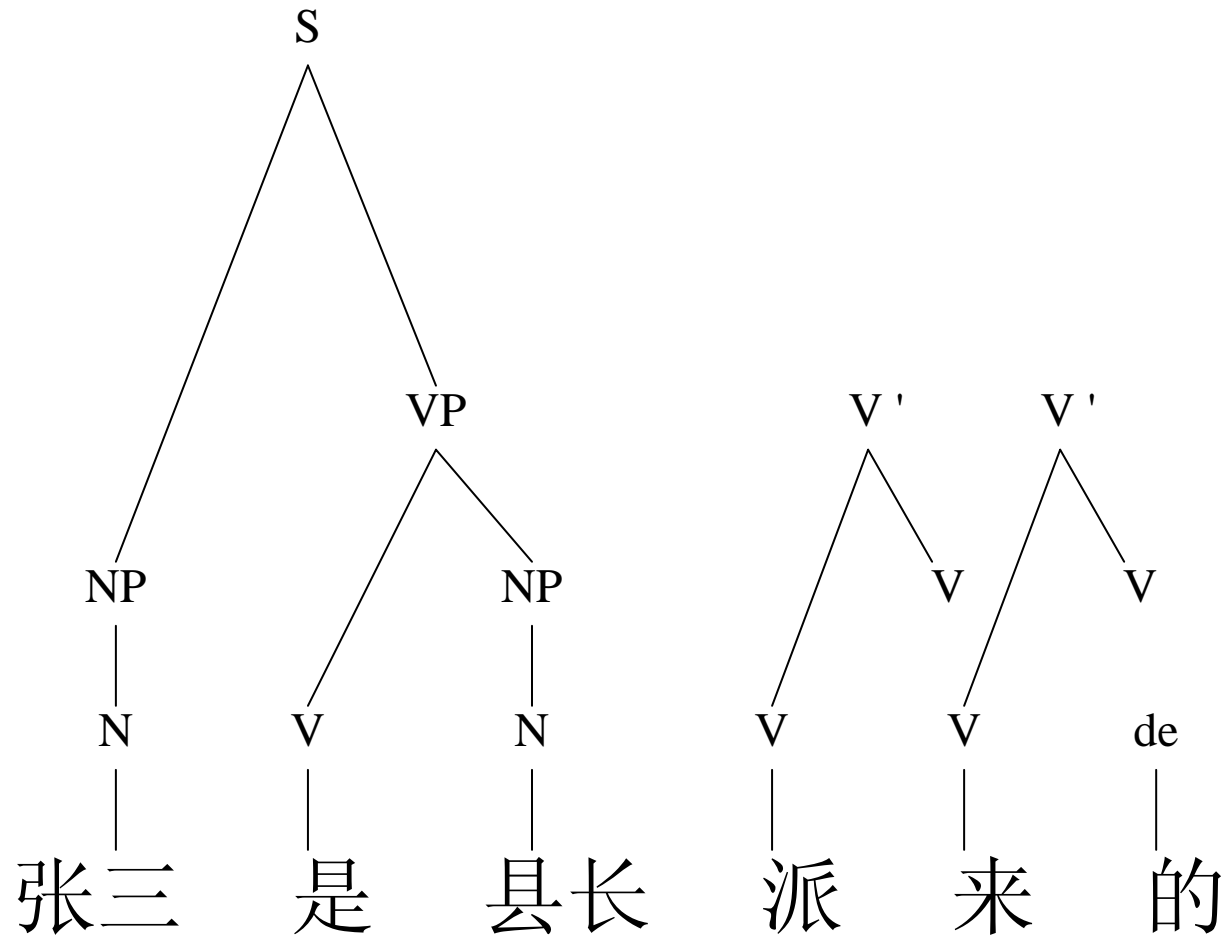
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



无规则可用  
回溯

# 左角分析法示例-17

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

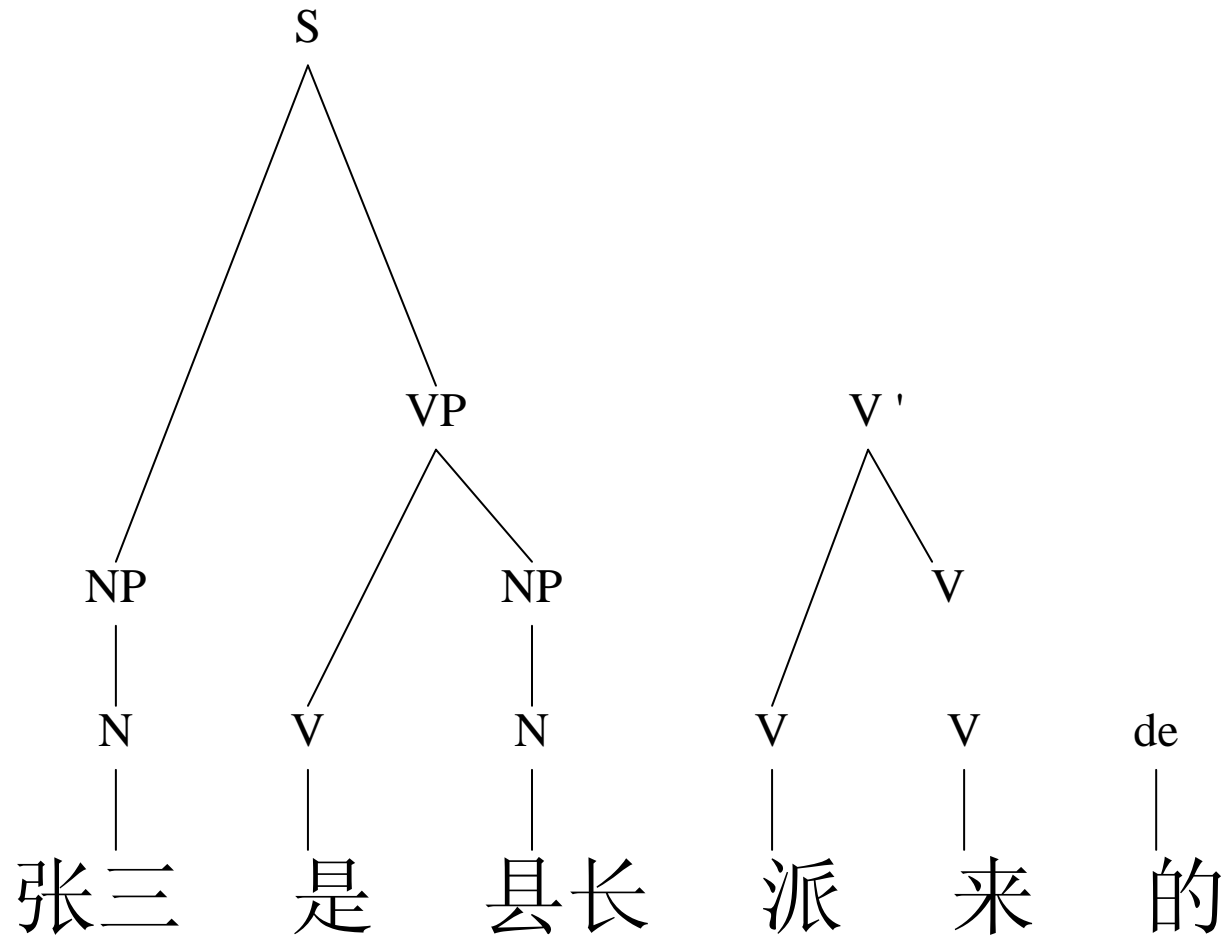


使用规则

$V' \rightarrow V V$

# 左角分析法示例-18

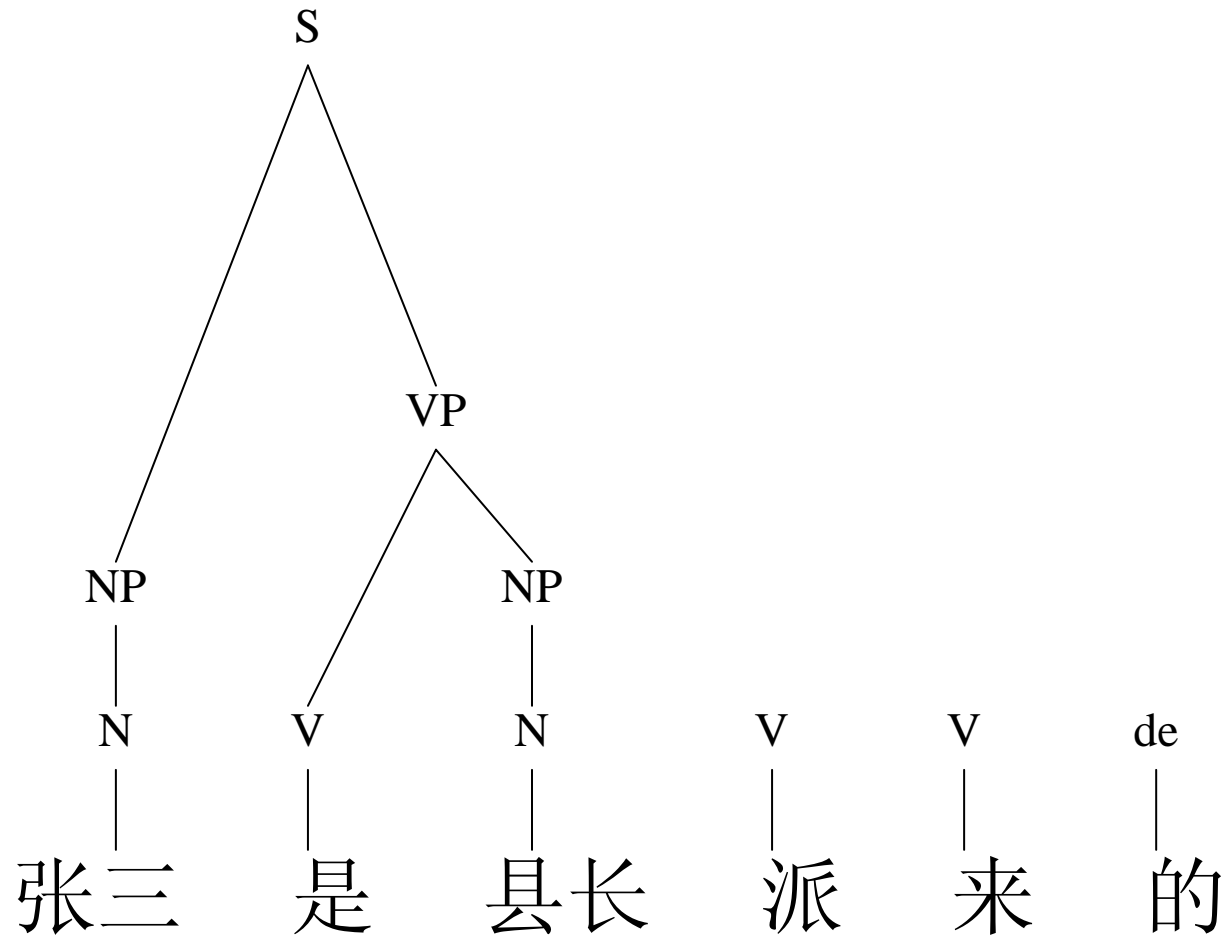
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



无规则可用  
回溯

# 左角分析法示例-19

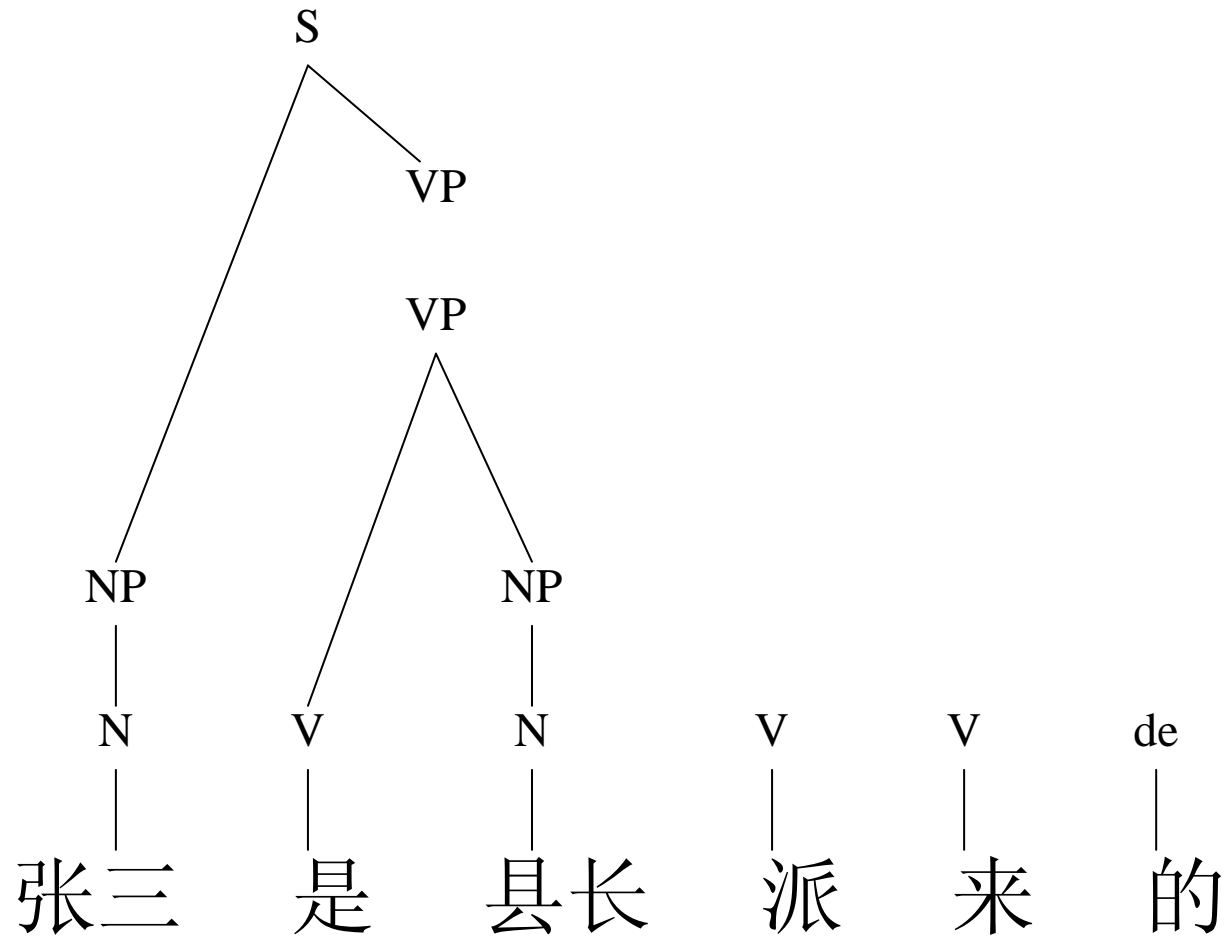
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



无规则可用  
回溯

# 左角分析法示例-20

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



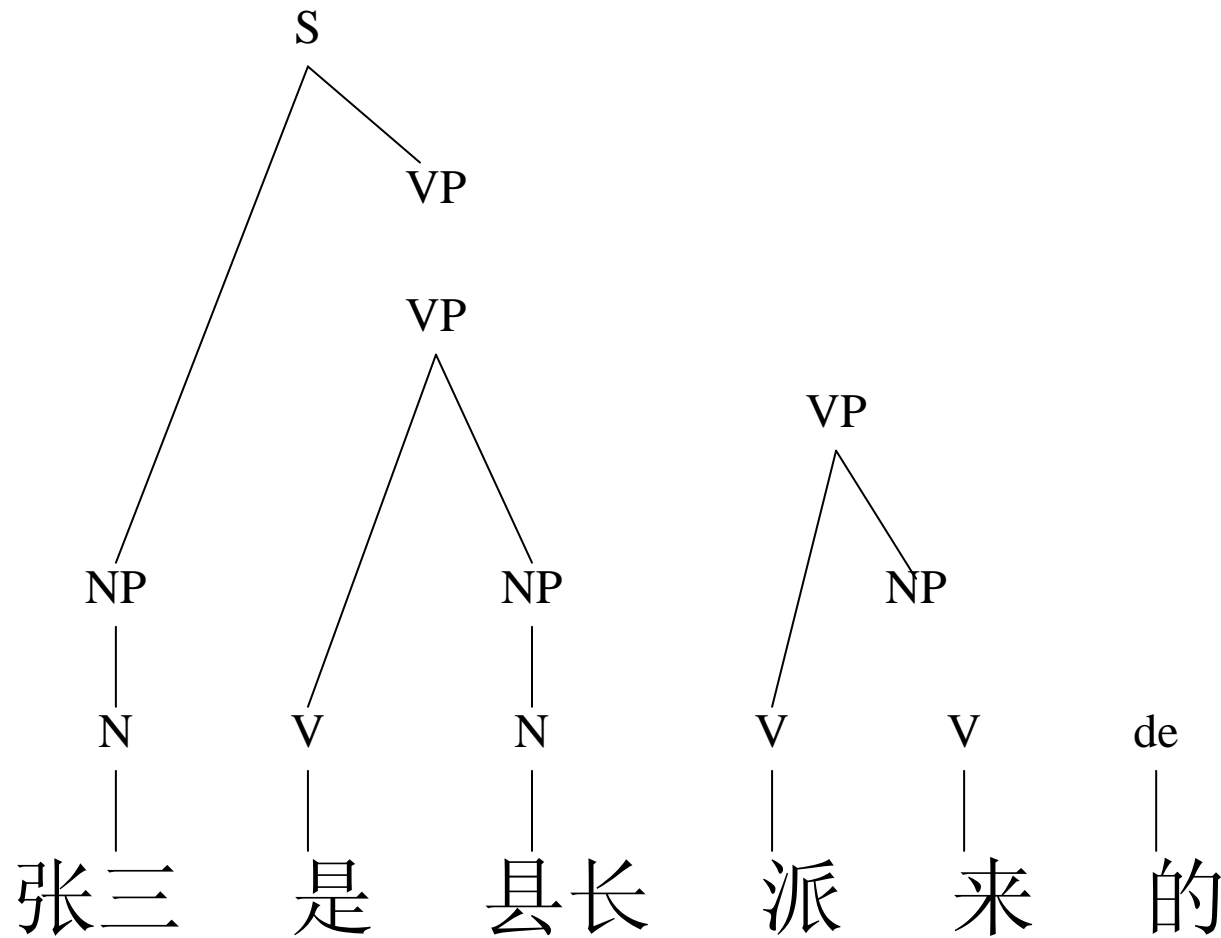
回溯

# 左角分析法示例-21

- (1)  $S \rightarrow NP \ VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS \text{ 的}$
- (4)  $CS \rightarrow NP \ V'$
- (5)  $VP \rightarrow V \ NP$
- (6)  $V' \rightarrow V \ V$

使用规则:

$VP \rightarrow V \ NP$

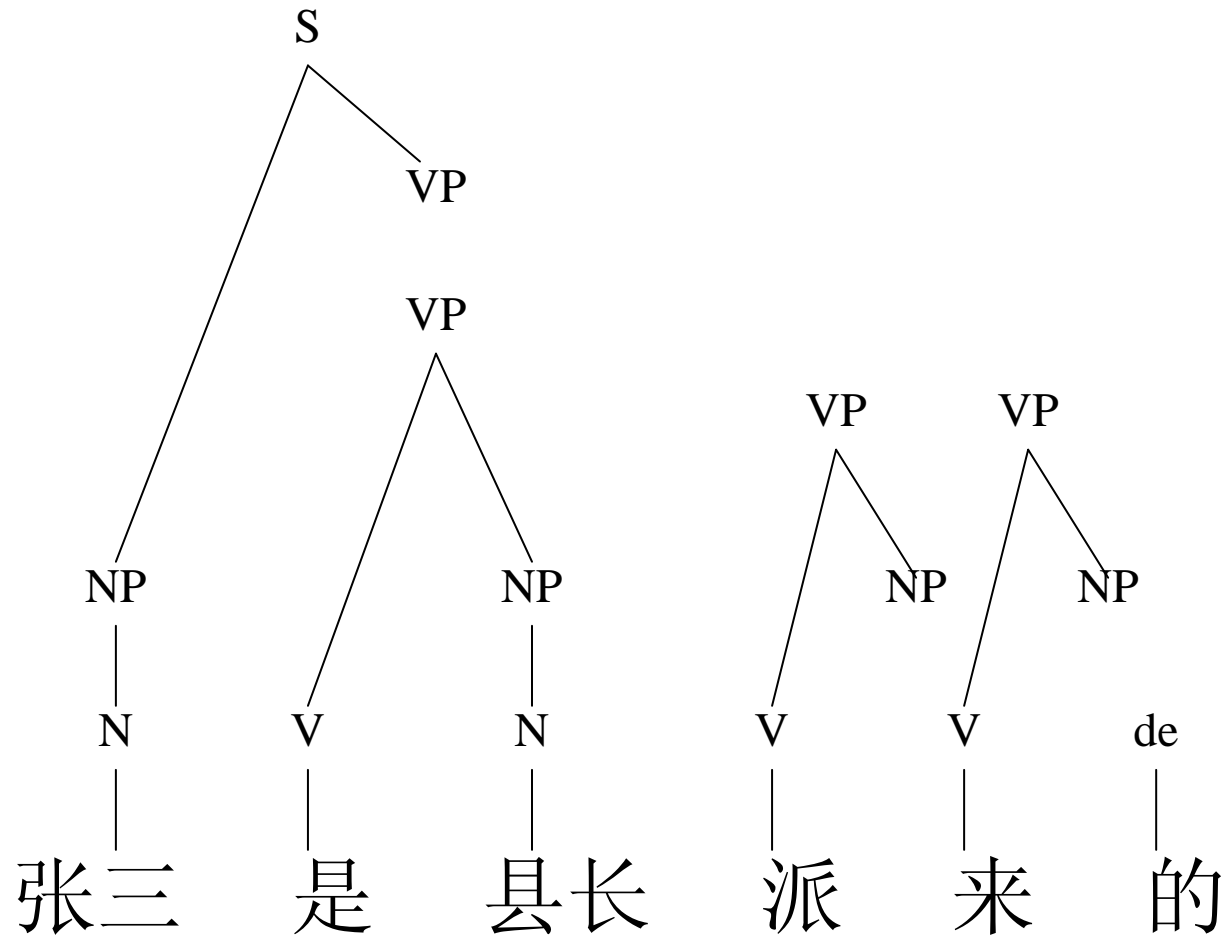




# 左角分析法示例-22

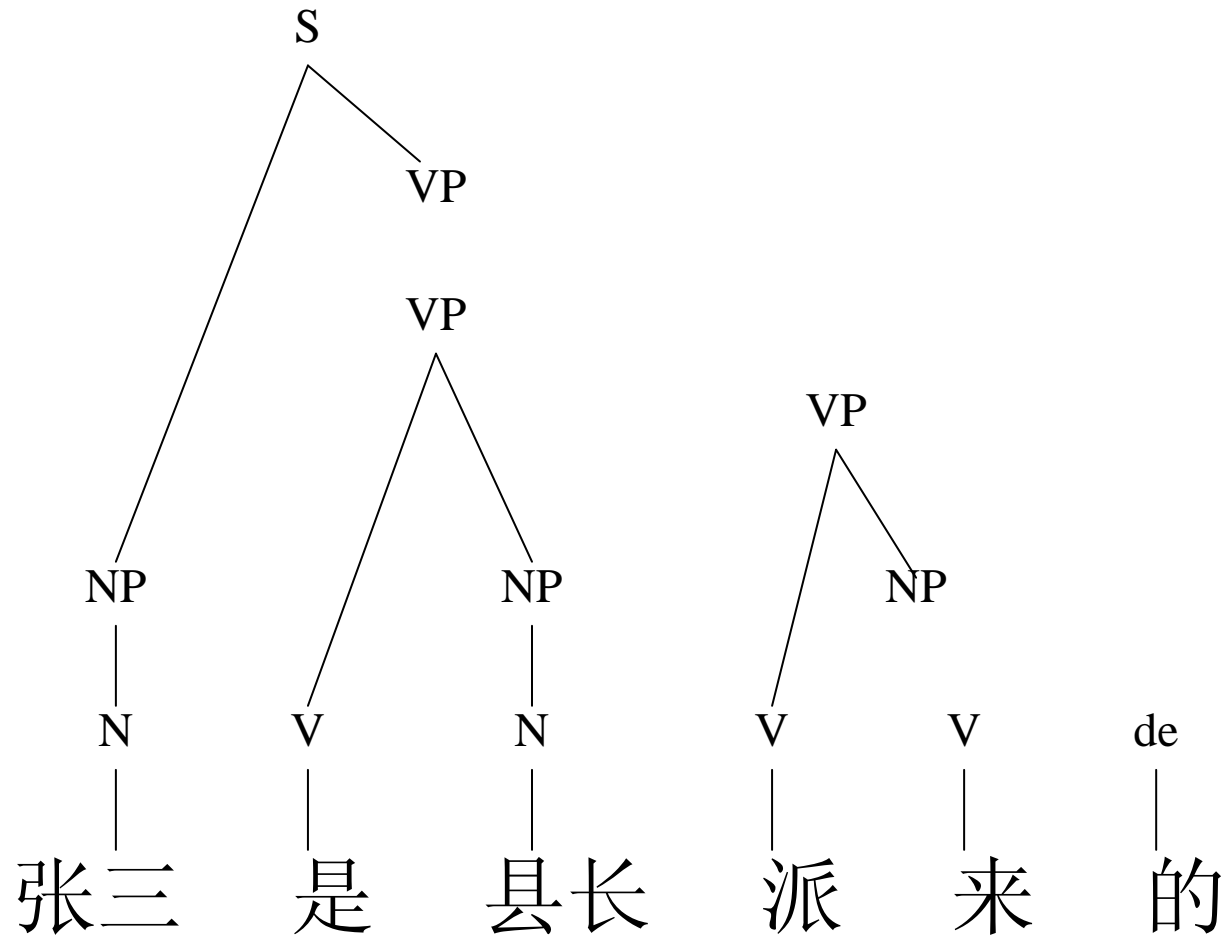
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则：  
 $VP \rightarrow V NP$



# 左角分析法示例-23

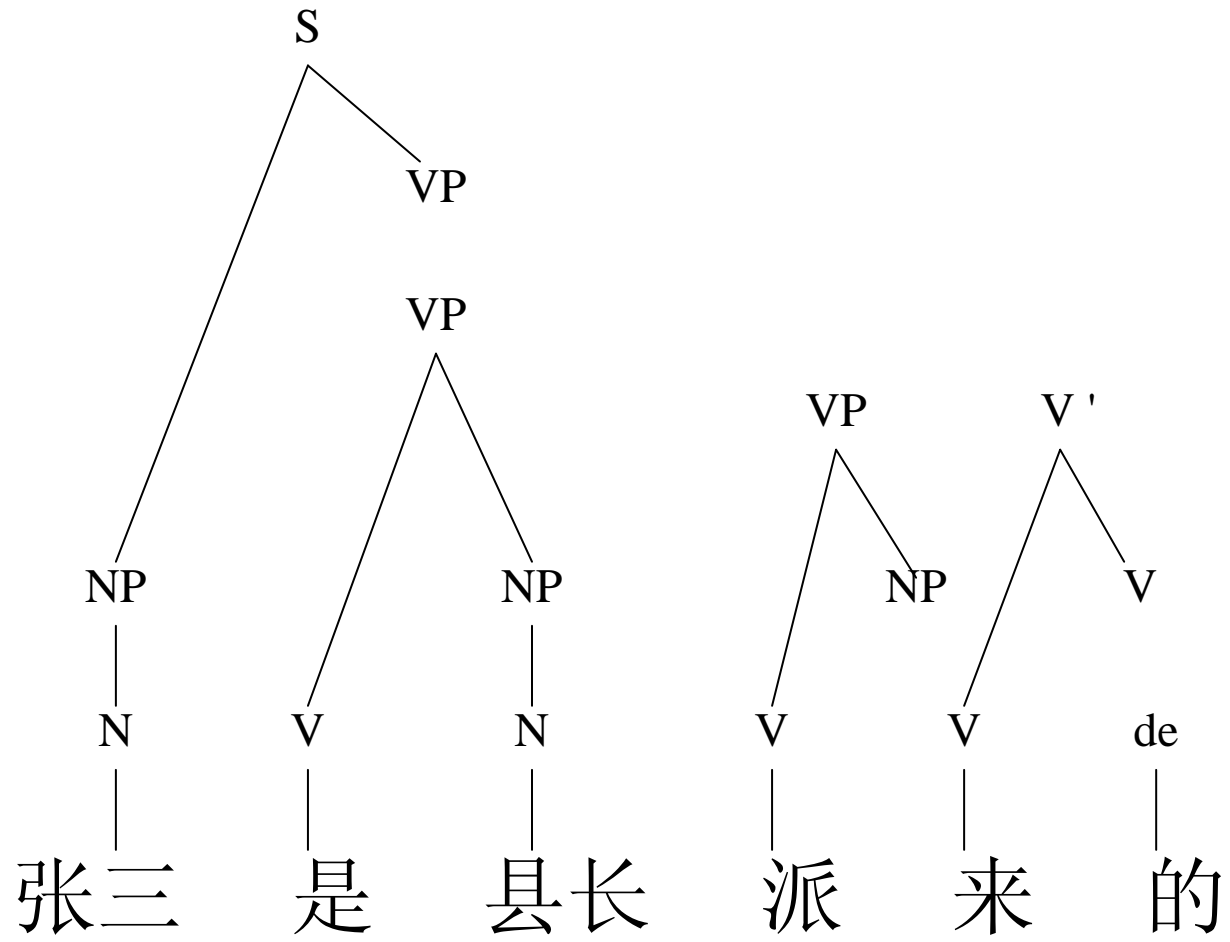
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



无规则可用  
回溯

# 左角分析法示例-24

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



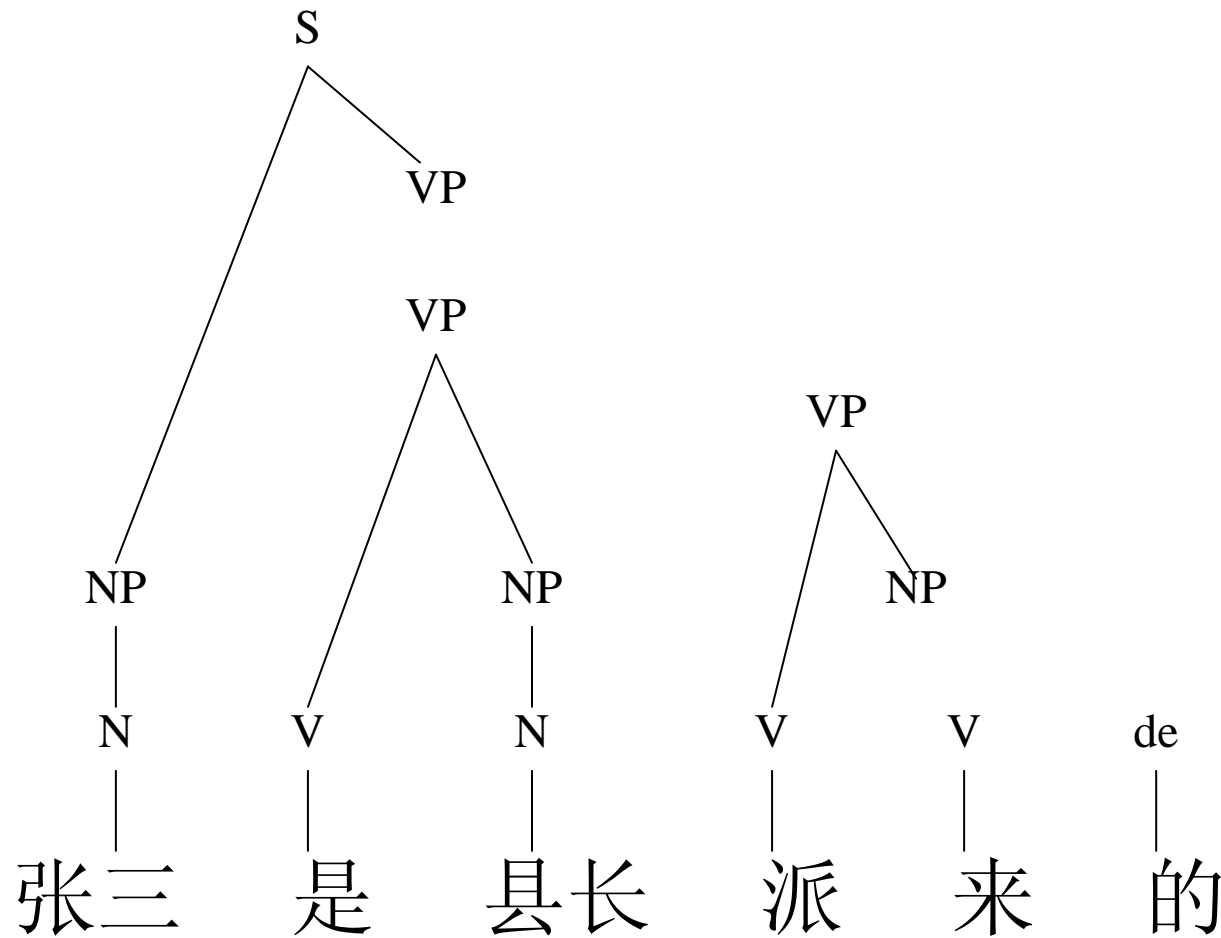
使用规则

$V' \rightarrow V V$

# 左角分析法示例-25

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

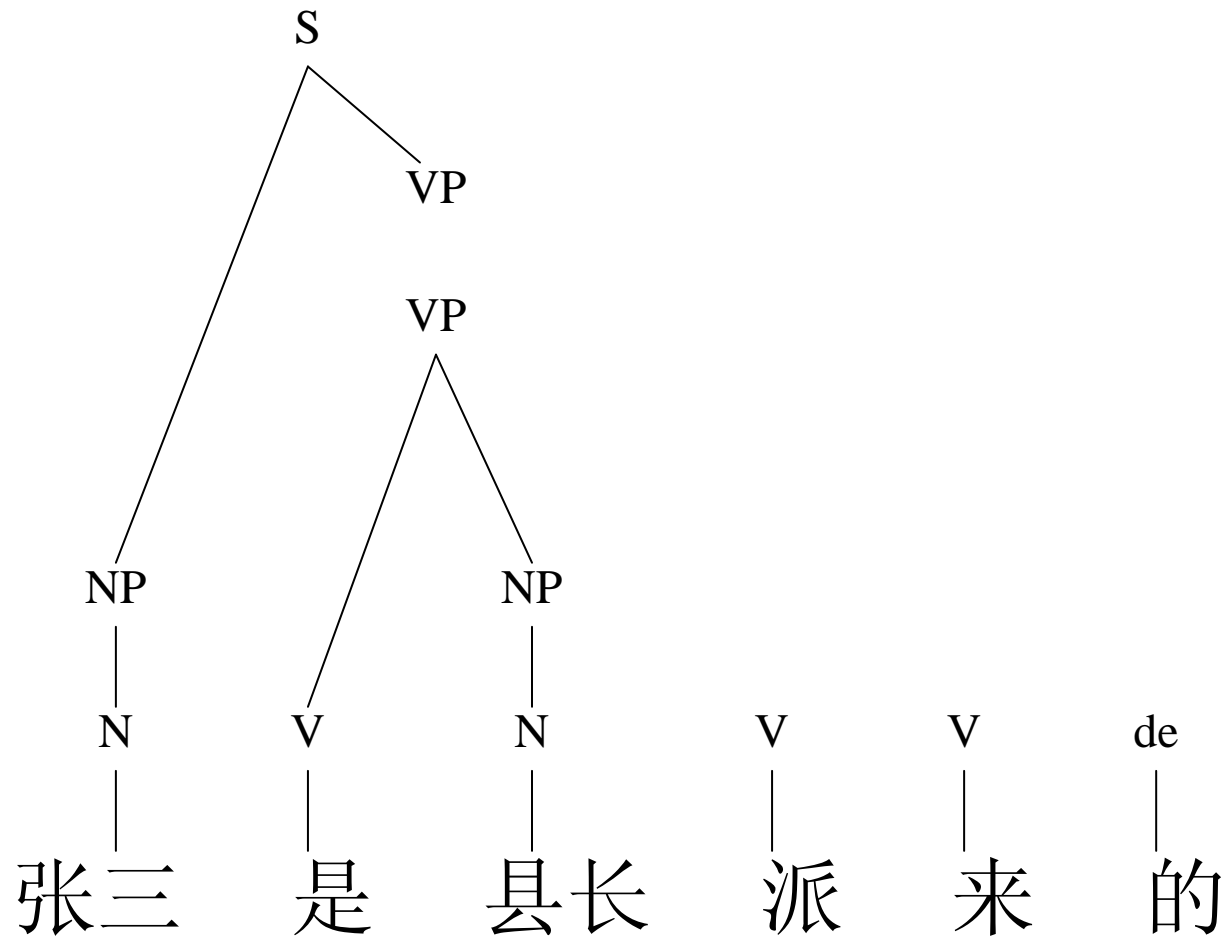
无规则可用  
回溯



# 左角分析法示例-26

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

无规则可用  
回溯

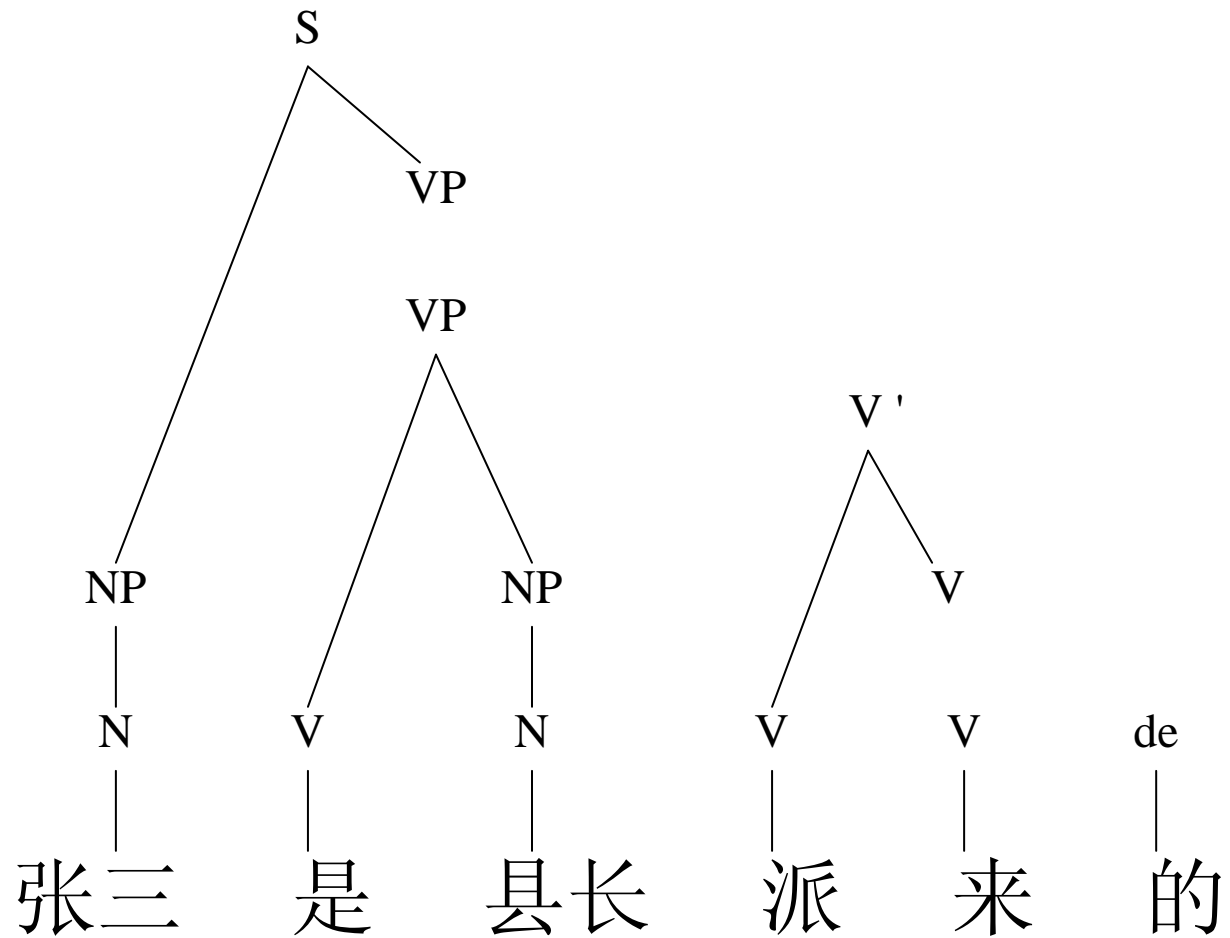


# 左角分析法示例-27

- (1)  $S \rightarrow NP \ VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS \text{ 的}$
- (4)  $CS \rightarrow NP \ V'$
- (5)  $VP \rightarrow V \ NP$
- (6)  $V' \rightarrow V \ V$

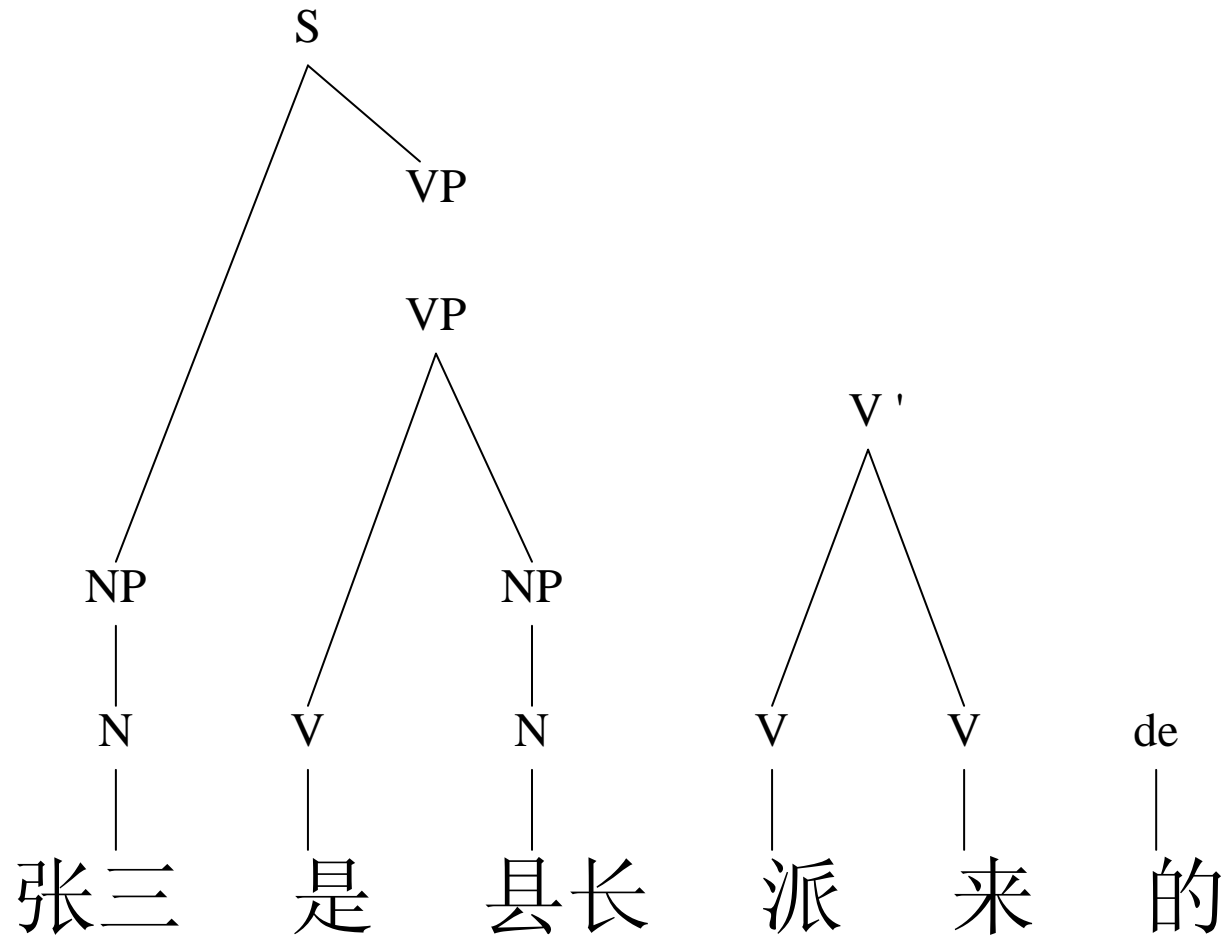
使用规则

$V' \rightarrow V \ V$



# 左角分析法示例-28

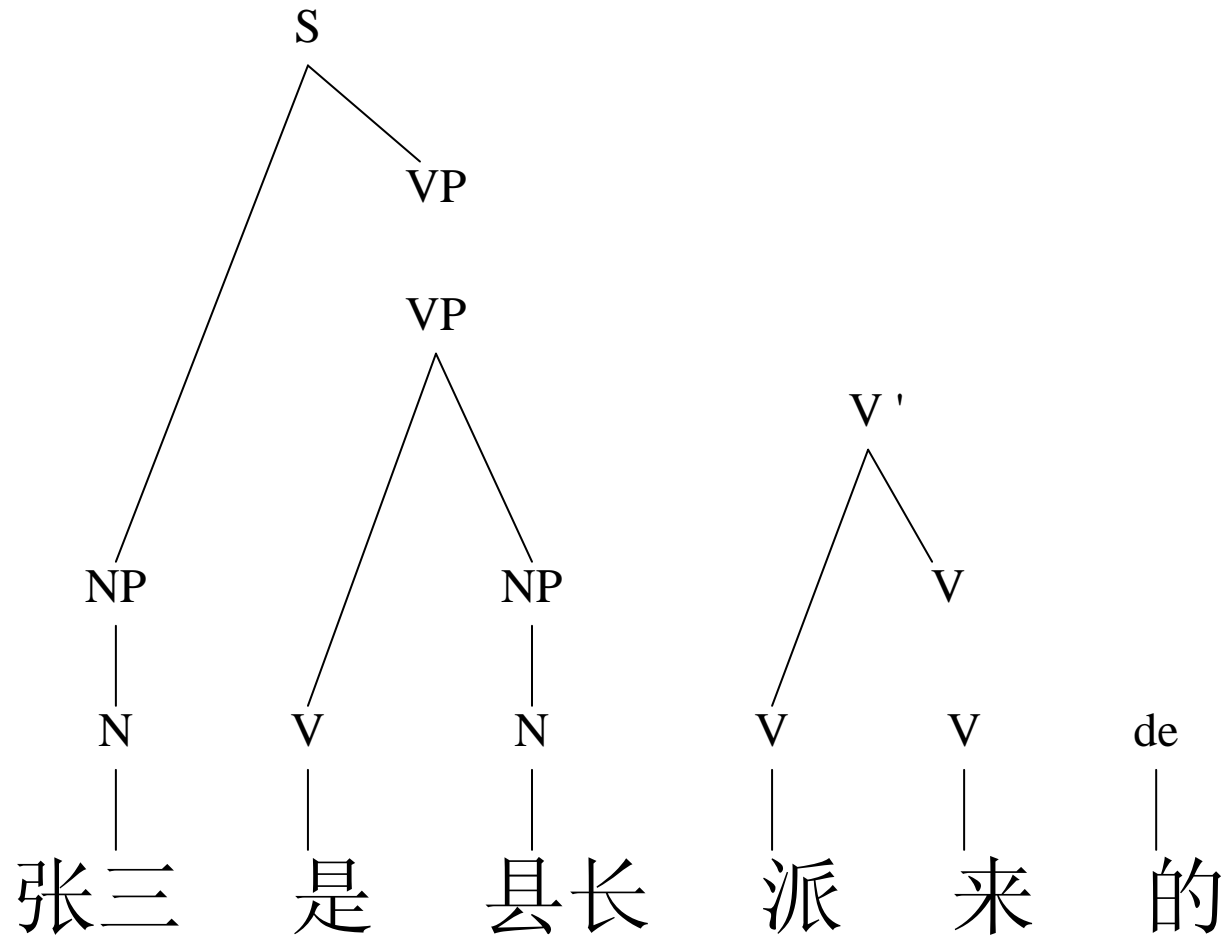
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



匹配成功

# 左角分析法示例-29

- (1)  $S \rightarrow NP \ VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS \text{ 的}$
- (4)  $CS \rightarrow NP \ V'$
- (5)  $VP \rightarrow V \ NP$
- (6)  $V' \rightarrow V \ V$

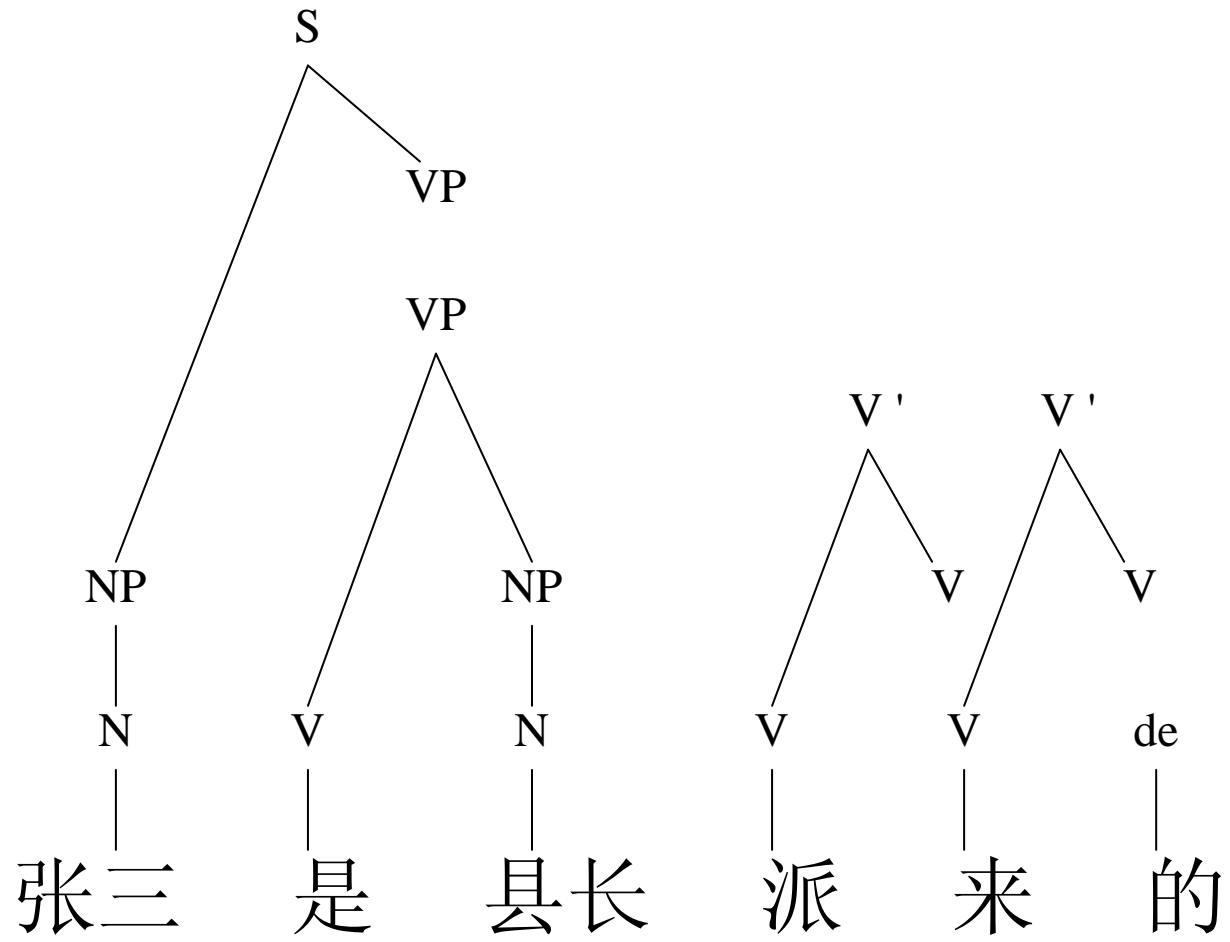


无规则可用  
回溯



# 左角分析法示例-30

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



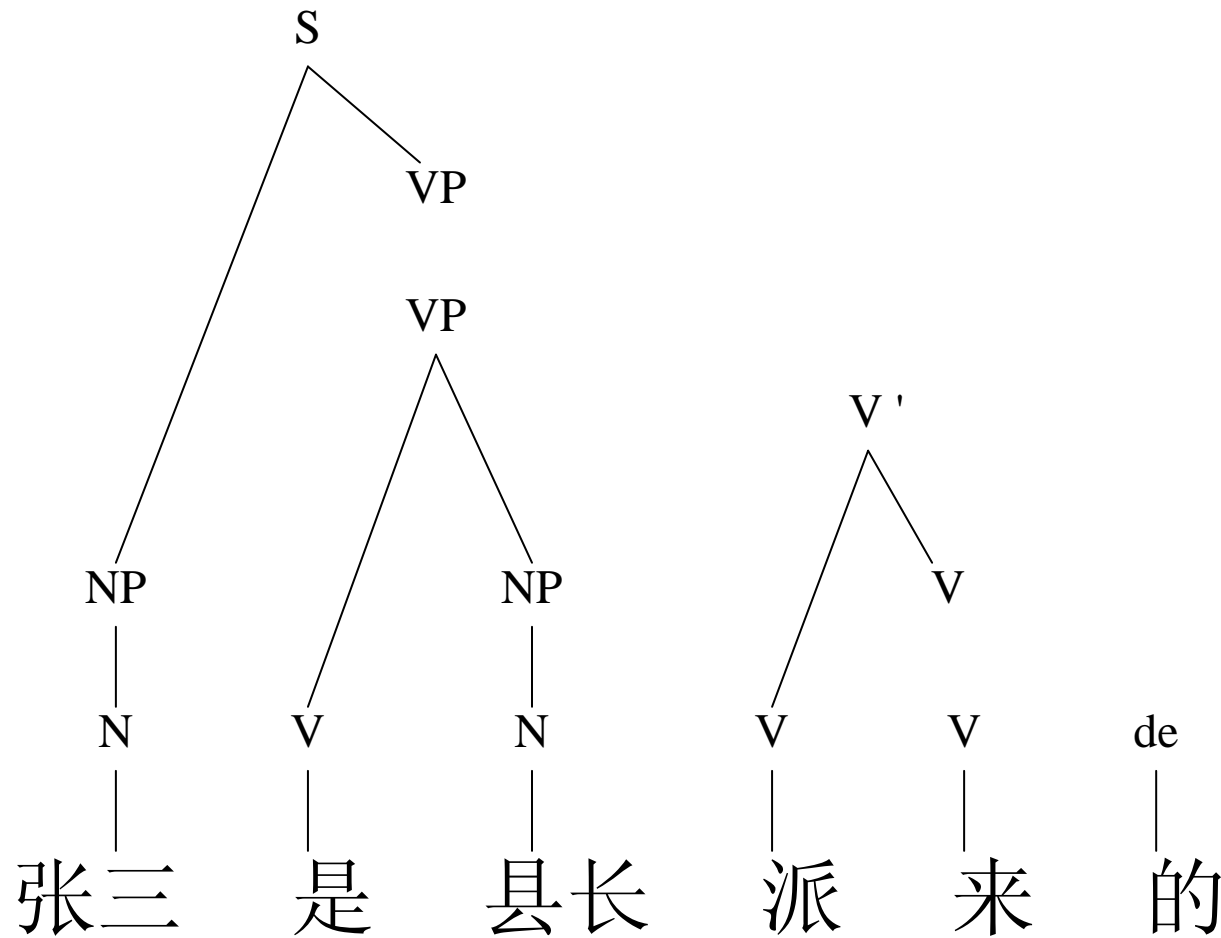
使用规则

$V' \rightarrow V V$

# 左角分析法示例-31

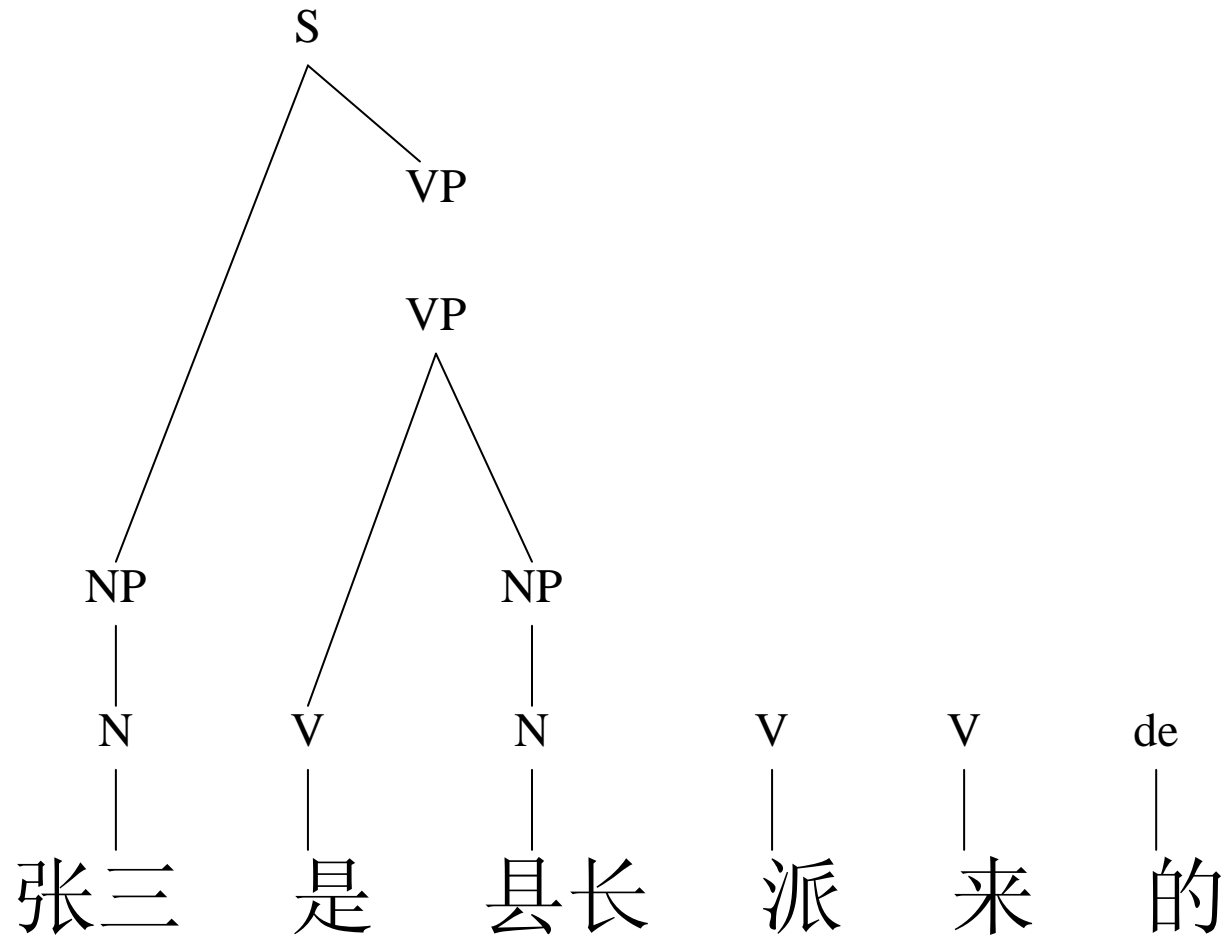
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

无规则可用  
回溯



# 左角分析法示例-32

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

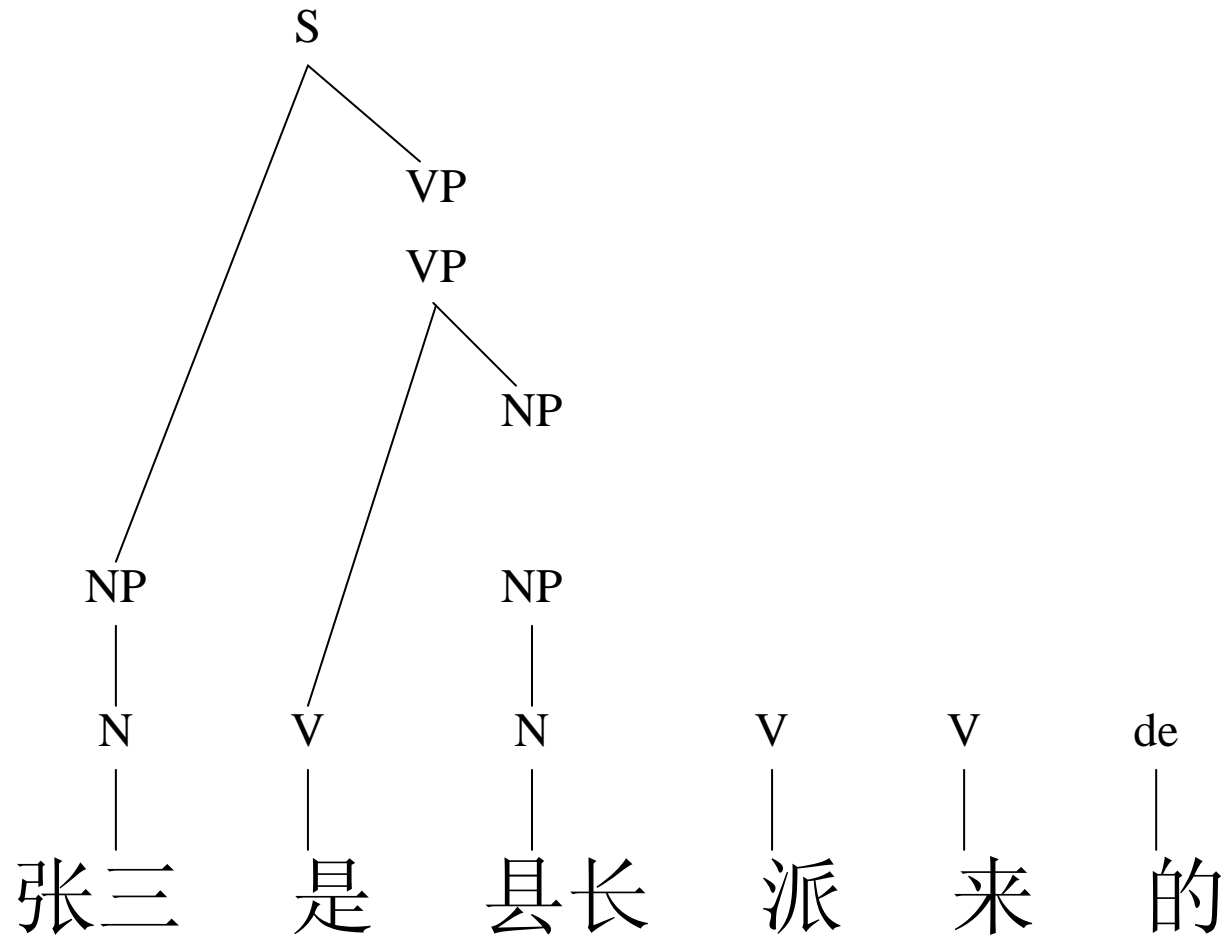


无规则可用  
回溯

# 左角分析法示例-33

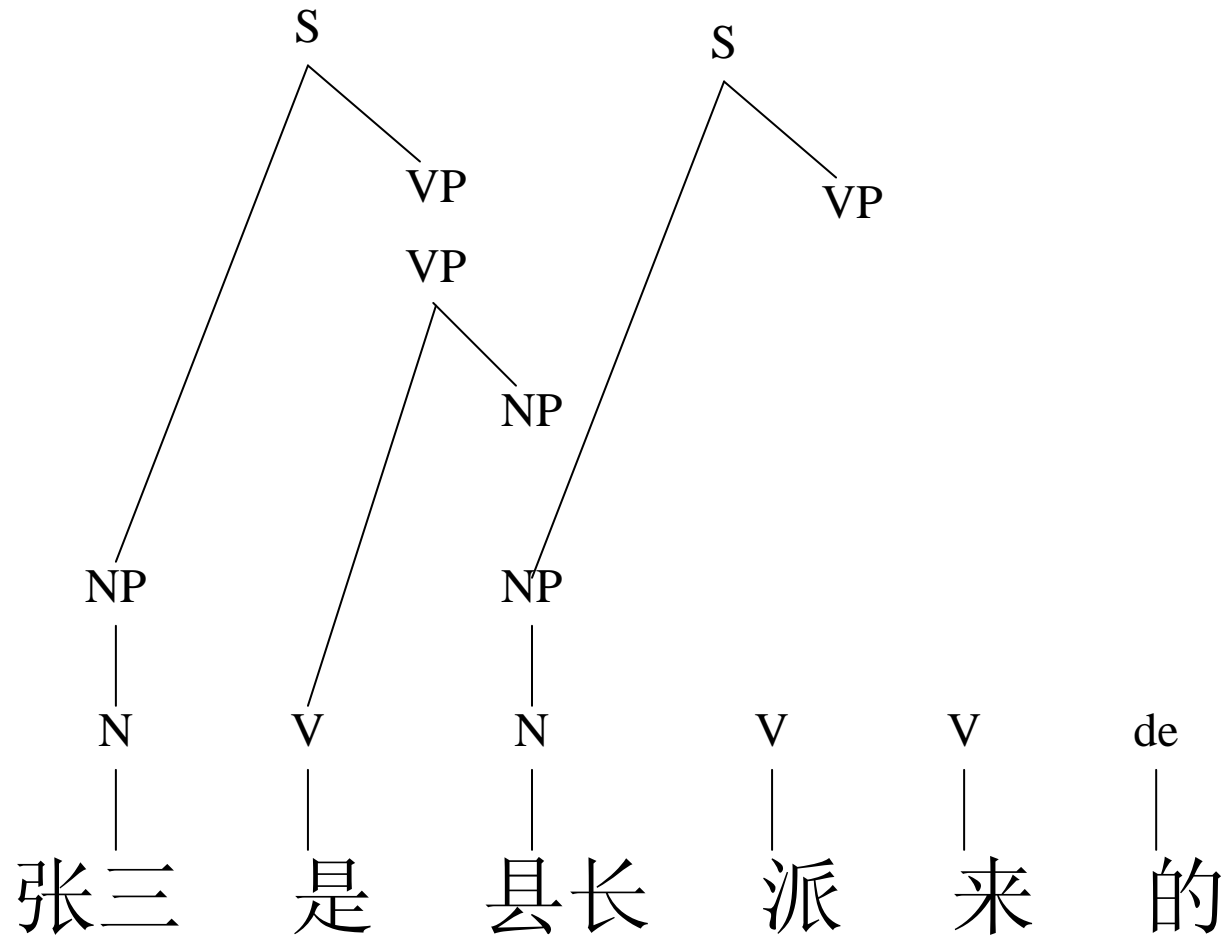
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

回溯



# 左角分析法示例-34

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

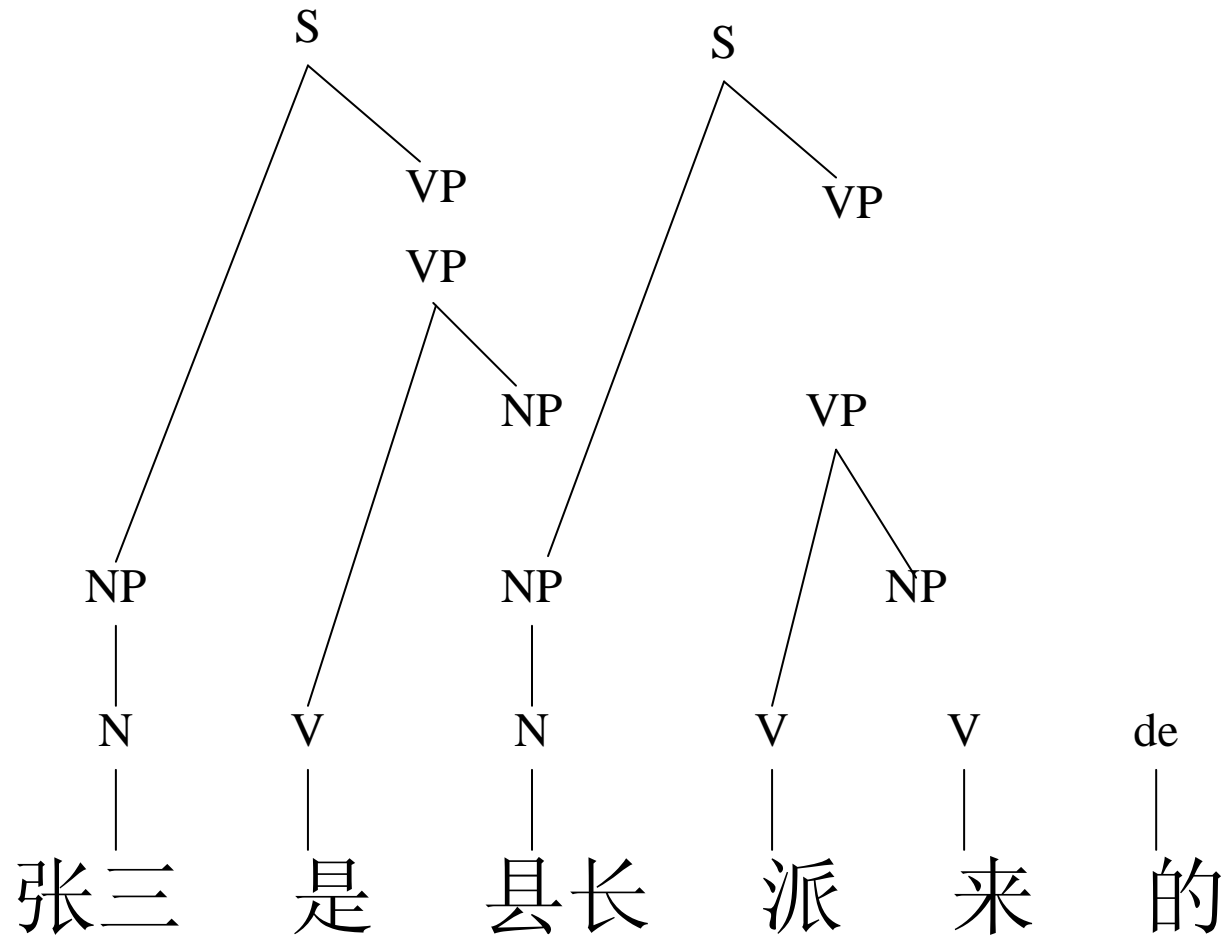


使用规则  
 $S \rightarrow NP VP$

# 左角分析法示例-35

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则：  
 $VP \rightarrow V NP$

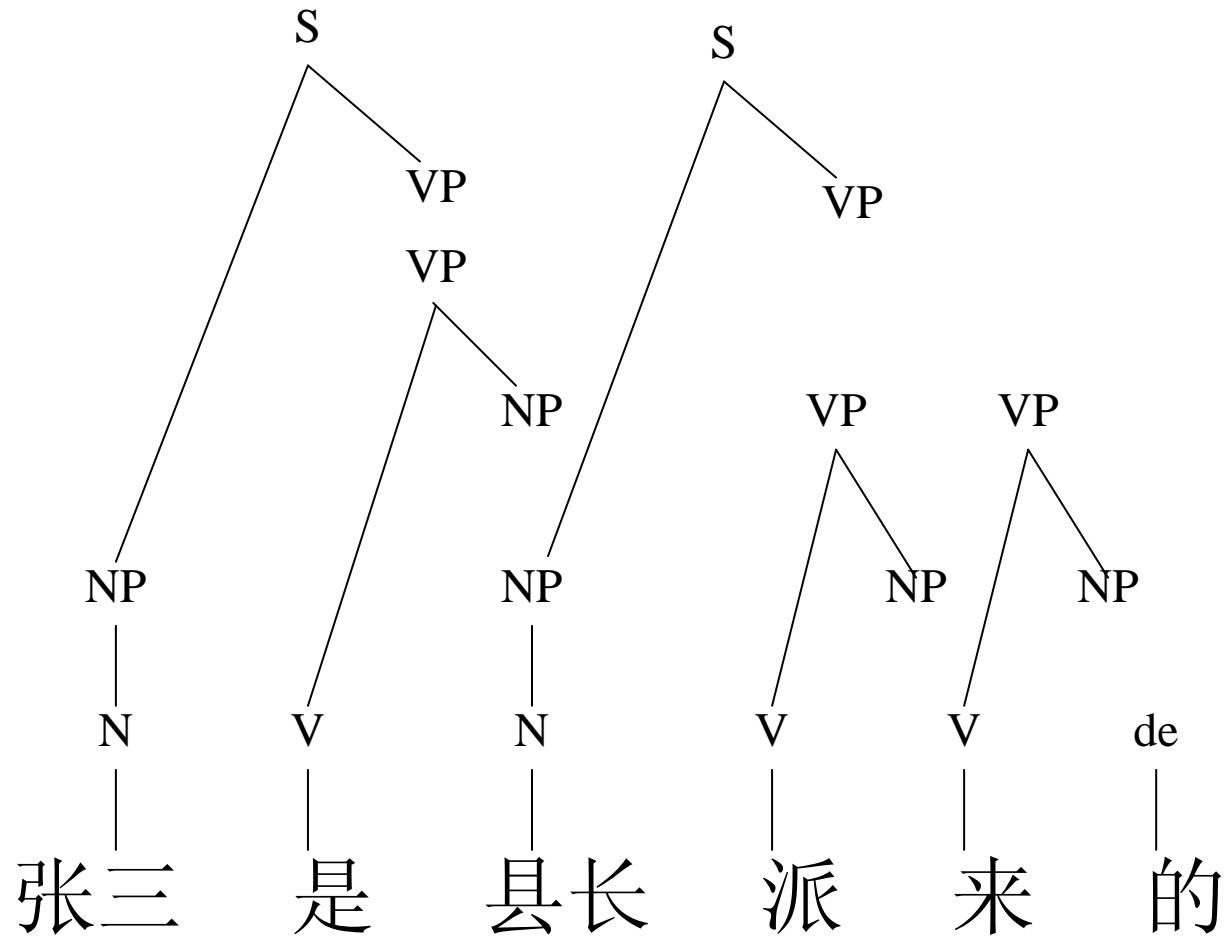


# 左角分析法示例-36

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则:

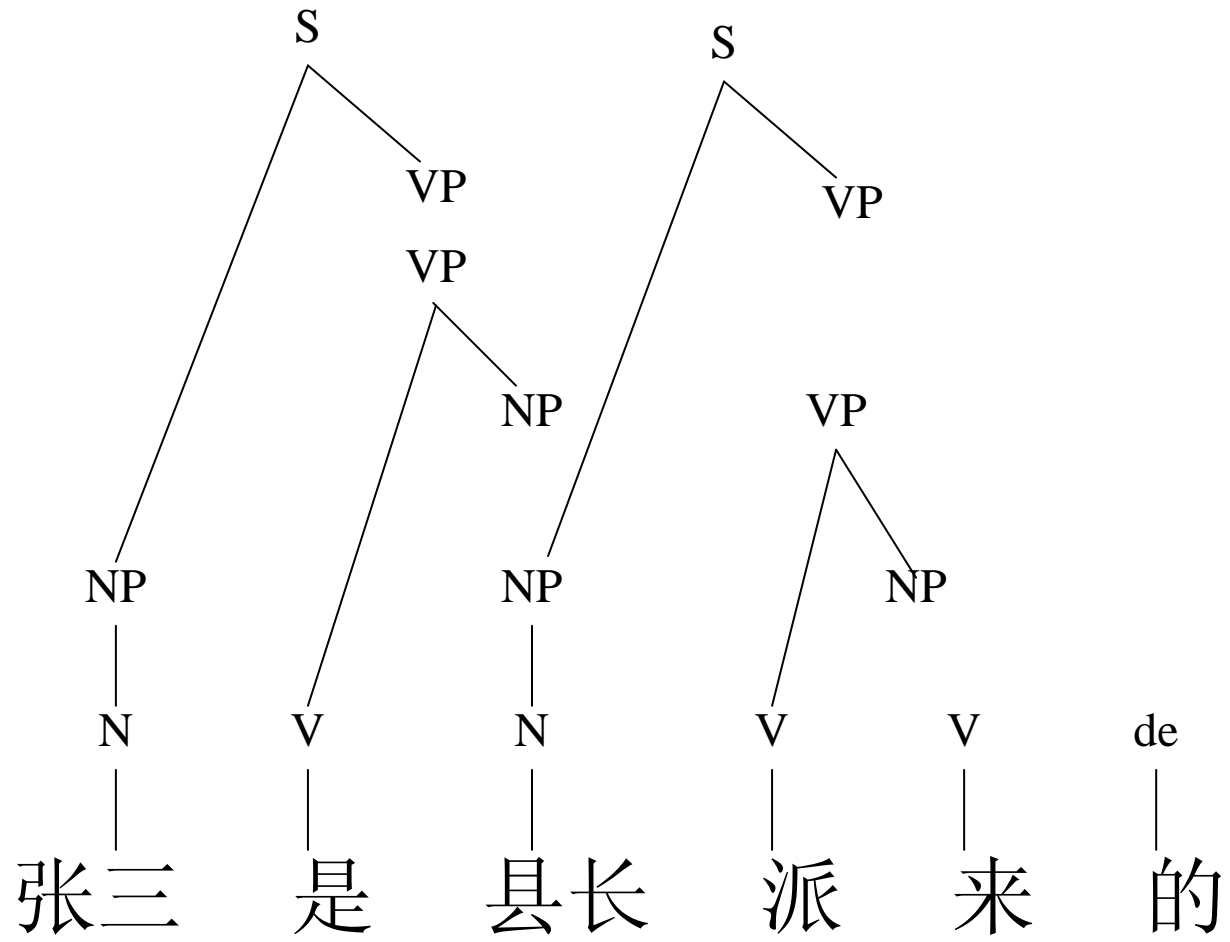
$VP \rightarrow V NP$



# 左角分析法示例-37

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

无规则可用  
回溯



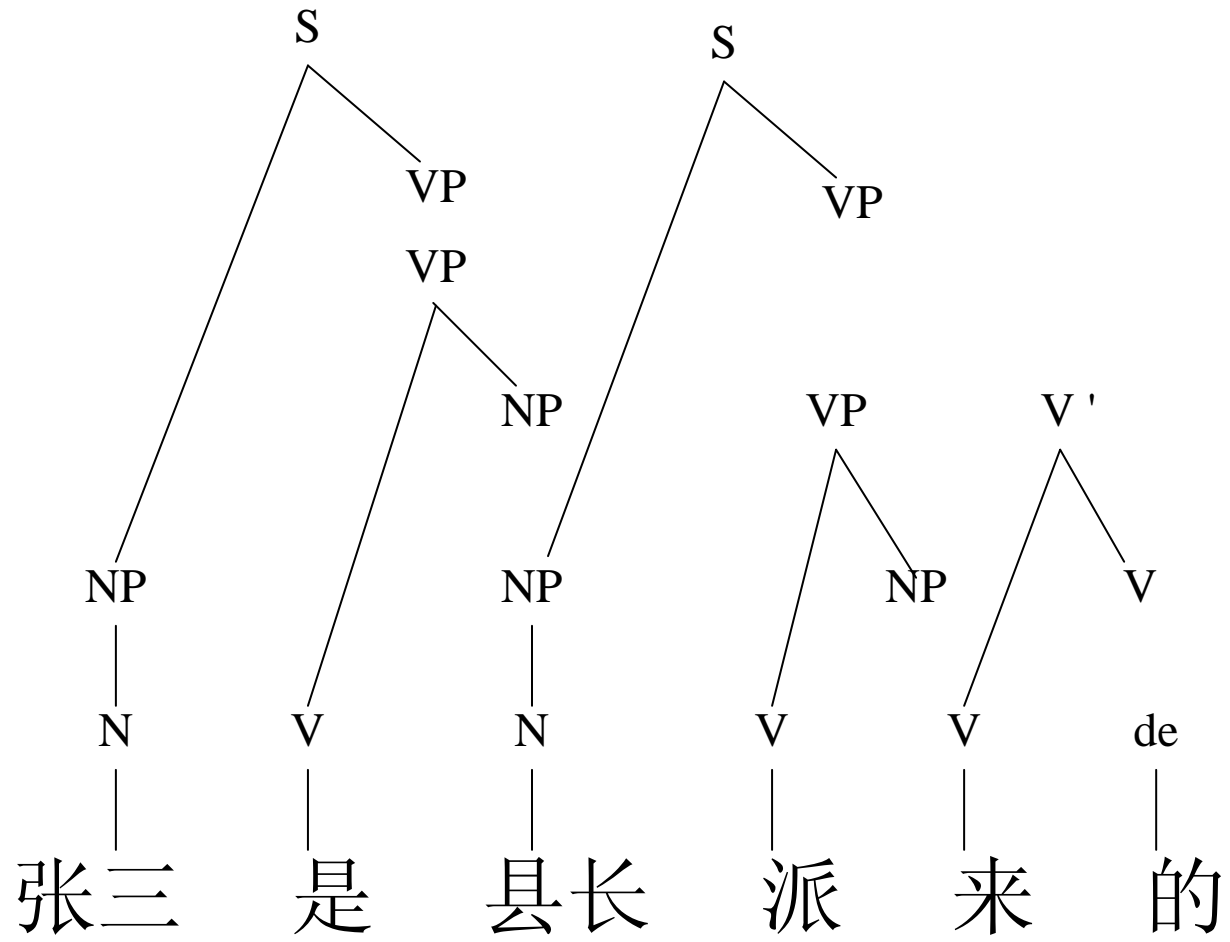


# 左角分析法示例-38

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则

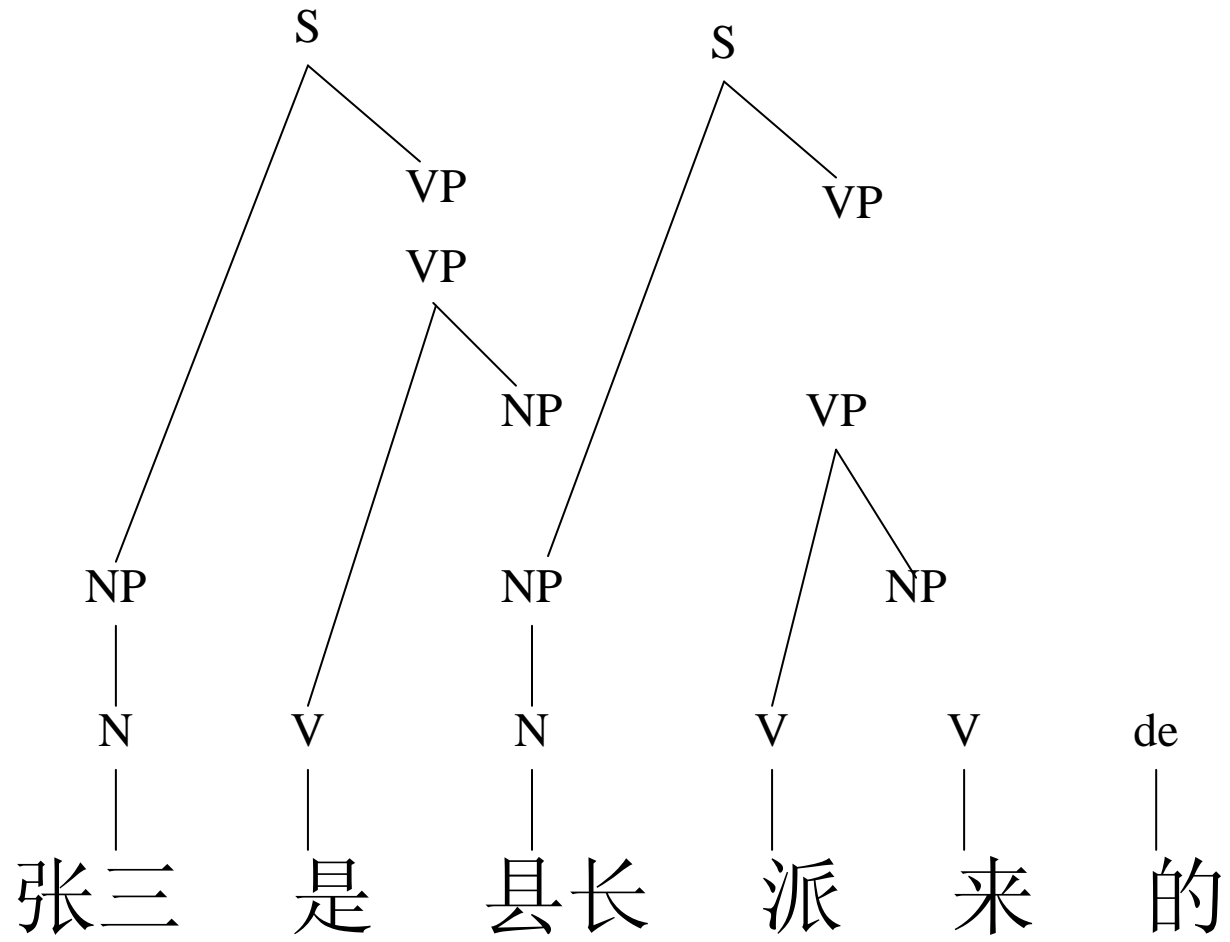
$V' \rightarrow V V$



# 左角分析法示例-39

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

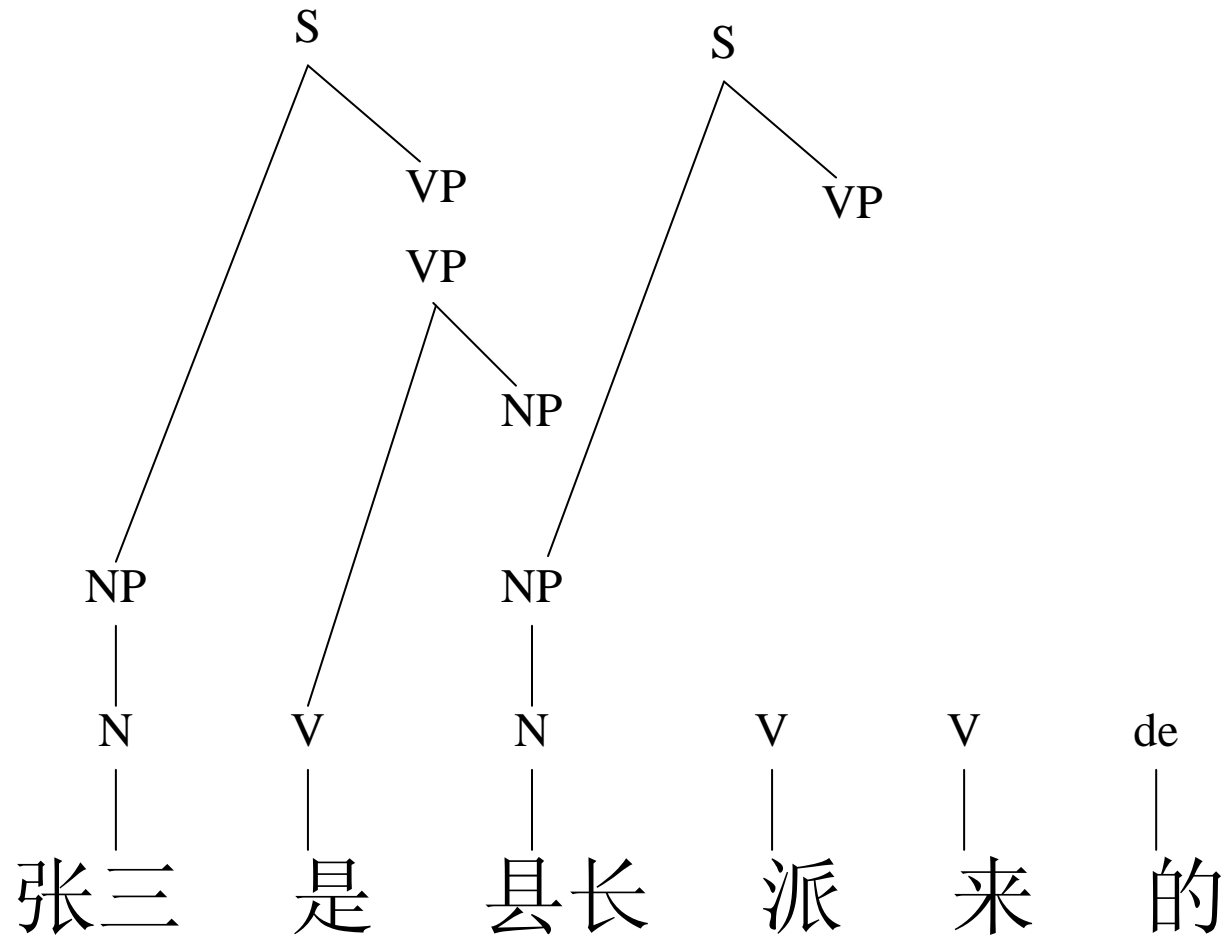
无规则可用  
回溯



# 左角分析法示例-40

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

无规则可用  
回溯

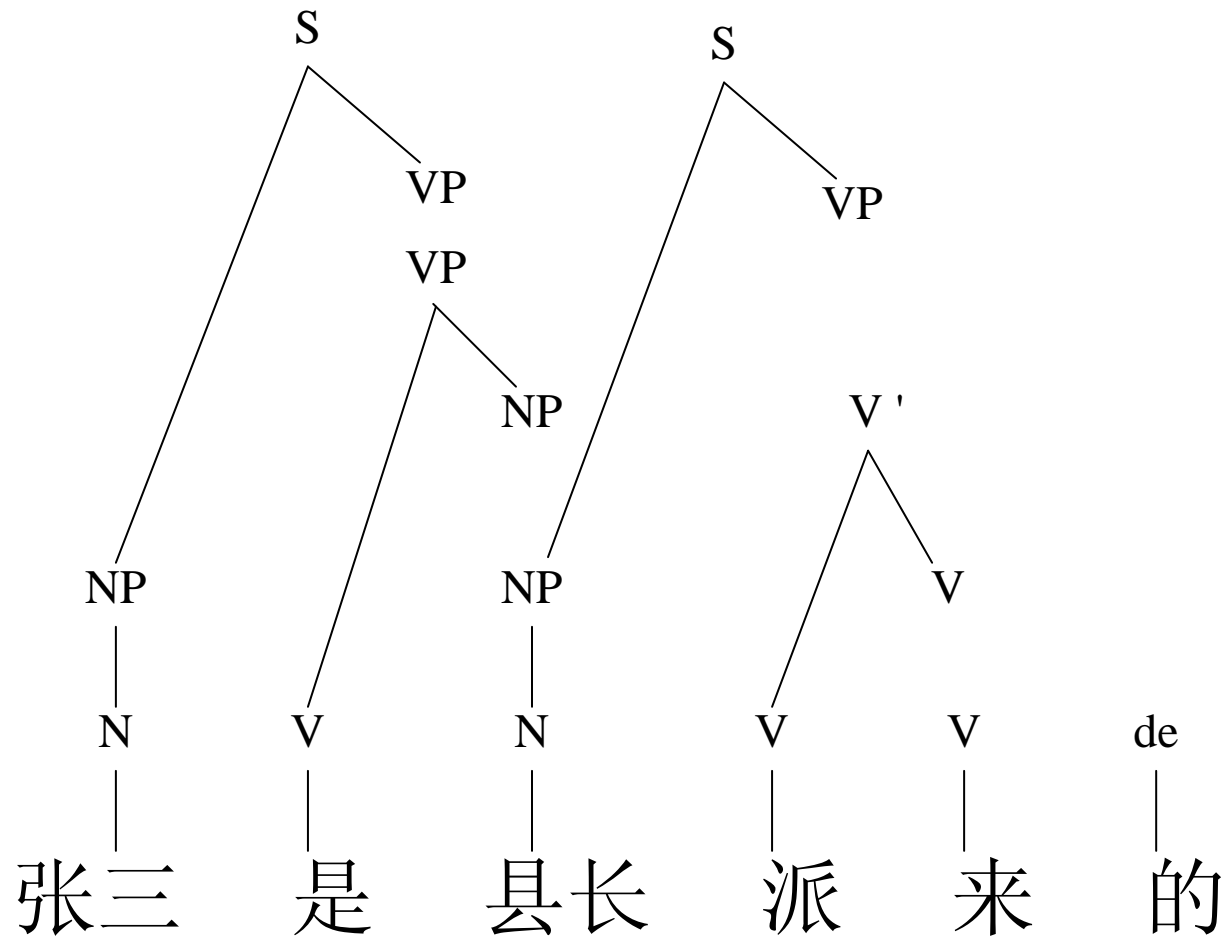


# 左角分析法示例-41

- (1)  $S \rightarrow NP \ VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS \ 的$
- (4)  $CS \rightarrow NP \ V'$
- (5)  $VP \rightarrow V \ NP$
- (6)  $V' \rightarrow V \ V$

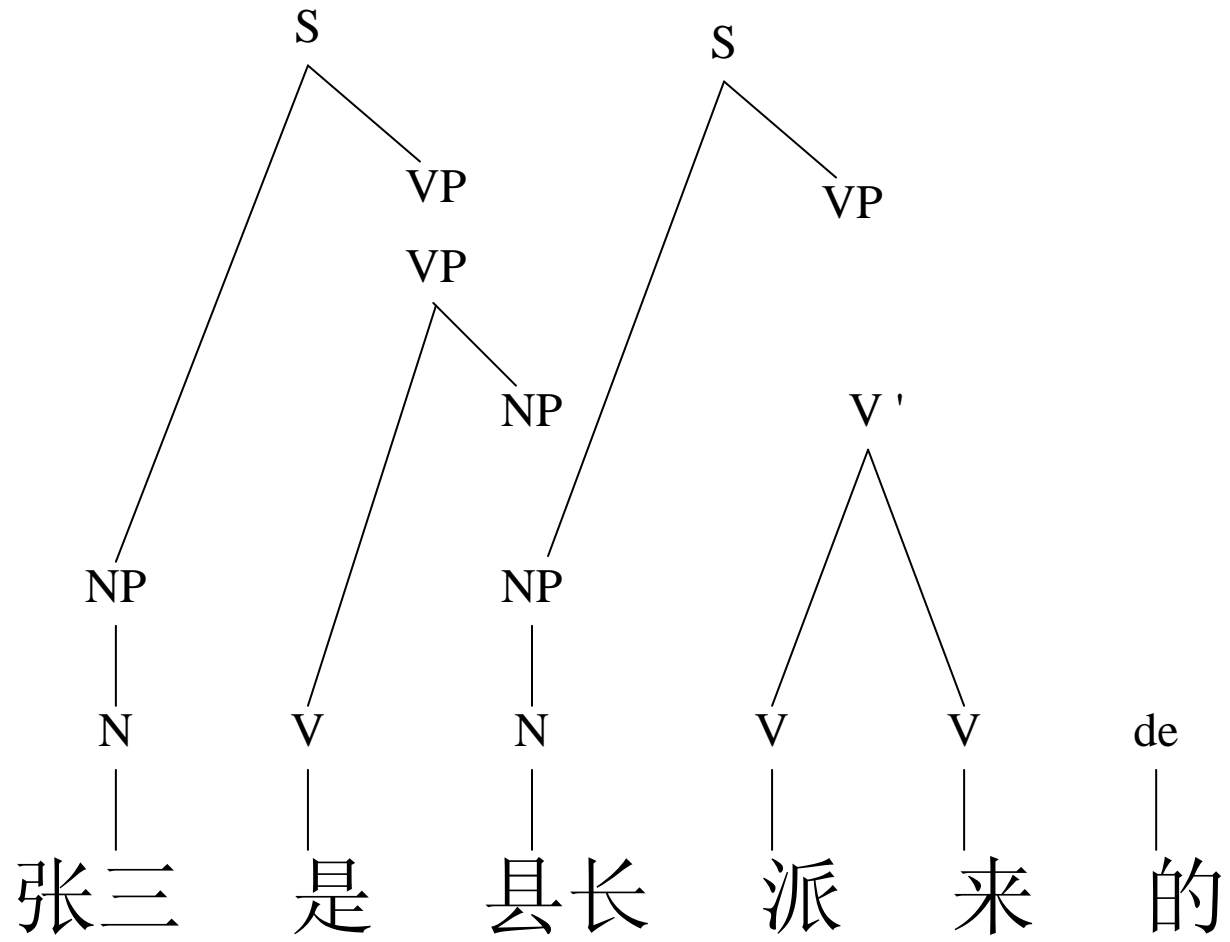
使用规则

$V' \rightarrow V \ V$



# 左角分析法示例-42

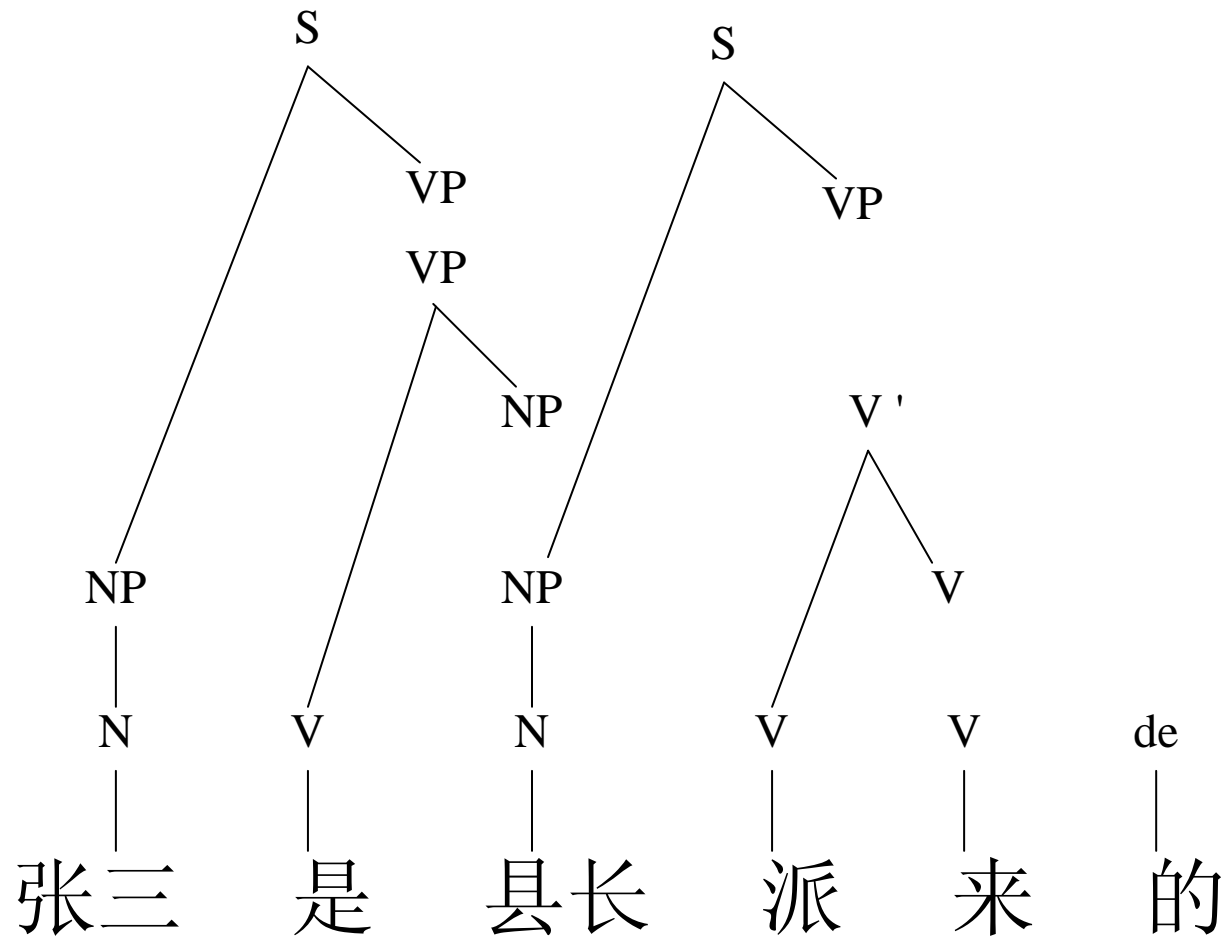
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



匹配成功

# 左角分析法示例-43

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



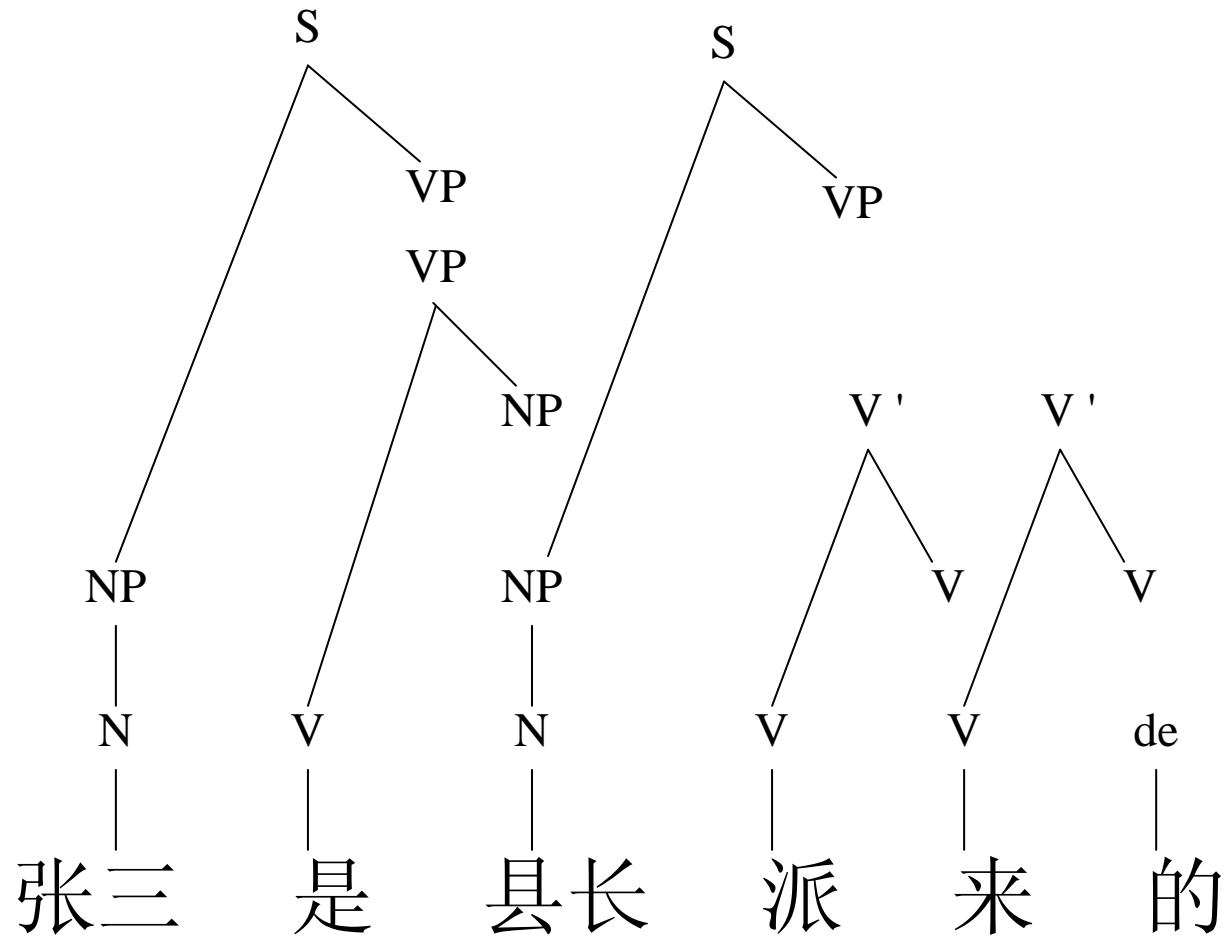
无规则可用  
回溯

# 左角分析法示例-44

- (1)  $S \rightarrow NP \ VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS \text{ 的}$
- (4)  $CS \rightarrow NP \ V'$
- (5)  $VP \rightarrow V \ NP$
- (6)  $V' \rightarrow V \ V$

使用规则

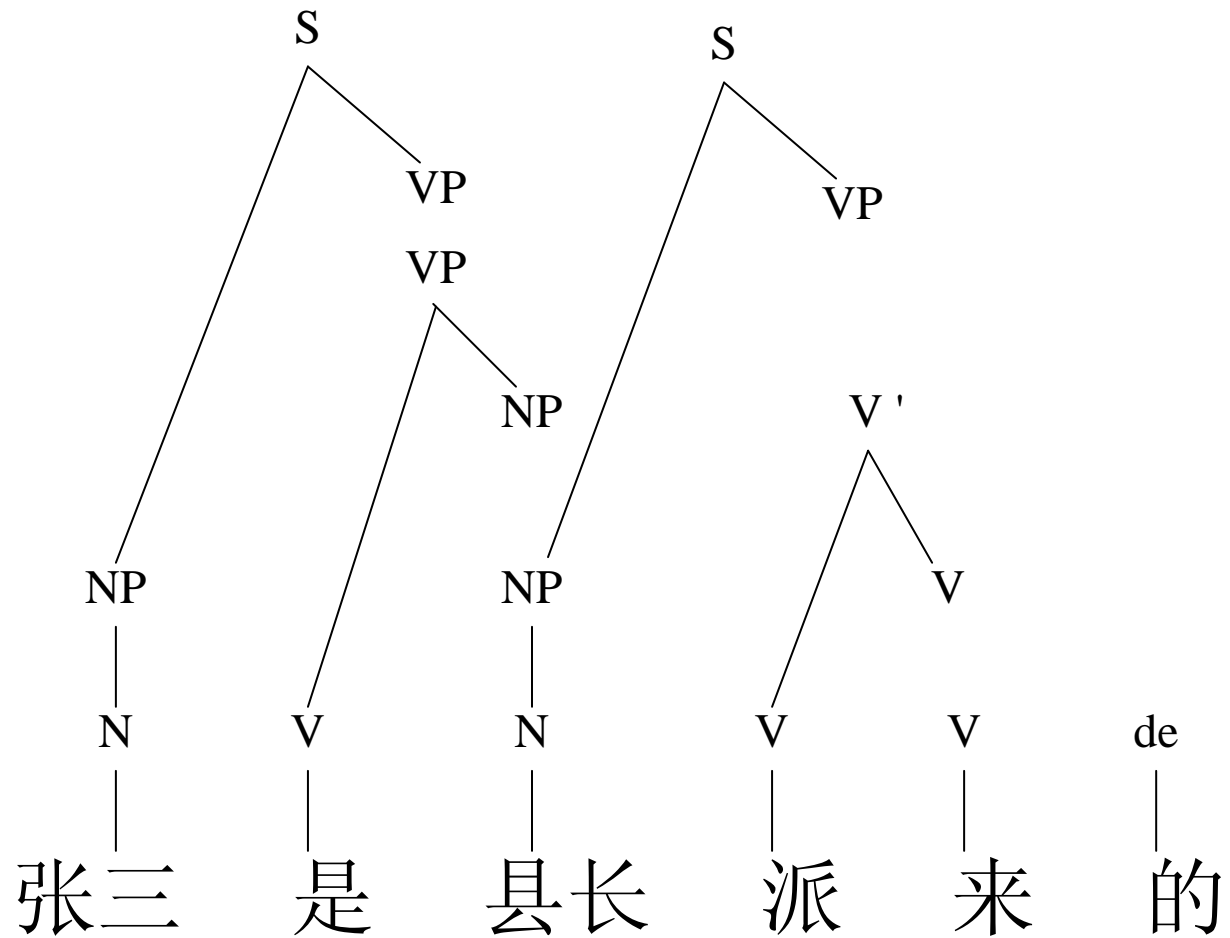
$V' \rightarrow V \ V$



# 左角分析法示例-45

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

无规则可用  
回溯

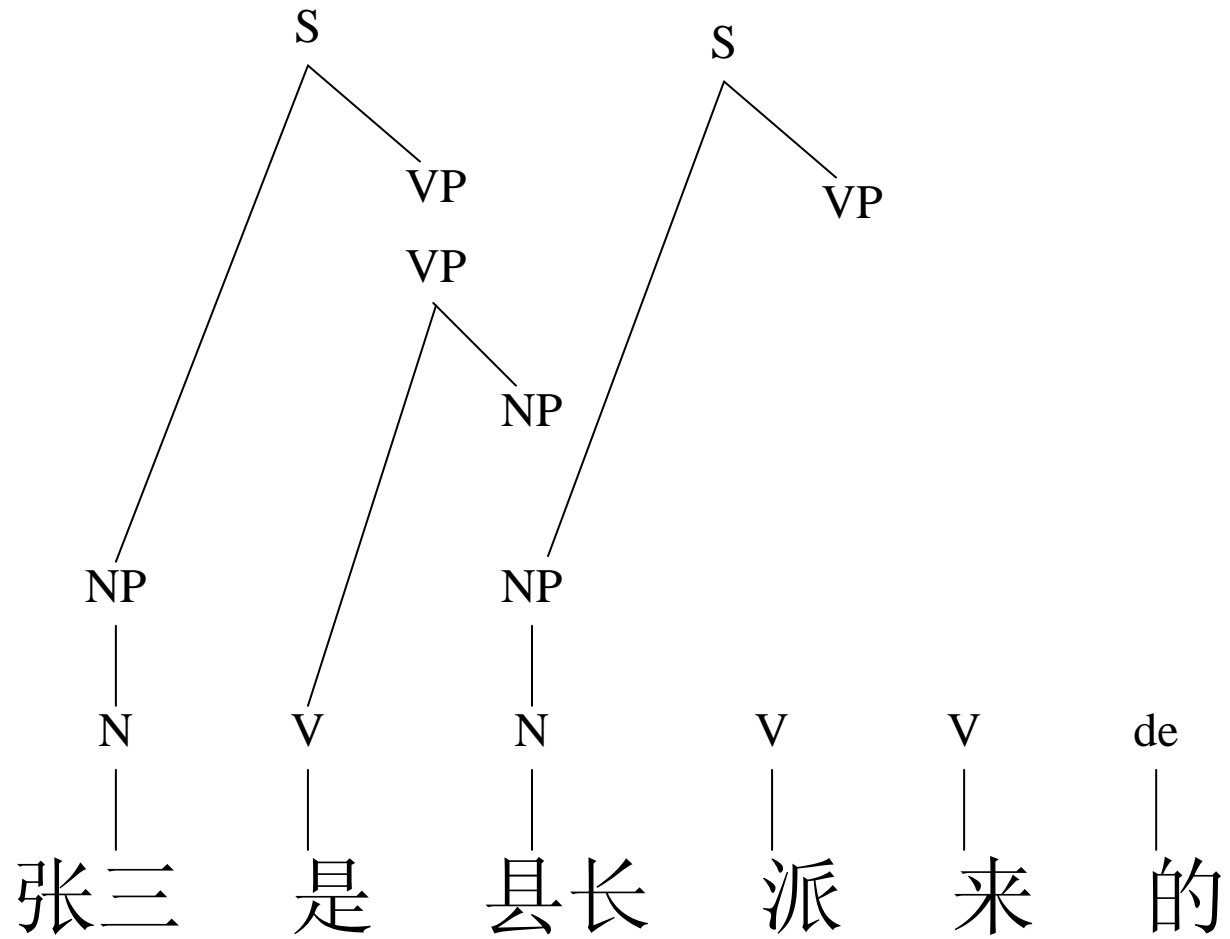




# 左角分析法示例-46

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

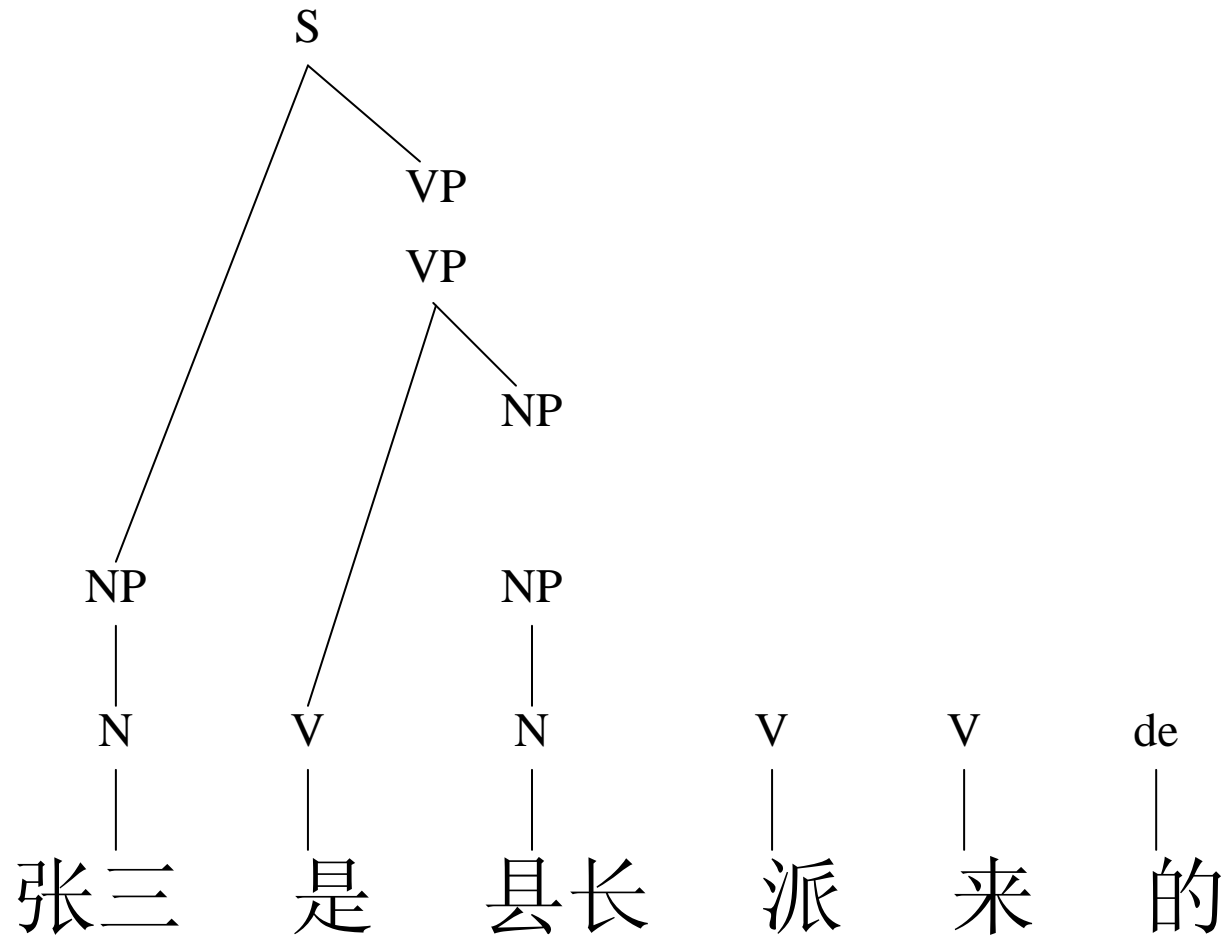
无规则可用  
回溯



# 左角分析法示例-47

- (1)  $S \rightarrow NP \ VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS \text{ 的}$
- (4)  $CS \rightarrow NP \ V'$
- (5)  $VP \rightarrow V \ NP$
- (6)  $V' \rightarrow V \ V$

无规则可用  
回溯

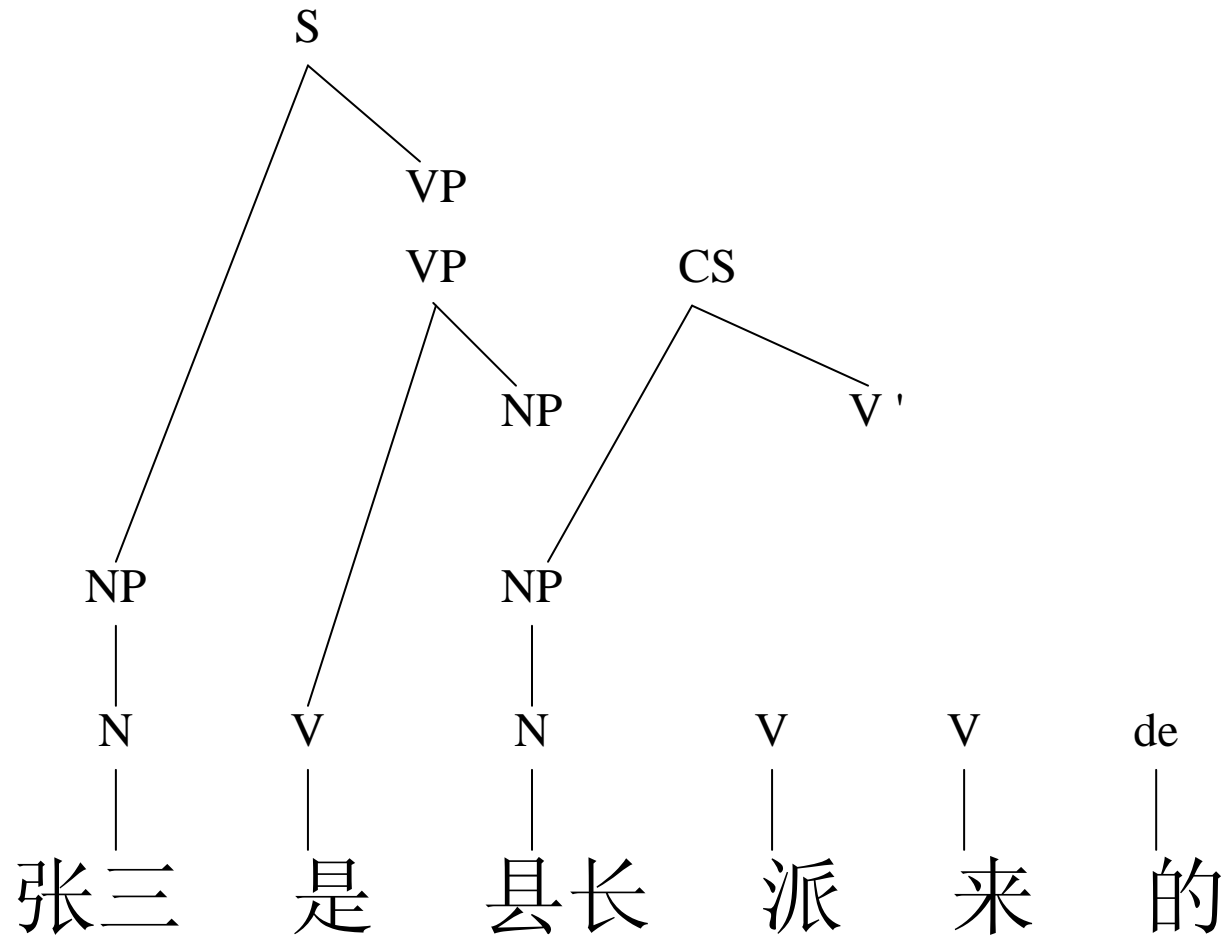


# 左角分析法示例-48

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则:

$CS \rightarrow NP V'$

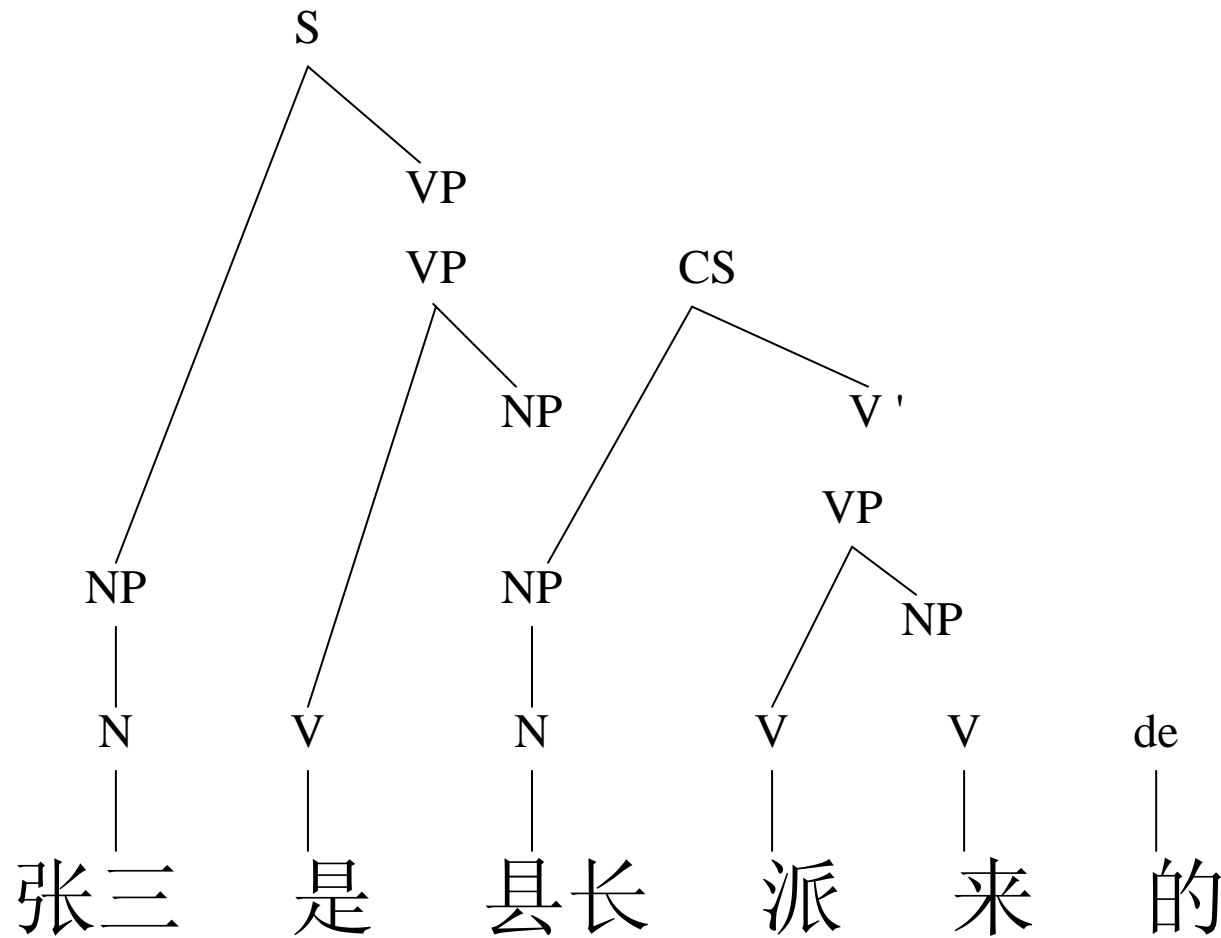


# 左角分析法示例-49

- (1)  $S \rightarrow NP \ VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS \ 的$
- (4)  $CS \rightarrow NP \ V'$
- (5)  $VP \rightarrow V \ NP$
- (6)  $V' \rightarrow V \ V$

使用规则:

$VP \rightarrow V \ NP$

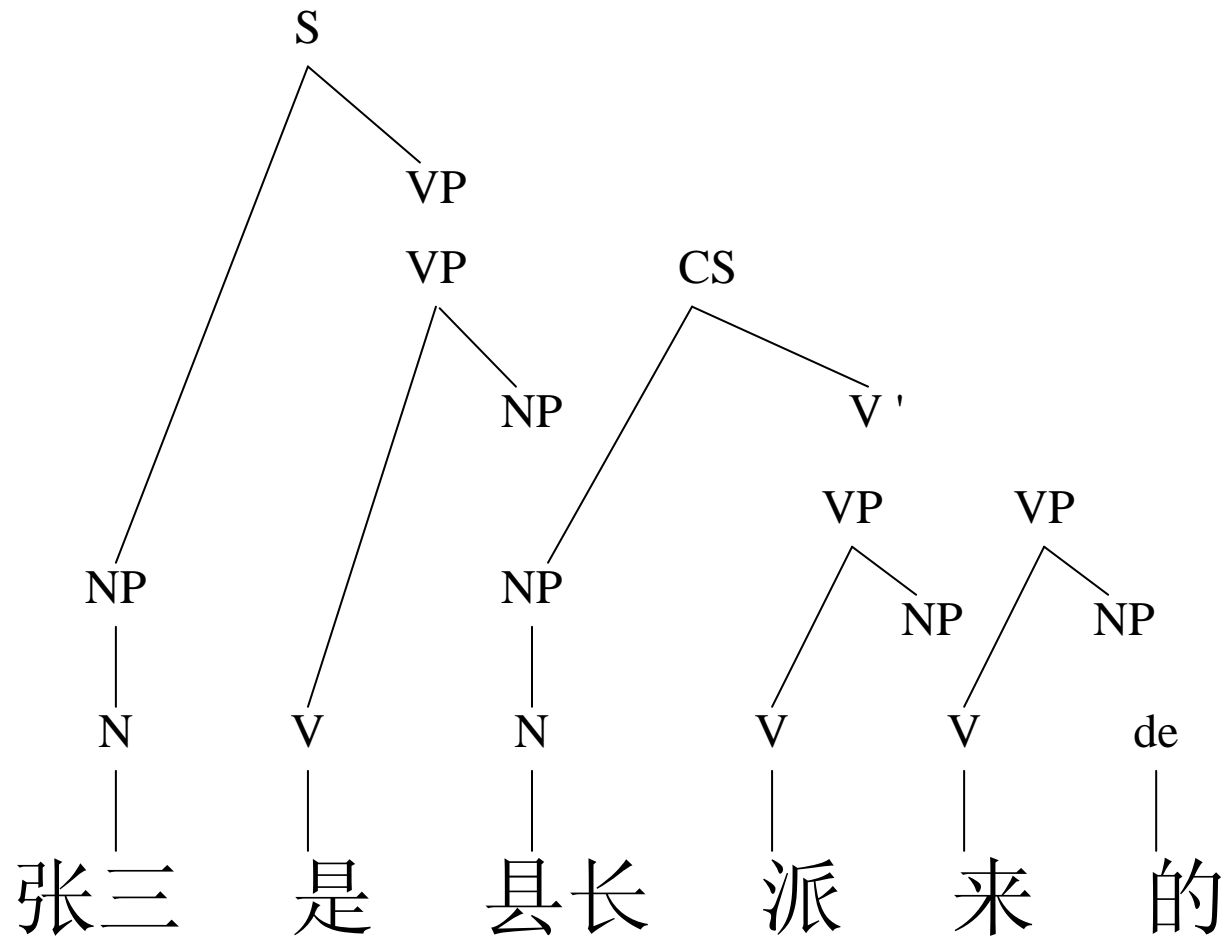


# 左角分析法示例-50

- (1)  $S \rightarrow NP \ VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS \text{ 的}$
- (4)  $CS \rightarrow NP \ V'$
- (5)  $VP \rightarrow V \ NP$
- (6)  $V' \rightarrow V \ V$

使用规则:

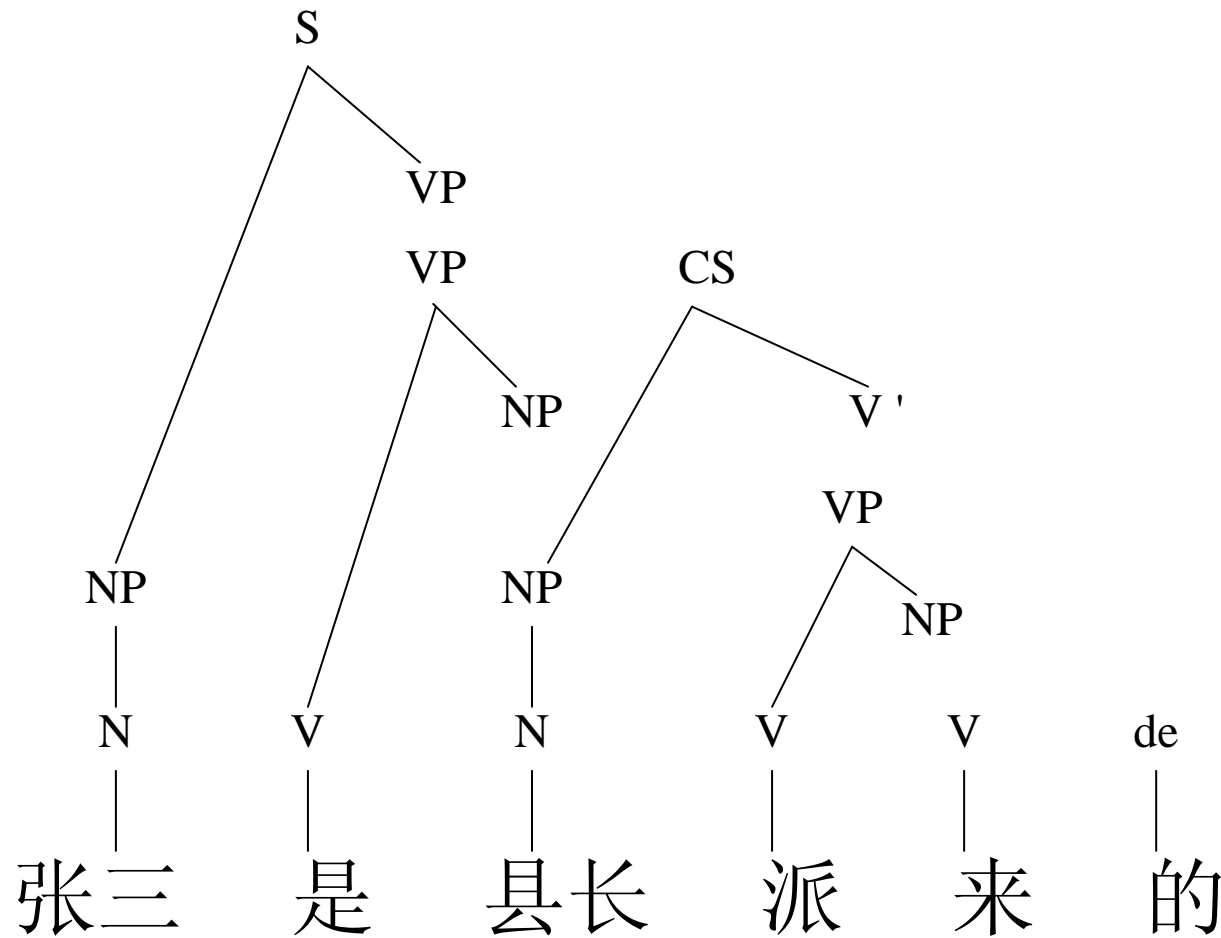
$VP \rightarrow V \ NP$



# 左角分析法示例-51

- (1)  $S \rightarrow NP \ VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS \text{ 的}$
- (4)  $CS \rightarrow NP \ V'$
- (5)  $VP \rightarrow V \ NP$
- (6)  $V' \rightarrow V \ V$

无规则可用  
回溯

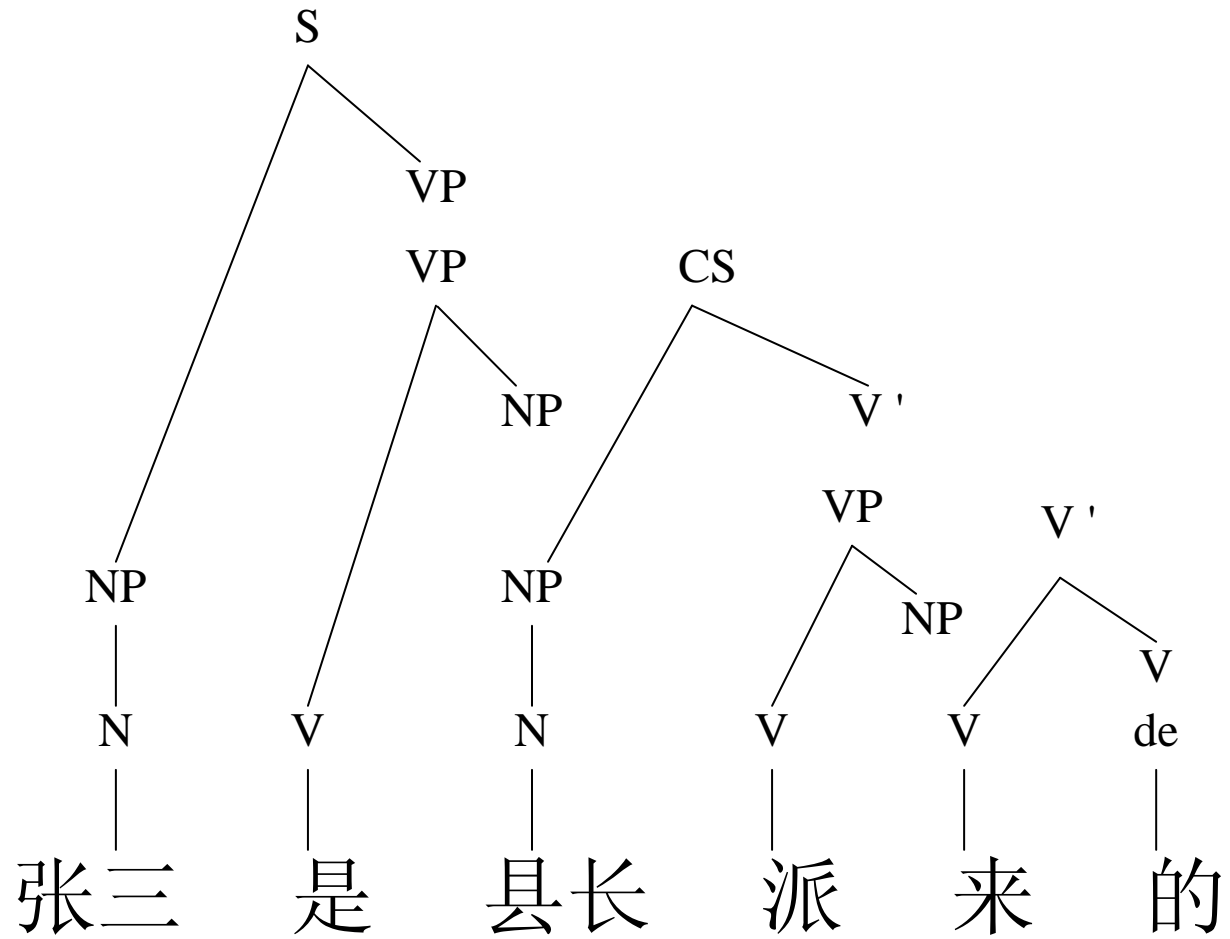


# 左角分析法示例-52

- (1)  $S \rightarrow NP \ VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS \text{ 的}$
- (4)  $CS \rightarrow NP \ V'$
- (5)  $VP \rightarrow V \ NP$
- (6)  $V' \rightarrow V \ V$

使用规则:

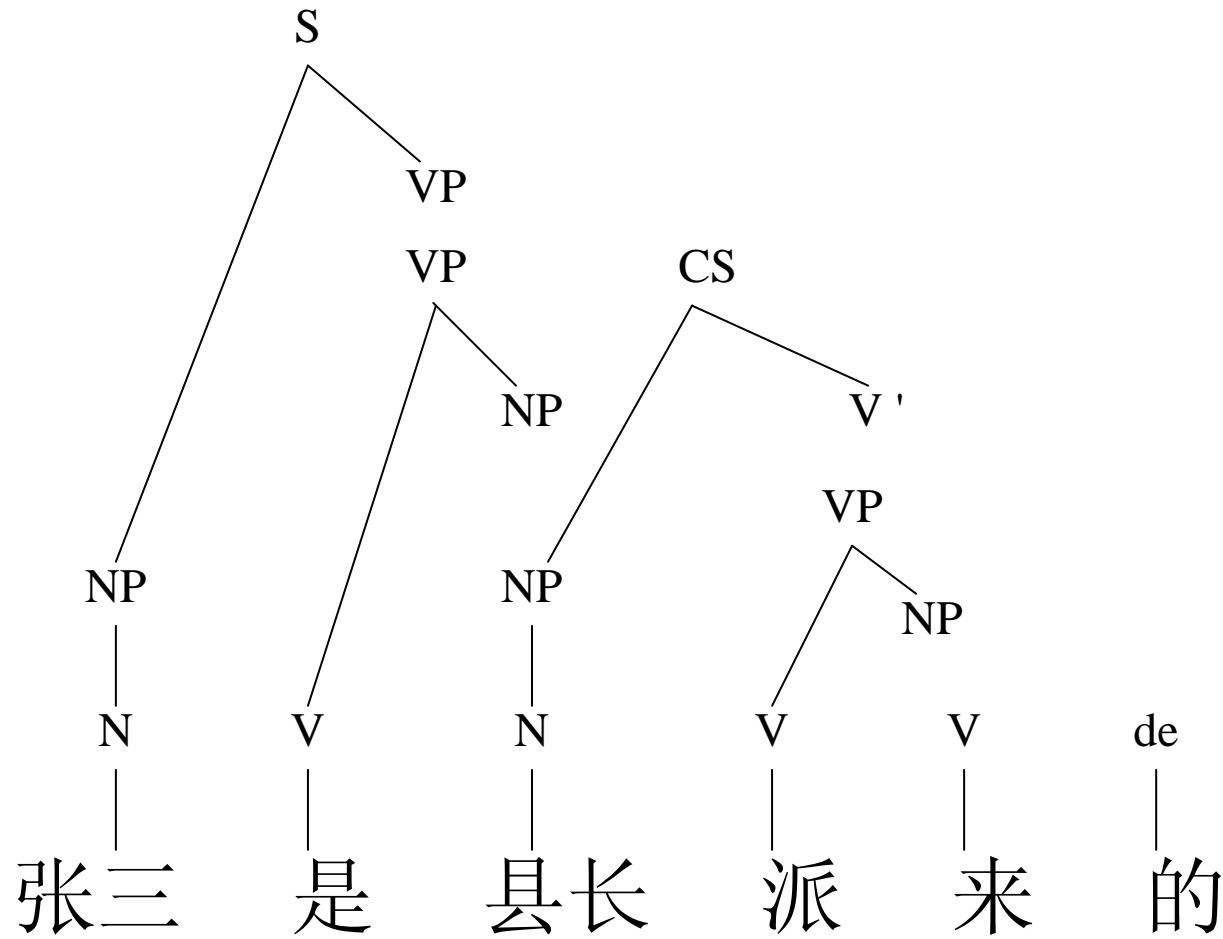
$CS \rightarrow NP \ V'$



# 左角分析法示例-53

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

无规则可用  
回溯

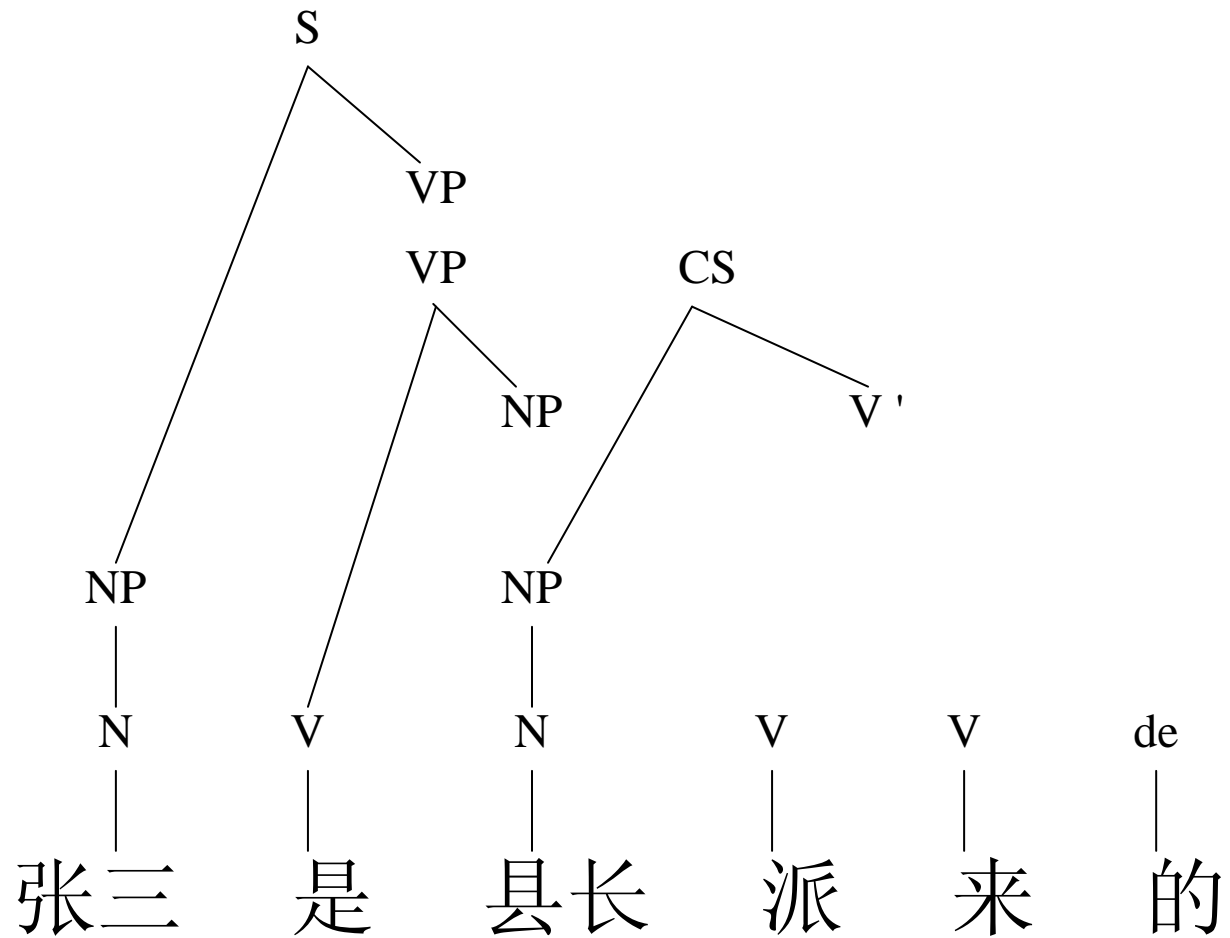




# 左角分析法示例-54

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

无规则可用  
回溯

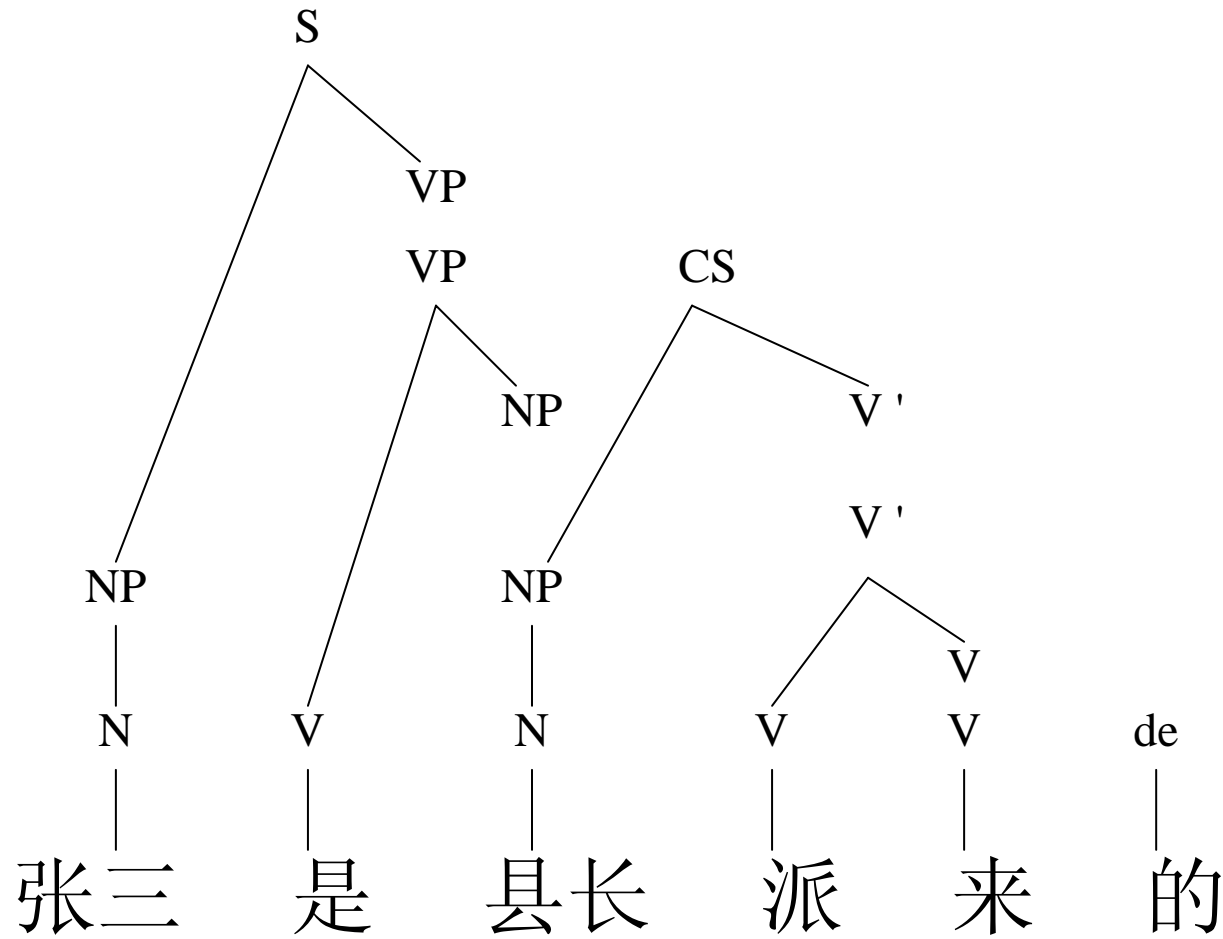


# 左角分析法示例-55

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则:

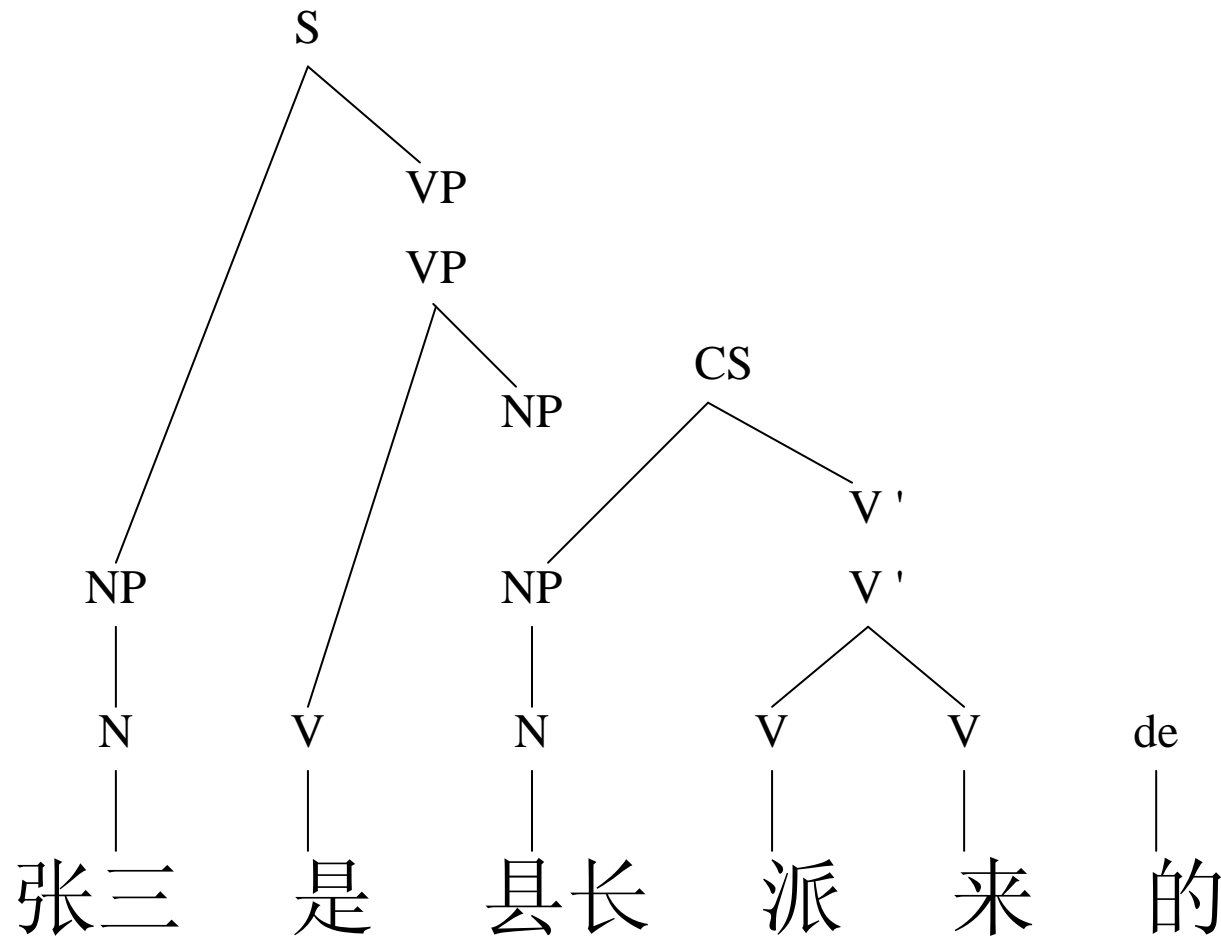
$V' \rightarrow V V$



# 左角分析法示例-56

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

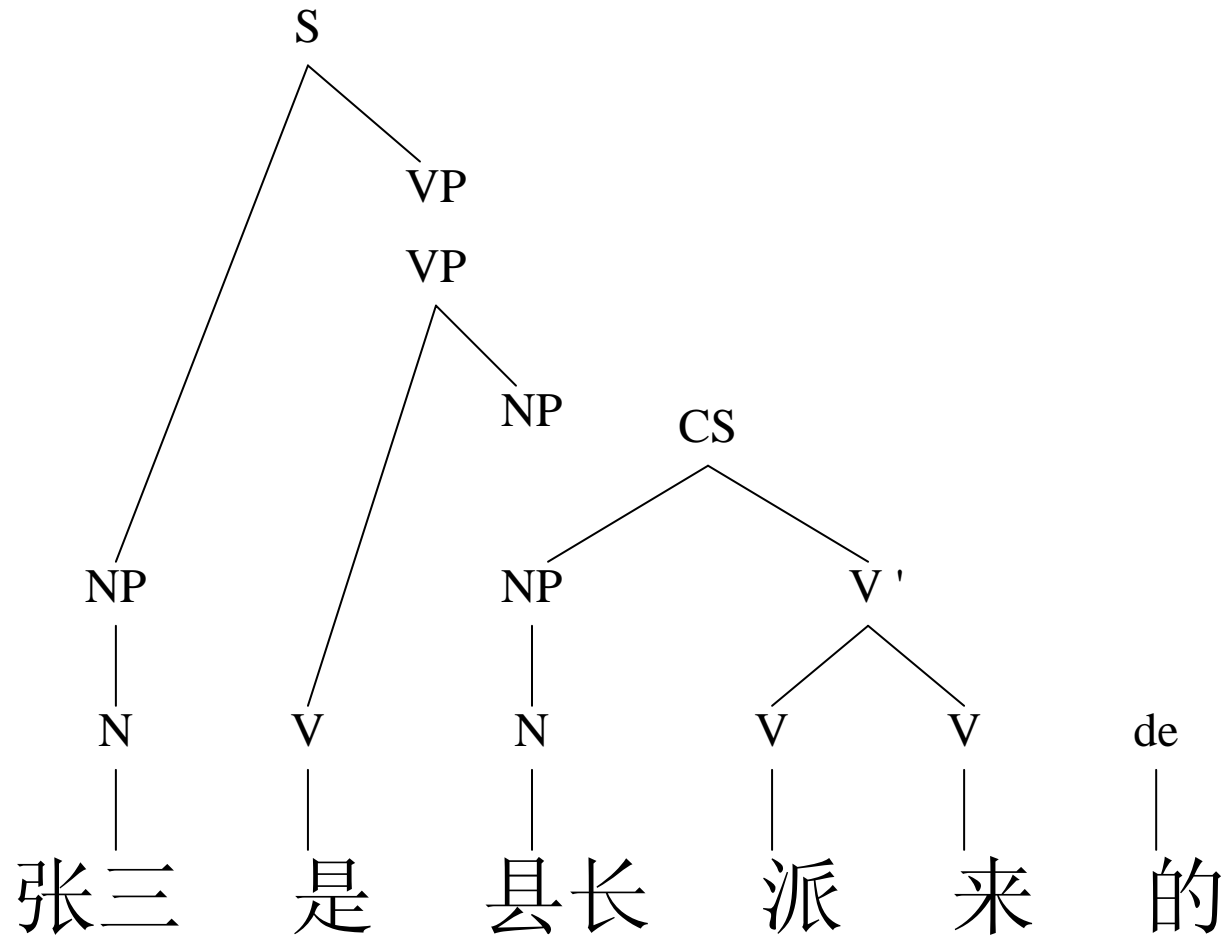
匹配成功



# 左角分析法示例-57

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

匹配成功

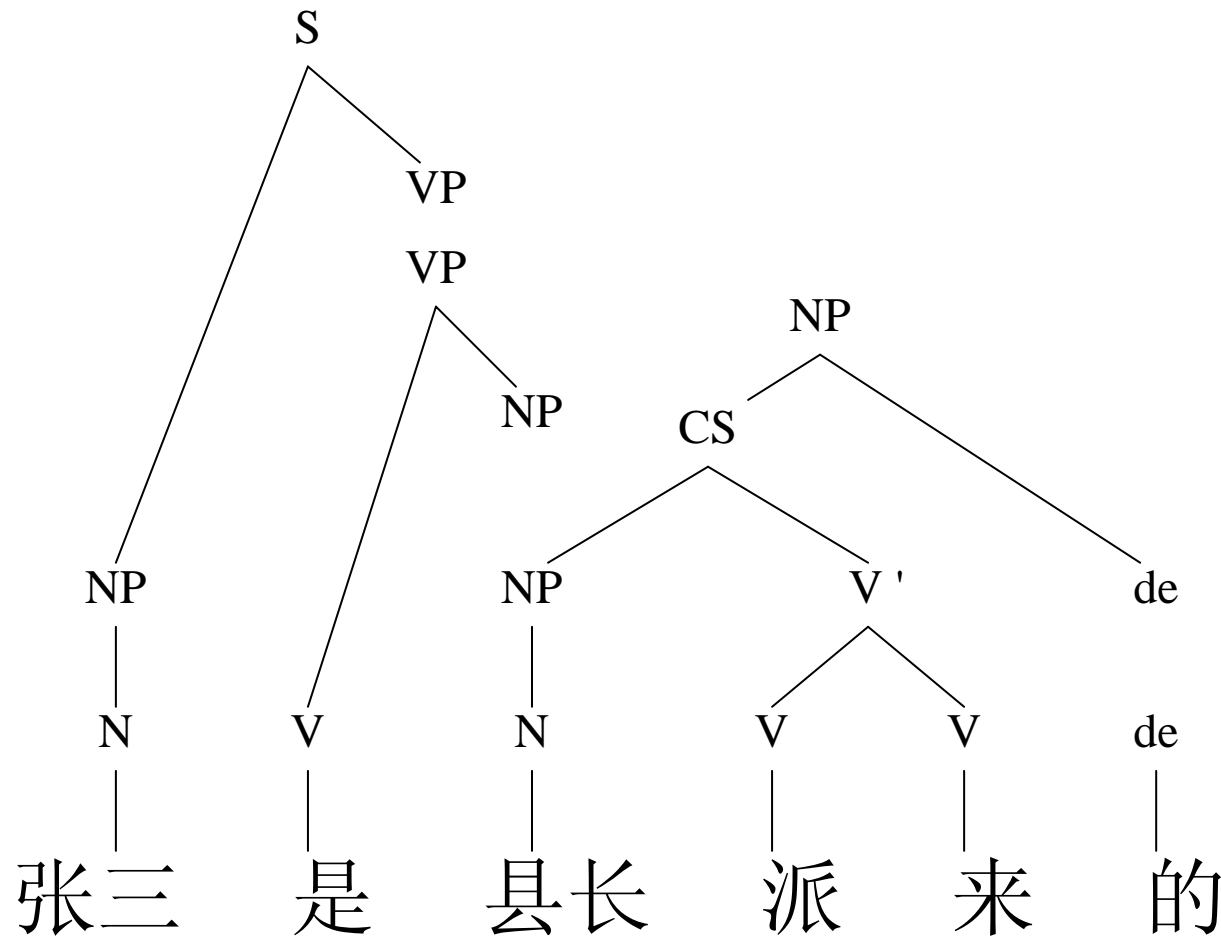


# 左角分析法示例-58

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则:

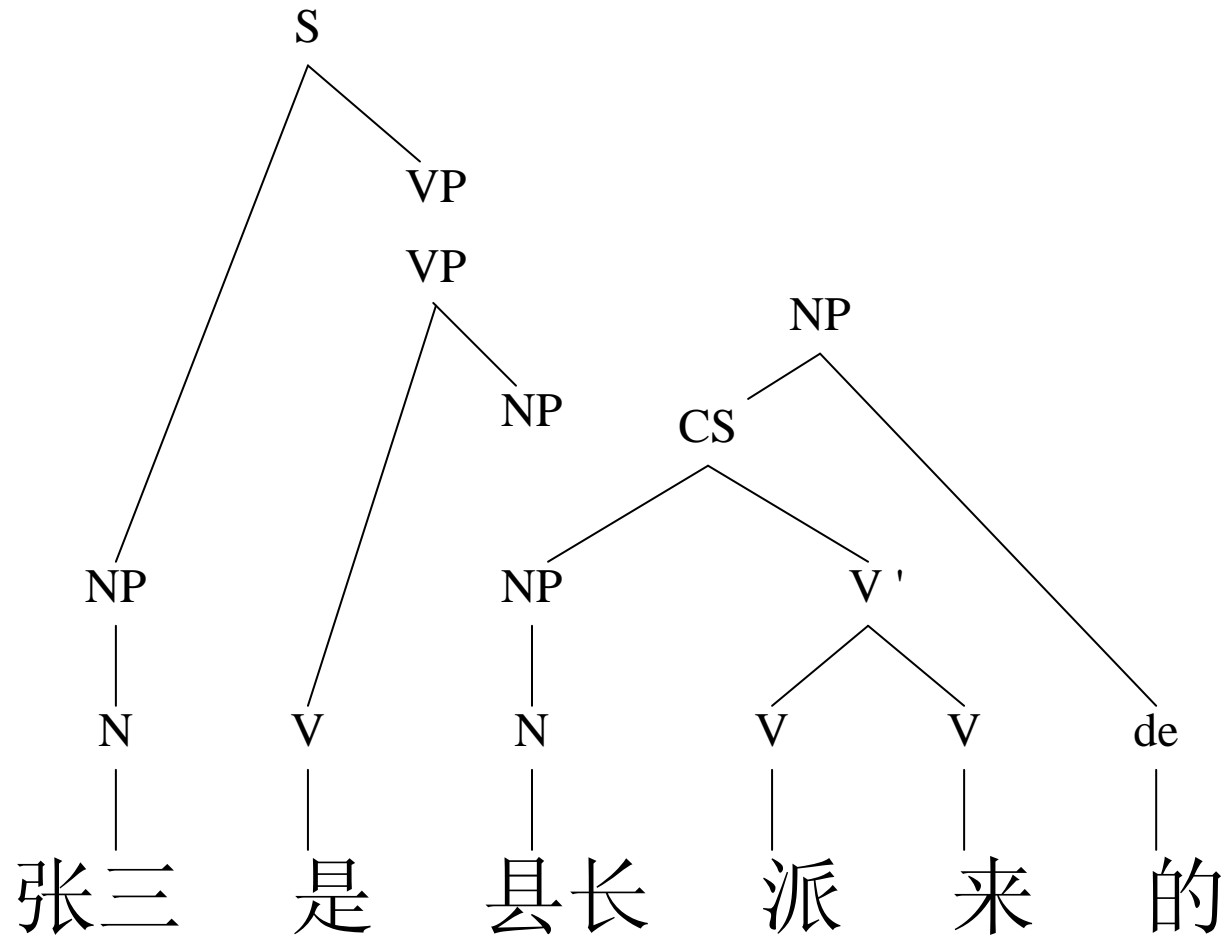
$NP \rightarrow CS$  de



# 左角分析法示例-59

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

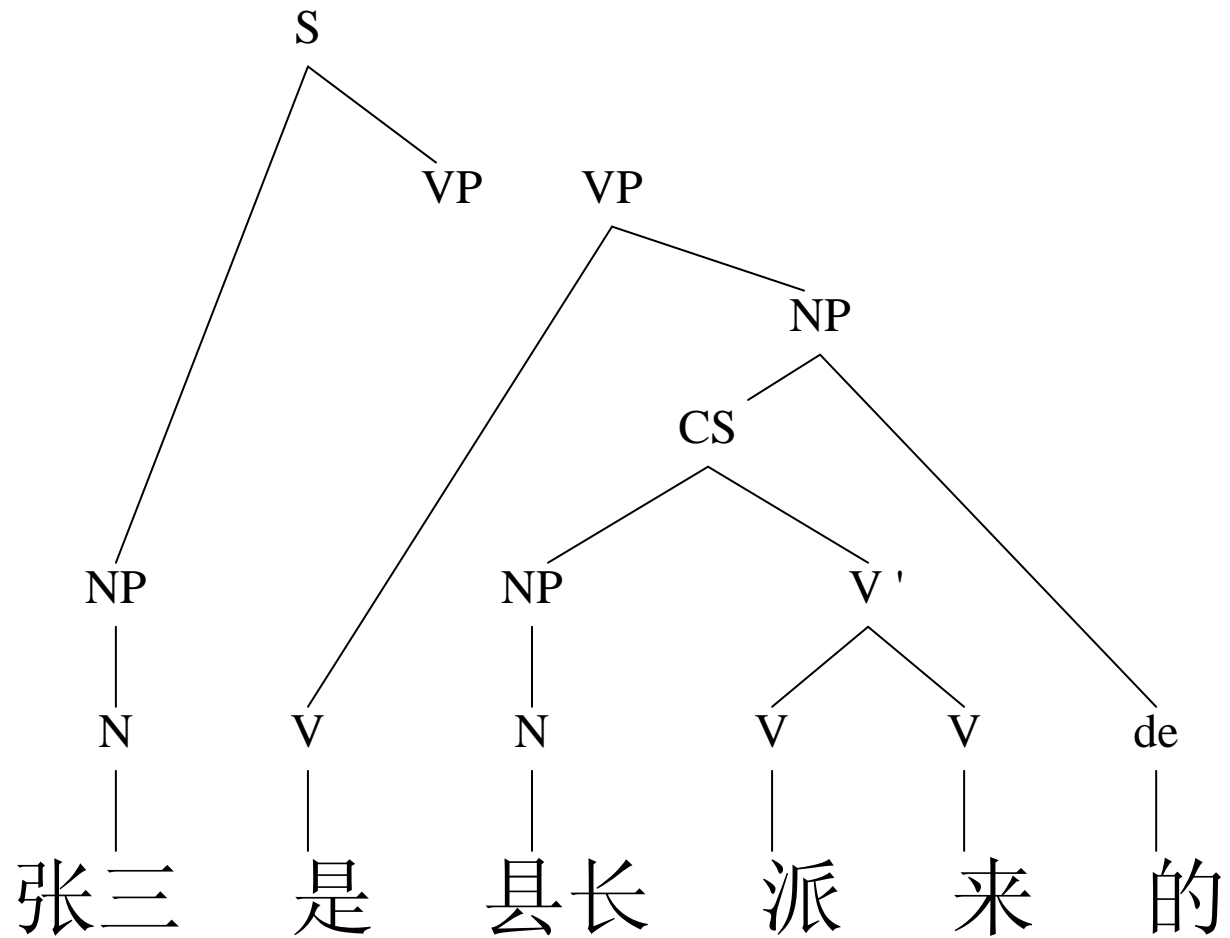
匹配成功



# 左角分析法示例-60

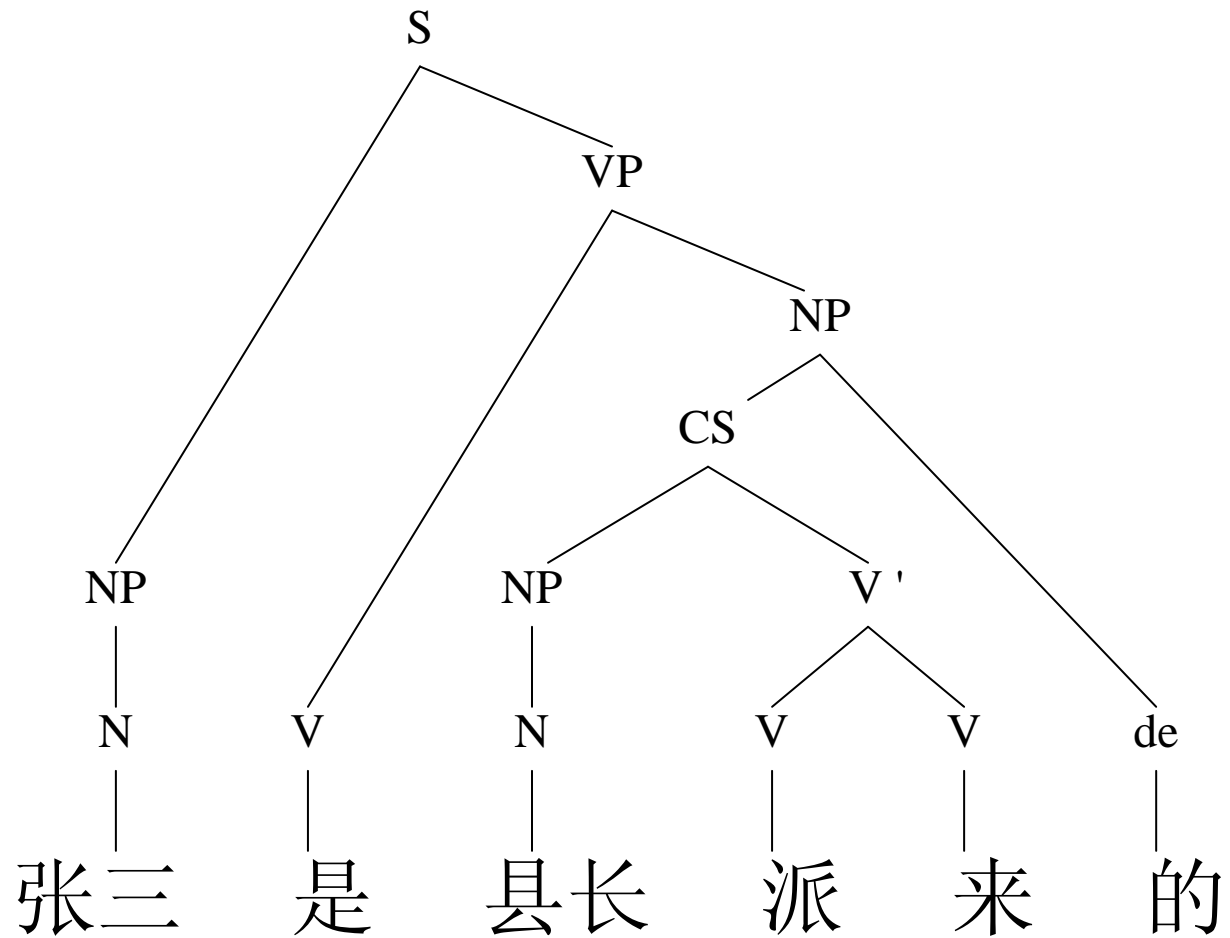
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

匹配成功



# 左角分析法示例-61

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



匹配成功  
分析结束