Comparisons on LR(k) and LL(k) Parsers

$\partial_{LR}([A \rightarrow \alpha.B\gamma, z]) = \{[B \rightarrow .\beta, v] \mid B \rightarrow \beta \in P, v \in First_k(\gamma z)\}$

$\partial_{LL}([A \rightarrow \alpha B.\gamma, v]) = \{[B \rightarrow \beta., v] \mid B \rightarrow \beta \in P\}$

$\chi_{LR}^{X}([A \rightarrow \alpha.X\gamma, v]) = \partial_{LR}^{*}([A \rightarrow \alpha X.\gamma, v])$

$\chi_{LL}^{X}([A \rightarrow \alpha X.\gamma, v]) = \partial_{LL}^{*}([A \rightarrow \alpha.X\gamma, y])$ where $v \in First_k(Xy)$

$M_{LR} = (C_{LR}, \Sigma, P_{LR}, \langle\varepsilon\rangle_{LR}, \{\langle\varepsilon\rangle_{LR}\langle S\rangle_{LR}\})$

$M_{LL} = (C_{LL}, \Sigma, P_{LL}, \langle\varepsilon\rangle_{LL}\langle S\rangle_{LL}, \{\langle\varepsilon\rangle_{LL}\})$

$\langle\varepsilon\rangle_{LR} := \partial_{LR}^{*}([S' \rightarrow .S, \varepsilon]) \in C_{LR};$

for $^{\forall}\langle\delta\rangle_{LR} \in C_{LR}$ **do**

for $^{\forall}[A \rightarrow \alpha.X\beta] \in \langle\delta\rangle_{LR}$ **where** $X \in N \cup \Sigma$ **do**

$\langle\delta X\rangle_{LR} := \partial_{LR}^{*}([A \rightarrow \alpha X.\gamma]) \in C_{LR};$

$\langle\delta\rangle_{LR} \cdot X \rightarrow \langle\delta X\rangle_{LR} \in P_{LR}$

$\langle\varepsilon\rangle_{LL} := \partial_{LL}^{*}([S' \rightarrow S., \varepsilon]) \in C_{LL};$

for $^{\forall}\langle\delta\rangle_{LL} \in C_{LL}$ **do**

for $^{\forall}[A \rightarrow \alpha X.\beta] \in \langle\delta\rangle_{LL}$ **where** $X \in N \cup \Sigma$ **do**

$\langle\delta X\rangle_{LL} := \partial_{LL}^{*}([A \rightarrow \alpha.X\beta]) \in C_{LL};$

$\langle\delta\rangle_{LL} \cdot X \rightarrow \langle\delta X\rangle_{LL} \in P_{LL}$

If $[B \rightarrow \beta., v] \in \langle\delta\beta\rangle_{LR}$, $[B \rightarrow .\beta, v] \in \langle\delta\rangle_{LR}$,

$[B \rightarrow \beta., v] \in \chi_{LR}{}^{\beta}([B \rightarrow .\beta, v])$, ${}^{\exists}[A \rightarrow \alpha.B\gamma, z] \in \langle\delta\rangle_{LR}$.э.

$[B \rightarrow .\beta, v] \in \partial_{LR}([A \rightarrow \alpha.B\gamma, z])$, $v \in First_k(\gamma z)$,

$\langle\delta\rangle_{LR}\langle\delta\cdot 1{:}\beta\rangle_{LR}\langle\delta\cdot 2{:}\beta\rangle\ldots\langle\delta\beta\rangle_{LR} \mid v \rightarrow \langle\delta\rangle_{LR}\langle\delta B\rangle_{LR} \mid v \in P_{LR}$.

$\langle\delta\rangle_{LR} \mid a \rightarrow \langle\delta\rangle_{LR}\langle\delta a\rangle_{LR} \mid \in P_{LR}$, *if* $[A \rightarrow \alpha.a\beta, y] \in \langle\delta\rangle_{LR}$.

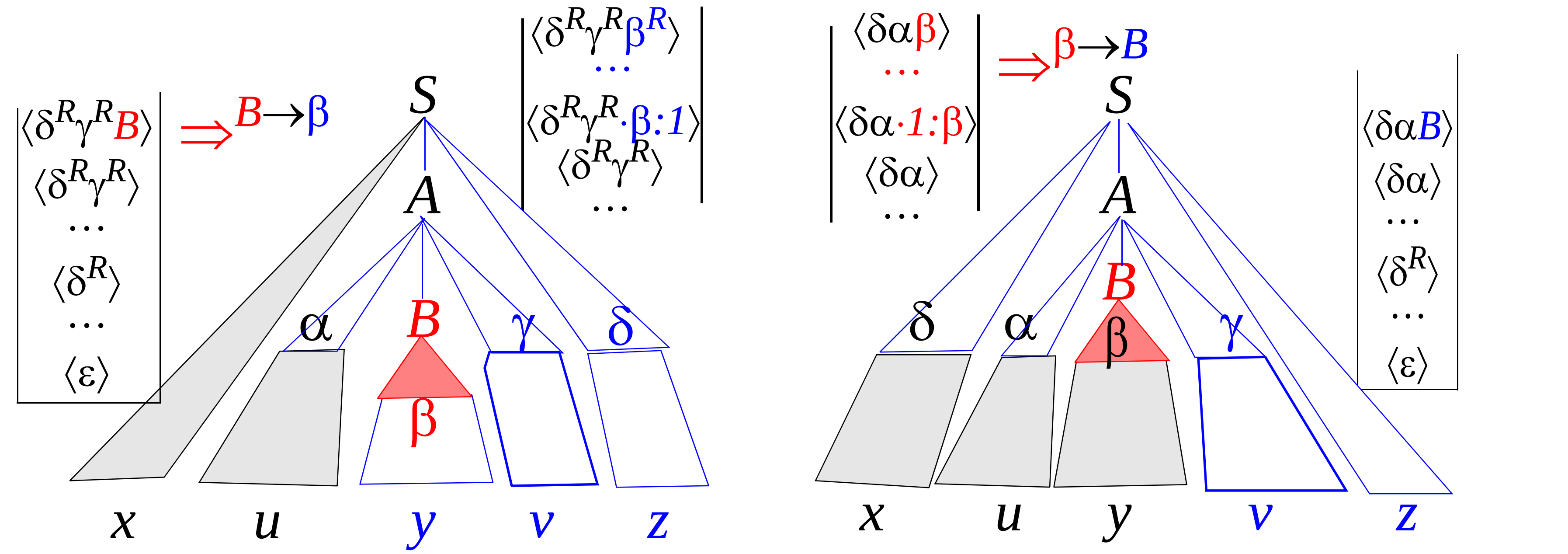
If $[B \rightarrow .\beta, y] \in \langle\delta^R\beta^R\rangle_{LL}$, $[B \rightarrow \beta., v] \in \langle\delta^R\rangle_{LL}$, *stack top is in right*

$[B \rightarrow \beta., z] \in \chi_{LL}{}^{\beta}([B \rightarrow .\beta, u]$, ${}^{\exists}[A \rightarrow \alpha B.\gamma, z] \in \langle\delta^R\rangle_{LL}$.э.

$[B \rightarrow \beta., z] \in \partial_{LL}([A \rightarrow \alpha B.\gamma, z])$, $u \in First_k(\beta z)$.

$\langle\delta^R\rangle_{LL}\langle\delta^R B\rangle_{LL} \mid y \rightarrow \langle\delta^R\rangle_{LL}\langle\delta^R\cdot\beta{:}1\rangle_{LL}\langle\delta^R\cdot(\beta{:}2)^R\rangle_{LL}\ldots\langle\delta^R\beta^R\rangle_{LL} \mid y \in P_{LL}$.

$\langle\delta\rangle_{LL}\langle\delta a\rangle_{LL} \mid a \rightarrow \langle\delta\rangle_{LL} \mid \in P_{LL}$, *if* $[A \rightarrow \alpha.a\beta, y] \in \langle\delta a\rangle_{LL}$.



$[A \to \alpha B.\gamma, v] \in \langle \delta^R \gamma^R \rangle$

B ↓

$[A \to \alpha.B\gamma, y] \in \langle \delta^R \gamma^R B \rangle$

$[B \to \beta., v] \in \partial(\langle \delta^R \gamma^R \rangle)$

… β ↓

$[B \to .\beta, y] \in \partial(\langle \delta^R \gamma^R \beta^R \rangle$

$[A \to \alpha.B\gamma, z] \in \langle \delta\alpha \rangle$

B ↓

$[A \to \alpha B.\gamma, z] \in \langle \delta\alpha B \rangle$

$[B \to .\beta, v] \in \partial(\langle \delta\alpha \rangle)$

… β ↓

$[B \to \beta., v] \in \partial(\langle \delta\gamma\beta \rangle$

Consider two produce actions *in LL(k) parsing*

$S \Rightarrow^*_{lm} xA\delta \Rightarrow^{A\to\alpha B\gamma}_{lm} x\alpha B\gamma\delta \Rightarrow^*_{lm} xuB\gamma\delta \Rightarrow^{B\to\beta}_{lm} xu\beta\gamma\delta \Rightarrow^*_{lm} xuyvz$

Assume $\alpha \Rightarrow^* u$, $B \Rightarrow \beta \Rightarrow^* y$, $\gamma \Rightarrow^* v$, $A \Rightarrow \alpha B\gamma \Rightarrow^* uyv$, and $\delta \Rightarrow^* z$.

$\$[\varepsilon][S] \mid xuyvz\$ \Rightarrow^* \$[\varepsilon][\delta{:}1]\ldots[\delta^R][\delta^R A] \mid uyvz\$$ stack top is in right!

$\Rightarrow^{A\to\alpha B\gamma}$ $\$[\varepsilon]\ldots[\delta^R][\delta^R\cdot\gamma{:}1]\ldots[\delta^R\gamma^R][\delta^R\gamma^R B]\ldots[\delta^R\gamma^R B\alpha^R] \mid uyvz\$$

$\Rightarrow^*$ $\$[\varepsilon]\ldots[\delta^R][\delta^R\cdot\gamma{:}1][\delta^R\cdot(\gamma{:}2)^R]\ldots[\delta^R\gamma^R][\delta^R\gamma^R B] \mid yvz\$$

$\Rightarrow^{B\to\beta}$ $\$[\varepsilon]\ldots[\delta^R][\delta^R\cdot\gamma{:}1]\ldots[\delta^R\gamma^R][\delta^R\gamma^R\cdot\beta{:}1]\ldots[\delta^R\gamma^R\beta^R] \mid yvz\$$

$\Rightarrow^*$ $\$[\varepsilon]\ldots[\delta^R][\delta^R\cdot\gamma{:}1]\ldots[\delta^R\gamma^R] \mid vz\$$

$\Rightarrow^*$ $\$[\varepsilon]\ldots[\delta^R] \mid z\$$ $\Rightarrow^* \$[\varepsilon] \mid \$$

$[A\to\alpha B.\gamma, v] \in \langle\delta^R\gamma^R\rangle_{LL}$ $[A\to\alpha.B\gamma, y] \in \langle\delta^R\gamma^R B\rangle_{LL}$

$[B\to\beta., v] \in \partial(\langle\delta^R\gamma^R\rangle_{LL})$

…

$[B\to.\beta, y] \in \langle\delta^R\gamma^R\beta^R\rangle_{LL}$

***Consider two reduce actions** in LR(k) parsing*

$S \Rightarrow^*_{rm} \delta A z \Rightarrow^{A\to\alpha B\gamma}_{rm} \delta\alpha B\gamma z \Rightarrow^*_{rm} \delta\alpha B v z \Rightarrow^{B\to\beta}_{rm} \delta u \beta v z \Rightarrow^*_{rm} \delta u y v z.$

$xuyvz \Leftarrow^*_{rm} \delta\alpha\beta v z \Leftarrow^{\beta\to B}_{rm} \delta\alpha B v z \Leftarrow^*_{rm} \delta\alpha B\gamma z \Leftarrow^{\alpha\beta\gamma\to A}_{rm} \delta A z \Leftarrow^*_{rm} S.$

$\$[\varepsilon] \mid xuyvz\$ \Rightarrow^* \$[\varepsilon][1{:}\delta]\ldots[\delta] \mid uyvz\$$ *stack top is in right!*

$\Rightarrow^* \quad \$[\varepsilon][1{:}\delta]\ldots[\delta][\delta\cdot 1{:}\alpha]\ldots[\delta\alpha] \mid yvz\$$

$\Rightarrow^* \quad \$[\varepsilon][1{:}\delta]\ldots[\delta][\delta\cdot 1{:}\alpha]\ldots[\delta\alpha][\delta\alpha\cdot 1{:}\beta]\ldots[\delta\alpha\beta][\delta\alpha B] \mid vz\$$

$\Rightarrow^{\beta\to B} \quad \$[\varepsilon][1{:}\delta]\ldots[\delta][\delta\cdot 1{:}\alpha]\ldots[\delta\alpha][\delta\alpha B] \mid vz\$$

$\Rightarrow^* \quad \$[\varepsilon][1{:}\delta]\ldots[\delta][\delta\cdot 1{:}\alpha]\ldots[\delta\alpha][\delta\alpha B{:}\gamma][\delta\alpha B\cdot 1{:}\gamma]\ldots[\delta\alpha B\gamma] \mid z\$$

$\Rightarrow^{\alpha\beta\gamma\to A} \$[\varepsilon][1{:}\delta]\ldots[\delta][\delta A] \mid z\$$ $\quad \Rightarrow^* \$[\varepsilon][S]] \mid \$$

$[A\to\alpha.B\gamma, z] \in \langle\delta\alpha\rangle_{LR}$ $\quad [A\to\alpha B.\gamma, z] \in \langle\delta\alpha A\rangle_{LR}$

$[B\to.\beta, v] \in \partial(\langle\delta\alpha\rangle_{LR})$

…

$[B\to\beta., v] \in \langle\delta\alpha\beta\rangle_{LR}$