EM

- sentence; $w_1 \dots w_n$
- vocabulary; $\mathcal{W}$
- modifier; $m \in \{1 \dots n\}$
- head; $h \in \{0 \dots n\}$
- direction; $\mathcal{D} = \{\mathrm{L}, \mathrm{R}\}$
- edge; $\mathcal{E} = \{$E(h, m!=–, dir, ADJ, cont=1)$,$ E(h, m=–, dir, ADJ, cont=1)$,$ E(h, dir, ADJ, cont=0)$\}$

  The first edge E(h, m!=–, ADJ, cont=1) is created when a Triangle whose head word is still taking children combines with a tringle whose headword has stopped taking children (TriStop) to form a trapezium.

  The edge E(h, m=–, ADJ, cont=1) is created when a Trapezium combines with a tringle whose headword has stopped taking children (TriStop) to form a Triangle.

  The edge E(h, dir, ADJ, cont=0) is created when a Triangle's headword stops taking children to form TriStop.
- marginals $p(edge)$

The probabilities

- $p(\mathrm{CONT}|w, dir, \mathrm{ADJ})$; $\mathrm{CONT} \in \{0, 1\}$, $w \in \mathcal{W}$, $\mathrm{ADJ} \in \{0, 1\}$, $dir \in \{0, 1\}$
- $c(\mathrm{CONT}, w, \mathrm{ADJ})$
- $p(u|v, dir, \mathrm{ADJ})$; $\mathrm{CONT} \in \{0, 1\}$, $u, v \in \mathcal{W}$, $\mathrm{ADJ} \in \{0, 1\}$
- $c(u, v, dir)$
- $c(u, v, dir, \mathrm{ADJ})$

Estimation Step
Fill in the c charts.

$$c(\mathrm{CONT} = 0, h, dir, \mathrm{ADJ} = 1) \leftarrow \sum p(\mathrm{E(h, dir, ADJ = 1, CONT = 0)})$$

$$c(\mathrm{CONT} = 0, h, dir, \mathrm{ADJ} = 0) \leftarrow \sum p(\mathrm{E(h, dir, ADJ = 0, CONT = 0)})$$

$$c(h, m, dir, \mathrm{ADJ}) \leftarrow \sum p(\mathrm{E(h, m! = --, dir, ADJ, CONT = 1)})$$

$$c(h, m, dir) \leftarrow \sum_{ADJ=\{0,1\}} p(\mathrm{E(h, m! = --, dir, CONT = 1)})$$

Maximization Step

$$p(\mathrm{CONT}|h, dir, \mathrm{ADJ}) \leftarrow \frac{c(\mathrm{CONT}, h, dir, \mathrm{ADJ})}{\sum_{m \in \mathcal{W}} c(h, m, dir, ADJ) + c(\mathrm{CONT}, h, dir, \mathrm{ADJ})}$$

$$p(m|h, dir) \leftarrow \frac{c(h, m, dir)}{\sum_{m \in \mathcal{W}} c(h, m, dir)}$$