Continuous Feature Structures

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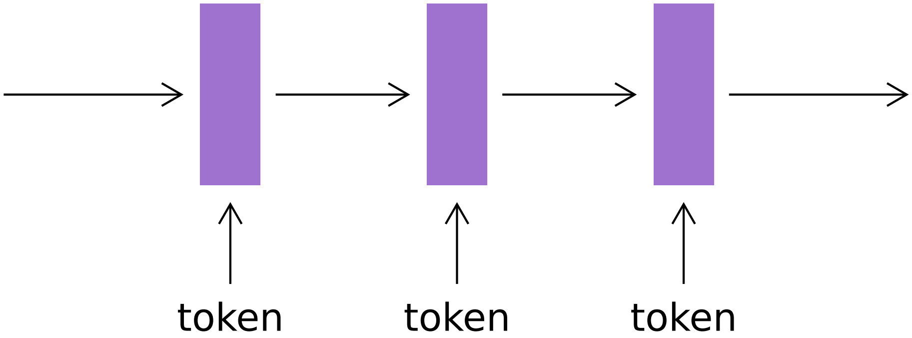
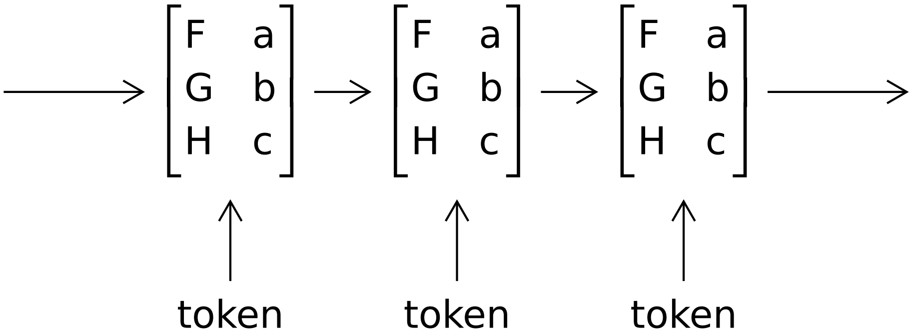
Delph-in 2017

Recursive Neural Networks



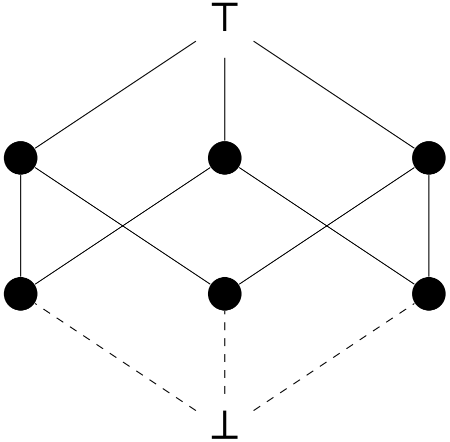
Recursive Neural Networks



Overview

- Continuous types
- Abstract feature structures
- Continuous abstract feature structures

"Trails" – Continuous Types



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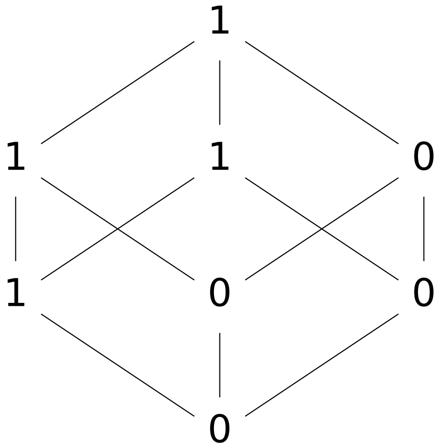

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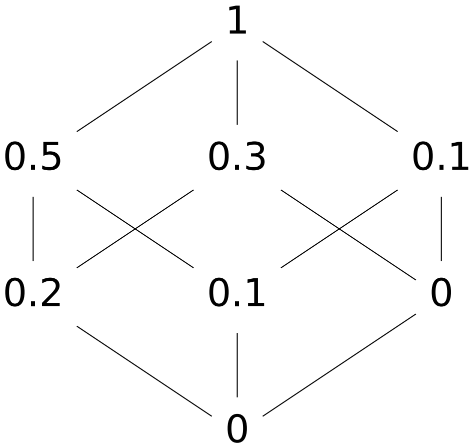

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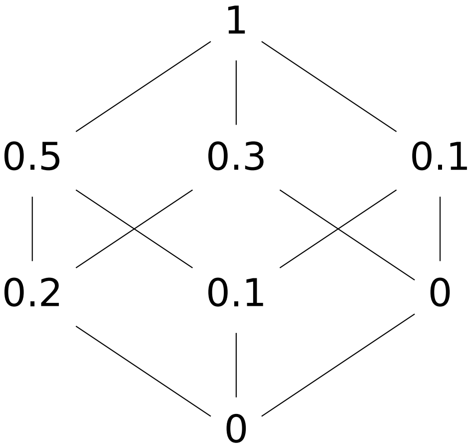
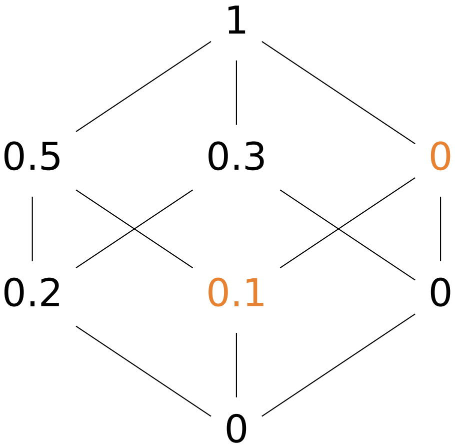


- $\tau : H \rightarrow [0, 1]$
- Decreasing with lower types
- $\tau(a \sqcup b) \geq \tau(a) + \tau(b) - 1$

"Trails" – Continuous Types



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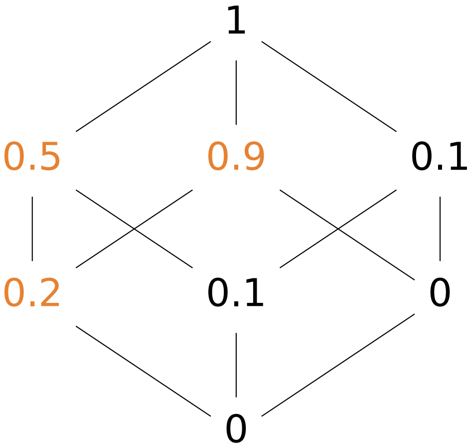

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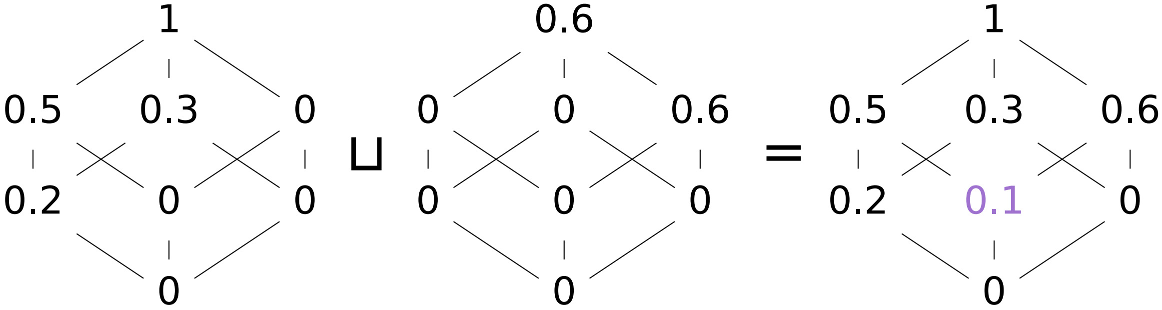
Trail Unification



Abstract Feature Structures

$$\begin{bmatrix} a & & \\ \mathrm{F} & \boxed{1}\ b & \\ \mathrm{G} & \begin{bmatrix} c & \\ \mathrm{H} & a \\ \mathrm{G} & \boxed{1} \end{bmatrix} & \end{bmatrix}$$

- paths $\{\epsilon$, F, G, GH, GG$\}$
- types $\{\epsilon{:}a$, F:b, G:c, GH:a, GG:$b\}$
- re-entrancies {(F, GG)}

Abstract Feature Structures

Given features F and type hierarchy H:

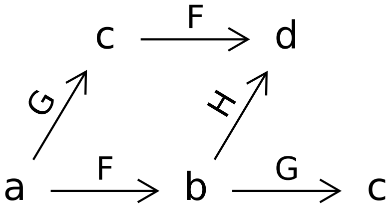
- paths $P \subset F^{\star}$, finite
- types $\theta : P \rightarrow H$
- re-entrancies $\approx : P \times P \rightarrow \{0, 1\}$

Abstract Feature Structures

Given features F and type hierarchy H:

- paths $P \subset F^{\star}$, finite
- types $\theta : P \rightarrow H$
- re-entrancies $\approx : P \times P \rightarrow \{0, 1\}$
- $\approx$ equivalence relation
- shorter paths exist: $\pi\alpha \in P \Rightarrow \pi \in P$
- $\approx$ propagates: $\pi\alpha \in P, \pi \approx \pi' \Rightarrow \pi'\alpha \in P, \pi\alpha \approx \pi'\alpha$
- θ respects $\approx$: $\pi \approx \pi' \Rightarrow \theta(\pi) = \theta(\pi')$

“Plumes” – Cts. Abstract Feature Structures



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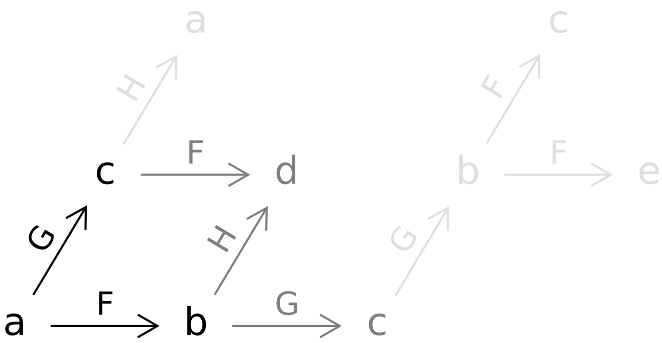

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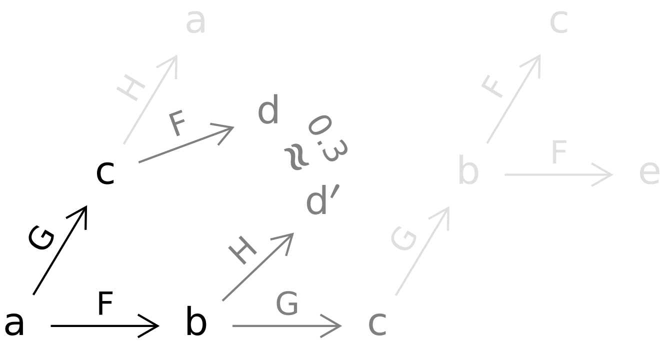

"Plumes" – Cts. Abstract Feature Structures

Given features F and type hierarchy H:

- types $\theta : F^\star \rightarrow H \cup \{0\}$, finite nonzero
- re-entrancies $\approx : F^\star \times F^\star \rightarrow \{0, 1\}$, finite nonzero

“Plumes” – Cts. Abstract Feature Structures

Given features F and trails $T(H)$ over type hierarchy H:

- types $\theta : F^\star \rightarrow T(H)$, finite nonzero
- re-entrancies $\approx : F^\star \times F^\star \rightarrow [0, 1]$, finite nonzero

“Plumes” – Cts. Abstract Feature Structures

Given features F and trails $T(H)$ over type hierarchy H:

- types $\theta : F^\star \to T(H)$, finite nonzero
- re-entrancies $\approx : F^\star \times F^\star \to [0, 1]$, finite nonzero
- $\approx(\pi_1, \pi_2) = \approx(\pi_2, \pi_1)$
- $\approx(\pi_1, \pi_3) \geq \approx(\pi_1, \pi_2) + \approx(\pi_2, \pi_3) - 1$
- $\theta(\pi)(\top) \geq \theta(\pi\alpha)(\top)$
- $\approx(\pi_1\alpha, \pi_2\alpha) \geq \approx(\pi_1, \pi_2) + \theta(\pi_1\alpha)(\top) - 1$
- $\max_t |\theta(\pi_1)(t) - \theta(\pi_2)(t)| \leq 1 - \approx(\pi_1, \pi_2)$