Note on Match-seeking and Match-repelling particles

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Between two primitive particles

Let us consider two V-particles which are not composite – they are given with their semantic signatures respectively:

$ssig(V') = [\boldsymbol{p}'_0\;\; \boldsymbol{a}'_{0,1}\;\; \boldsymbol{p}'_1\;\; \boldsymbol{p}'_0\;\; \boldsymbol{a}'_{0,2}\;\; \boldsymbol{p}'_2\;\; \boldsymbol{p}'_0\;\; \boldsymbol{a}'_{0,3}\;\; \boldsymbol{p}'_3\;\; \dots\;\; \boldsymbol{p}'_i\;\; \boldsymbol{a}'_{i,n}\;\; \boldsymbol{p}'_n]$

$ssig(V'') = [\boldsymbol{p}''_0\;\; \boldsymbol{a}''_{0,1}\;\; \boldsymbol{p}''_1\;\; \boldsymbol{p}''_0\;\; \boldsymbol{a}''_{0,2}\;\; \boldsymbol{p}''_2\;\; \boldsymbol{p}''_0\;\; \boldsymbol{a}''_{0,3}\;\; \boldsymbol{p}''_3\;\; \dots\;\; \boldsymbol{p}''_j\;\; \boldsymbol{a}''_{j,m}\;\; \boldsymbol{p}''_m]$

Here each of the quantities $\boldsymbol{p}$ denotes the property signature vector of the corresponding property P of the V particle. The vector $\boldsymbol{a}_{r,s}$ denotes the signature of the property association particle $A_{r,s}$ which binds to a pair of properties P_r and P_s in the property graph $\mathcal{P}$ of the V particle.

Match-seeking particle MA binds to a subgraph $\mathcal{S}$ of the property graph $\mathcal{P}$ of the V particle.

There is a closeness condition which needs to be obeyed in order the particle MA to bind to the particle V.

Binding matrix of a match-seeking particle

The match-seeking particle MA exposes a binding matrix $mbind(MA)$:

$$mbind(MA) = [\mathbf{B}_1\; \mathbf{B}_2\; \mathbf{B}_3\;\; \dots\;\; \mathbf{B}_q]$$

$$\mathbf{B}_1 = [\boldsymbol{p}_0\;\; \boldsymbol{a}_{0,1}\;\; \boldsymbol{p}_1]\,, \mathbf{B}_2 = [\boldsymbol{p}_0\;\; \boldsymbol{a}_{0,2}\;\; \boldsymbol{p}_2]\,, \mathbf{B}_3 = [\boldsymbol{p}_0\;\; \boldsymbol{a}_{0,2}\;\; \boldsymbol{p}_3]\,, \dots,\; \mathbf{B}_q = [\boldsymbol{p}_p\;\; \boldsymbol{a}_{p,q}\;\; \boldsymbol{p}_q]$$

Obviously, each of the blocks $\mathbf{B}_i$ is $N \times 3$ matrix where N is the dimension of the semantic space.

Closeness condition for a bind between match seeking particle and primitive semantic particle

Let us denote by $sfil(MA, V)$ the following diagonal matrix which will be named *Filter matrix* of the match seeking particle:

$$sfil(MA, V) = \begin{bmatrix} I_1 & & & & & & \\ & 0 & & & & & \\ & & I_2 & & & & \\ & & & 0 & & & \\ & & & & \cdot & & \\ & & & & & \cdot & \\ & & & & & & I_k \end{bmatrix}$$

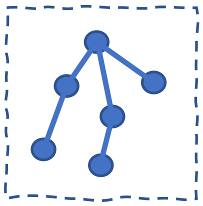
Here $I_i, i = 1,2, \dots, k$ are identity matrices which represent the regions of interest in the semantic signature matrix of V to the match seeking particle MA.

The regions of interest $sreg(MA, V)$ in the semantic signature of V are obtained by multiplying $sfil(MA, V)$ with $ssig(V)$:

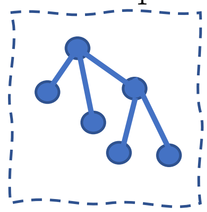
$$sreg(MA, V) = sfil(MA, V) \times ssig(V)$$

Between two semantic structures

Let us have two semantic structures S_1 and S_2.



S_1



S_2

Let the semantic signature of S_1 is given with:

$$ssig(S_1) = [\mathbf{V}_1 \; \mathbf{A}_{1,2} \; \mathbf{V}_2 \; \mathbf{A}_{1,3} \; \mathbf{V}_3 \; \ldots \; \mathbf{A}_{r,p} \; \mathbf{V}_p]$$

and the semantic signature of S_2 is given with:

Between a primitive V particle and a semantic structure S