The Concept of Semantic Space, Affinity Space and Execution Space

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The Concept of Semantic Space

Every V-particle is adorned with a semantic signature which can be represented by a DAG where each node contents can be represented as an integer number and each arc is assigned a weight which is a positive real number. Equivalently, the semantic signature can be represented as a matrix (refer to the document Thought Synthesis for details). Every semantic structure is represented by its semantic signature. The weights of the arcs in its semantic signature represent confidence values which are not normalized. The Semantic space is a metric space where the metric (norm) is the semantic distance denoted by $sdist$. The semantic distance is defined recursively as:

Let us denote the semantic distance between two particles V_{a_1} and V_{b_1} with $sdist(V_{a_1}, V_{b_1})$.
Let us evaluate the semantic distance between V_{a_1} and V_{b_1}.

$$\begin{array}{c} V_{a_1} \\ / \, w \\ V_{a_2} \end{array}$$

Here V_{a_1} is connected to V_{a_2} with an arc having a weight w. Let us assume that the $sdist\left(V_{a_1}, V_{b_1}\right) < \varepsilon$ where ε is a small positive number. Let us denote the new compound V particle with $V_{new} = [V_{a_1} \xrightarrow{w} V_{a_2}]$. We want the following asymptotic behavior to hold true when we make the weight arbitrary small:

$sdist(V_{new}, V_{a_2}) < \varepsilon$ when $w \to 0$

We want also $sdist(V_{new}, V_{a_2}) < \varepsilon$ when $sdist(V_{a_2}, V_{\emptyset})$ is small enough. Here $V_{\emptyset}$ represents the null semantic particle which has no meaning i.e. it is arbitrarily close in terms of semantic distance to any other semantic structure or particle. The last asymptotic relation is equivalent to disregarding V-particles which do not enrich the semantic structure of the resulting compound particle.
Example:

$text(V_{new}) = "Yes, he\ is\ Dimitar, yup"$
$text\left(V_{a_1}\right) = "Yes, he\ is\ Dimitar",\ text\left(V_{a_2}\right) = "yup"$

Possible ways to define semantic distance and equivalence between the semantic DAG G and signature matrix S

We want to create the signature matrix S from the semantic DAG G in such way that we preserve the asymptotic closeness properties of the semantic space defined earlier. Let us define the signature matrix of V particle in such a way that each row correspond to a property from the property graph $G(V)$ of V particle traversed *in order*. For details on the Property Graph of semantic particle consult *Properties and Dependent Properties* paragraph in the document Inference and Execution.
Using the definition of signature of semantic structure we will define ε-closeness of two semantic structures. The semantic structures S1 and S2 are ε-close if there exist a difference matrix $D = ssig(S_1) -$

Notes on Semantic Distance

Semantic distance between two structure is a measure of the connectedness between them.

Let us study the following problem-

We have an enclosing semantic structure (context) C_1 and we have associated with C_1 two separate semantic structures S_1 and S_2. Let the semantic structure S1 is represented by the DAG G1 composed p V-particles and q A-particles. The set of the V-particles in G1 will be denoted by $\mathfrak{S}_V = \left\{V_{k_1}, V_{k_2}, \dots, V_{k_p}\right\}$