ArLLecta:
A Decentralized **Sense-To-Sense** Network

[P-S Standard]

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Abstract.
A purely decentralized Internet would allow its users to create or get access to a public or private informational worldwide network with a guarantee not to be spammed, interrupted or attacked by a third party at all.
Semantic Normalizer (SN) would improve the user's Internet search experience and diminish search time greatly. **SN eliminates double-answering and double meaning problems.** It is a part of the architectural solution of ArLLecta and requires no additional pre-installations.
We propose a solution to the nontransparent and domain-centered Internet problem using a decentralized sense-to-sense network. S2S network allows creating public or private zones for business or personal needs. The data of each user, individual or corporate, is decoded and published only by direct permission. The architecture of S2S network prevents the centralization of its data by a single user. However, each user can create or join or leave any zone.

The main task of the S2S network is to give each user a possibility for a quick **sense-focused search** and save its data from unauthorized third parties.

1. Introduction

We are pretty much confident that there is no perspective practical possibility for achieving a sense-focused result as soon as the man is required to fill some tag-based website field. The introduction and usage of meta-tags of the HTML webpage prove this statement.

The structure of a digital document is usually updated on a regular basis. With updating, the sense of a single phrase or sentence can be changed significantly. Therefore, the mechanism of sense searching and associations between network content must exist and be turned on dynamically.

2. Problem

In an attempt to create artificial intelligence, humankind face with tons of problems that look unfeasible. Many worldwide engineers and IT specialists focus primarily on standardization of the presentation of digital data. *However, the core principles of forming human knowledge do not follow a predetermined pattern or mental template.*

In the context of the World Wide Web, there are three key technologies (standards) that might be the main barrier for creating a Truly Intellectual and Self-Learning Internet for humans and machines as well. Here are URI, HTTP, and HTML.

URI.

URI has two forms of presentation.

URN identifies a resource by name in a specific namespace. For example, URN for a book is specified by its unique edition number. Whereas, URN for an electronic device is specified by its serial number, etc.
The problem is that URN gives no information about:

1. associative relationship between two or more URNs.
2. existing duplicates of a unique URN.
3. location of a specific URN.
4. the authenticity of a URN.
5. area of use of a URN.

URL specifies both the access mechanism and network location. For example, URL such as http://www.example.com/author/main_page.html specifies location "www.example.com/author/main_page.html" accessed by the mechanism (protocol) "HTTP".
The problem is that URL gives no information about:

1. the degree of data relevance of a URL.
2. associative relationship between two or more URLs.
3. area of use of a specific URL.
4. authenticity and ownership of a URL.
5. semantic weight of a specific URL towards other URLs.

In other words, besides the name of a data resource and its network address, URN, as well as URL, *describe nothing semantic or associative that might be useful for qualitative analytics or predictive prognoses.*

HTTP.

First, HTTP is a client-server protocol. It allows a third party server to store personal user data. In other words, there is *no chance for a single user to get information nowadays on the Internet without sharing its data.*

Second, the main resource HTTP works on is URI. As we already know, URI *does not provide any sense-focused or resource-to-resource related data.* It works by only names and locations.

Third, HTTP-message consists of three main parts: starting line, headers, and message body. The headers cover a number of functionalities among which resource type, encoding, authorization, cache-control, range, location, etc. But it still *lacks a mechanism for sense-disposition between different HTTP-queries* (do not be confused with the content-disposition header).

Besides abovesaid, HTTP is the very overloaded protocol and does not have an architectural perspective for the determination of URI authenticity.

HTML.

HTML is a tag-based markup language. It provides a means to create a *structured document* by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes, and other items. Each HTML document can have such meta-tags as keywords and description. These meta-tags define the meta-data of the website. Tags and meta-data were intended to help classify websites and their data by topic, subject, sense, etc. But **the problem is that** HTML document still:

1. does not separate internal website data by topic
2. does not give a mechanism for clear and correct website description
3. does not realize a sense-to-sense approach between internal website data and external related links as well.

One of the non-commercial organizations (W3C) recommends a solution (RDF) for "*representing metadata about Web resources, such as the title, author, and modification date of a Web page, copyright and licensing information about a Web document, or the availability schedule for some shared resource*" [5]. "*RDF is based on the idea that the things being described have properties which have values…*". The organization uses the triple-based concept "subject-predicate-object". For example,

"**`http://www.example.org/index.html`** `has a` **`creator`** `whose value is` **`John Smith`**"

where RDF terms for the various parts of the statement are:

- the *subject* is the URL `http://www.example.org/index.html`
- the *predicate* is the word "creator"
- the *object* is the phrase "John Smith"

It is also declared that "*RDF is about making* machine-processable *statements*". RDF technology is considered as one of the basic instrument for encoding semantics of the website data. *But* **the problem is that** *RDF has a structural defect in nature*.

Let's consider the abovesaid example in details.

Variant 1:

"**`John Smith`** `is the` **`creator`** `of a website which has value` **`http://www.example.org/index.html`**"

where RDF terms for the various parts of the statement are:

- the *subject* is the phrase "John Smith"
- the *predicate* is the word "creator"
- the *object* is **undefined** (the part that identifies the value of the property is called the object [3]).

Variant 2:

"**`John Smith`** `is the` **`creator`** `of`

`http://www.example.org/index.html`”

where RDF terms for the various parts of the statement are:

- the *subject* is the phrase "John Smith"
- the *predicate* is the word "creator"
- the *object* is **undefined** (the part that identifies the value of the property is called the object [3]).

Both variants show clear that all three examples have the same semantics but interpreted differently by the "subject-predicate-object" concept.

Moreover, the semantics of a website can be realized by HTML-tags paradigm without the usage of RDF-format:

```
            <subject1>John Smith</subject1>
               is a
            <predicate1>creator</predicate1>
               of
   <predicate2:predicate1><subject2>website<subject2/><predicate2/>
               which has value
<object1:predicate2>http://www.example.org/index.html<object1/>.
```

In terms of first-order logic (predicate logic)[4], all three abovesaid examples can be formulated by a single expression:

*CREATOR(*John Smith, http://www.example.com/index.html*),*

where CREATOR – predicative symbol,

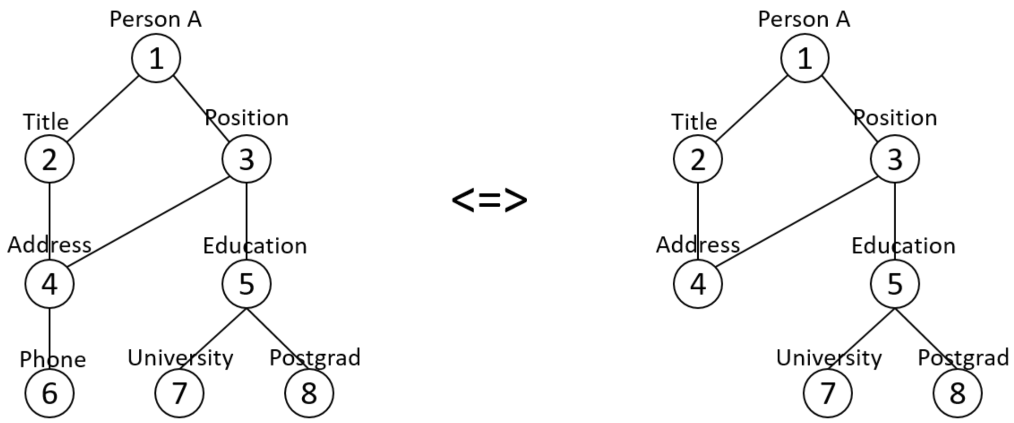
John Smith, http://www.example.com/index.html – individual or constant symbols.

In other words, while there is the number of the variants of a single-sense sentence, a mechanism of its semantic interpretation **must be unique**.

The number of data-models and search algorithms use graph-based architecture. However, in terms of sense consistency, there are sufficient difficulties in the presentation of an object and its properties by the graph model.

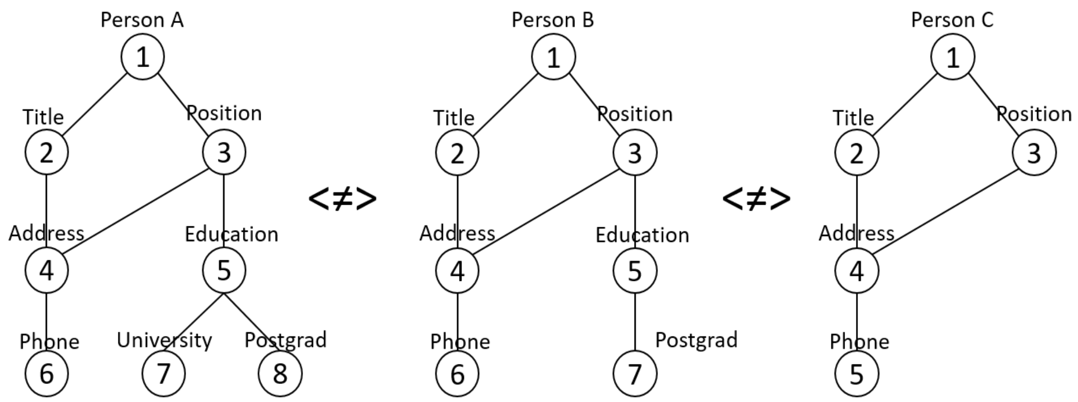
Let's consider the following example.

Graph model



The figure above presents the personal records of an employee in a corporate system. The employee has standard profile fields: position, title, education obtained, home address, phone number, university attended, and postgraduate status. In the graph model, each edge determines the subjective relationship between two vertices. As for the directed graph, the root vertice (Person A) is a parent vertice for other children ones. As we see in the figure above, the removal of one vertice (Phone) did not change the root vertice. However, in the context of Sense Theory (S2S Network), removal of even one single vertice may drastically change the relationship scheme between all the vertices and the root one as well.

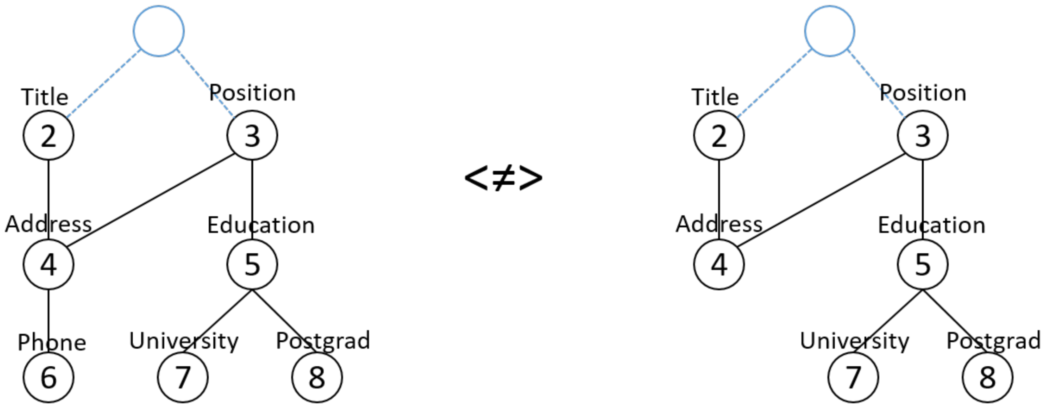
S2S model



Person A, Person B, and Person C are the zero-objects, $\circledcirc_A$, $\circledcirc_B$, and $\circledcirc_C$ respectfully.

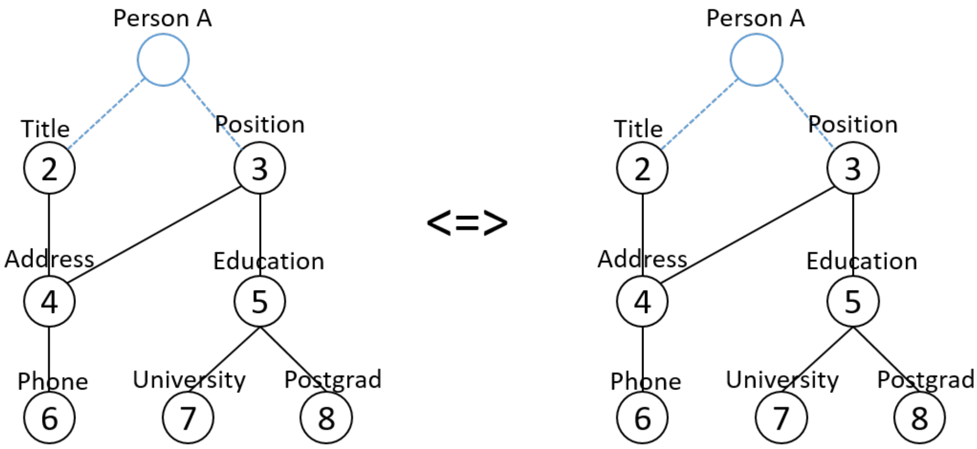
Consider one case, ‘removal of the root vertice’:

Graph model



After the removal of the root vertice in a graph model, the subjective relationship between children vertices becomes unspecified.

S2S model



In the case of S2S model, all the children vertices remain to be semantically tied. This assertion comes from the existence of a sense limit of vertices set.

Indeed,

$$\lim_{S} \not{S}_7 = \circledcirc_{\text{Person A}}$$

where Person A is a zero-object.

The uniqueness of the S2S model is that each pair of any vertices can have own zero-object and form a Sense Set as well.

Time complexity of graph-based algorithm is about O(b^d), whereas for S2S-based algorithms we have O($\log n$).

3. Solution

3.1. The derivative of semantic disunion.

Let's S_f to be defined on the set of Ꞩ_{N} or $\text{Ꞩ}_{O(N)}$. Then for any $S_f(\text{Ꞩ}_{M})$ defined on Ꞩ_{M} ($\text{Ꞩ}_{O(M)}$), where M < N, *semantic derivative* $S_f(\text{Ꞩ}_{N})$ *on disunion* is

$$S_f(\text{Ꞩ}_{N}) \ominus S_f(\text{Ꞩ}_{M}) = S_f(\text{Ꞩ}_{K})$$

or

$$S_f^{diff}(\text{Ꞩ}_{N}) = [S_f(\text{Ꞩ}_{N}) \ominus S_f(\text{Ꞩ}_{M})] = S_f(\text{Ꞩ}_{K}),$$

where N > K.

The equivalent form is

$$\underset{\ominus}{\text{diff}}\,[S_f(\text{Ꞩ}_{N})]_M = S_f(\text{Ꞩ}_{N}^{(\text{diff})} \ominus \text{Ꞩ}_{M}) = S_f(\text{Ꞩ}_{K})$$

It is important to remember that No-Sense Set of $S_f^{(diff)}$ is always put on the left side from the operator of semantic disunion as

$$\text{Ꞩ}_{N} \ominus \text{Ꞩ}_{M} \neq \text{Ꞩ}_{M} \ominus \text{Ꞩ}_{N}$$

Axiom:

"The semantic derivative on disunion always has a limit:

$$\lim_{S} \text{Ꞩ}_{K} = \circledcirc \quad \text{for} \quad \underset{\ominus}{\text{diff}}\,[S_f(\text{Ꞩ}_{N})]_M$$

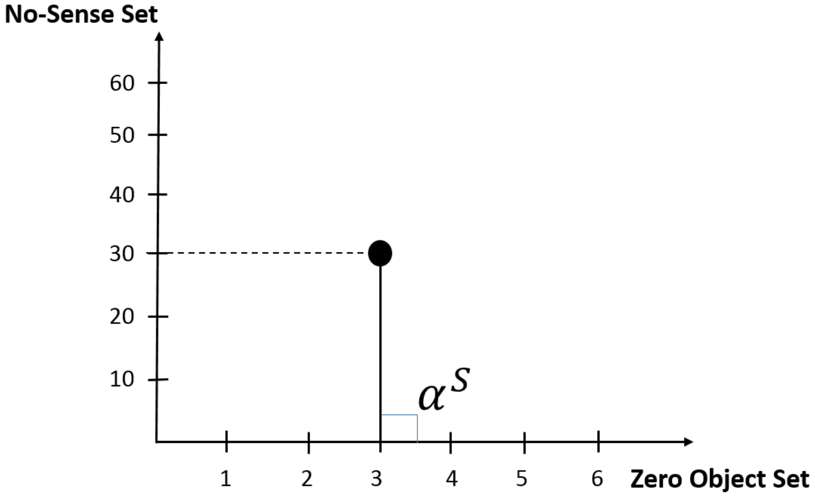
"

Graphical presentation.

Let's have S_f defined on the set of A_N, where $S_f(A_N) = O_{3(30)}$ [1]. A_N is a sense sequence. Also, we have numeric variable *m* which is defined by the following expression:

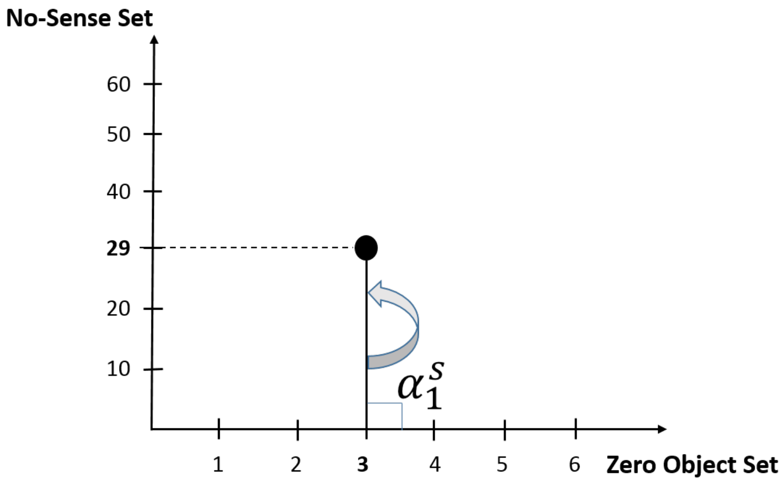
$$m = n - (n - 1).$$

Then, the graph of S_f is



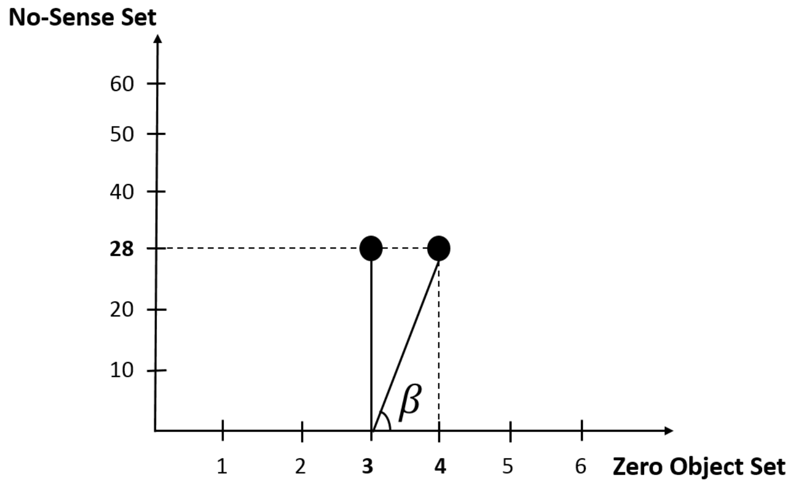
n=30, m=30, α^s=90^0

For $\{\underset{\ominus}{\text{diff}}\,[S_f(A_i)]_m\}_{i=n}^{1}$,



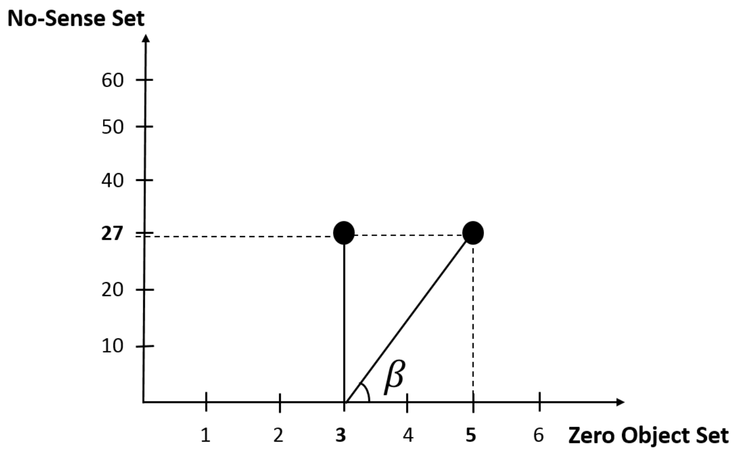
n=30, m=29, α_1^s=90^0

For m=28, for example, we have $S_f(A_i) = O_{4(28)}$,



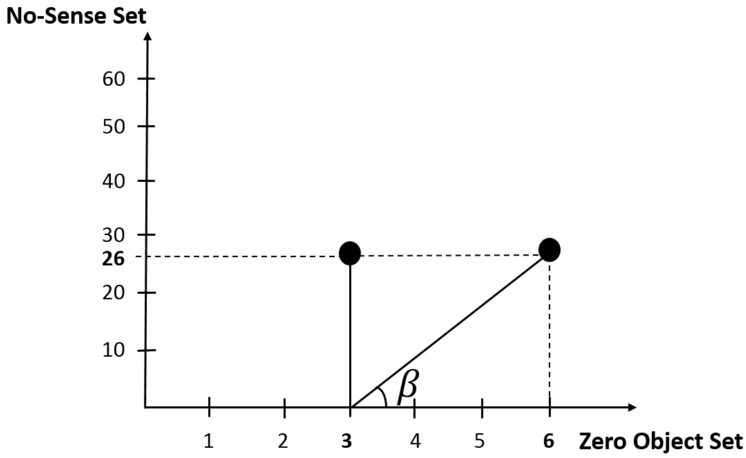
n=30, m=28, α_2^s=90^0-β

For m=27, for example, we have $S_f(A_i) = O_{5(27)}$,



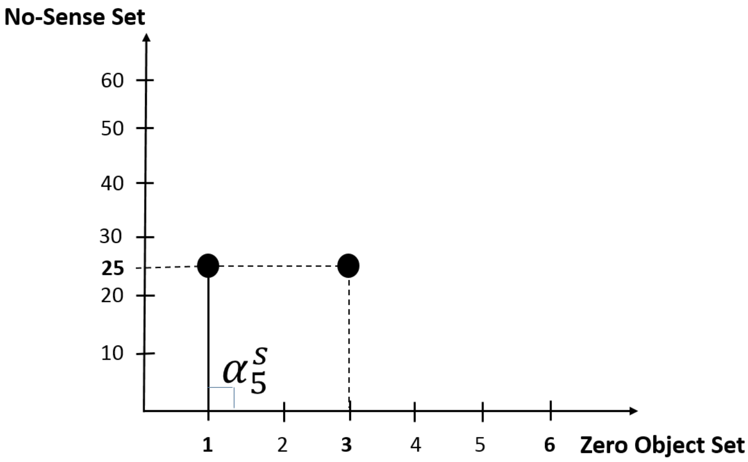
n=30, m=27, α_3^s=90^0-β

For m=26, for example, we have $S_f(A_i) = O_{6(26)}$,



n=30, m=26, α_4^s=90^0-β

And finally, for m=25 we have $S_f(A_i) = O_{1(25)}$,



n=30, m=25, α_5^s=90^0

It is clear that α_1^s, α_5^s > α_4^s > α_3^s > α_2^s.

Thus, changing the value of sense angle α^s characterizes the deviation of sense limit from their initial value before taking the first derivative.

Indeed,

$$\alpha_n \le \alpha^s \le 90^0,$$

where n is derivative order.

3.2. The derivative of semantic union.

Let's S_f to be defined on the set of $\$_K$ or $\$_{O(K)}$. Then for any $S_f(\$_L)$ defined on $\$_L$ ($\$_{O(L)}$), *semantic derivative* $S_f(\$_K)$ *on union* is

$$S_f(\$_K) \uplus S_f(\$_L) = S_f(\$_M)$$

or

$$S_f^{diff}(\$_K) = [S_f(\$_K) \uplus S_f(\$_L)] = S_f(\$_M),$$

where K < M, M > L.

The equivalent form is

$$\underset{\uplus}{\text{diff}}\, [S_f(\$_K)]_L = S_f(\$_K \uplus \$_L) = S_f(\$_M)$$

Unlike semantic derivative on disunion, No-Sense Set of $S_f^{(diff)}$ on union can be put as on the left side as on the right side from the operator of semantic union as

$$\$_K \uplus \$_L = \$_L \uplus \$_K$$

<u>**Axiom** (Sense Limit of Derivative)**:**</u>

"The semantic derivative on union has two cases:

1. the sense limit is defined:

$$\lim_{S} \$_M = \circledcirc \quad \text{for } \underset{\uplus}{\text{diff}}\, [S_f(\$_K)]_L$$

2. the sense limit is undefined:

$$\lim_{S} \$_M \neq \circledcirc \quad \text{or} \quad \lim_{S} \$_M = \$_M$$
"

<u>Graphical presentation.</u>

A semantic derivative on union has the same graphical presentation and construction mechanism as the semantic derivative on disunion does have.

Step increment (m) can have a place for both derivatives.

For example, for the task of increasing the number of object attributes while sense limit is constant,

$$\lim_{S} \Big(\underset{i=1,\dots n}{⊍} A_i \Big) = ◎_A \text{ , where } ◎_A \text{ - const.}$$

3.3. Antiderivative S_f.

Definition: The *antiderivative on disunion (union)* for defined S_f is a function S_F^{θ} (S_F^{0}) the derivative on disunion (union) of which is S_f,

$$S_F^{diff} = S_f.$$

Definition: The antiderivative S_F^{θ} on disunion for defined S_f is a derivative on union for the derivative on disunion for S_f,

$$S_F^{\theta} = \underset{⊍}{\text{diff}} \, [\underset{⊖}{\text{diff}} \, [S_f(₷_N)]_M]_M$$

Definition: The antiderivative S_F^{0} on union for defined S_f is a derivative on disunion for the derivative on union for S_f,

$$S_F^{0} = \underset{⊖}{\text{diff}} \, [\underset{⊍}{\text{diff}} \, [S_f(₷_K)]_L]_L$$

Axiom (Absence of Derivative)**:**

"The antiderivative S_F^{0} for defined S_f is undefined if and only if the sense limit of the derivative on union is undefined for S_f:

$$\lim_{S} \big(\underset{⊍}{\text{diff}} \, [S_f(₷_K)]_L\big) \neq ◎$$
"

3.4. Neighborhood of ₷, ◎, S_f.

Definition: *The sense neighborhood of element* a_k of $₷_N$ ($₷_{O(N)}$) is any nonzero subset A_i $(i \geq 2, i \neq k)$ of set $₷_N$ ($₷_{O(N)}$),

$$A_i \subseteq ₷_N(₷_{O(N)}) \; where \; i < N, a_k \notin A_i$$
,

denoted as

$$\underset{S}{\mathrm{PN}}(Ꞩ_N(a_k))$$
.

<u>Definition:</u> *The sense neighborhood of short-range order of object* ◎$_K$ *for the Sense Set S is* any object ◎$_L$ for which the following condition takes place:

$$L_i \ \overset{E}{|\!\Leftarrow\!\Rightarrow\!|}\ K_j$$
.

<u>Definition:</u> *The sense neighborhood of n-order of object* ◎$_K$ *for the Sense Set S is* any object ◎$_L$ for which the following two conditions take place:

1. $L_i \subseteq K_j \ i \neq j$ **,**
2. $n = j - i\ , j > i$ **.**

<u>Definition:</u> *The sense neighborhood of* $S_f(A_i) =$ ◎$_A$ *is* any function S_f the object of which is the sense neighborhood of short-range order for the object ◎$_A$.

3.5. Derivative on property.

Let's S_f to be defined on the set of Ꞩ$_N$ or Ꞩ$_{O(N)}$. Then for any S_f(Ꞩ$_M$) defined on Ꞩ$_M$ (Ꞩ$_{O(M)}$), where M<N and M⊆N, *semantic derivative* S_f*(* Ꞩ$_N$ *) on* p_i *on disunion* is

$$S_f^{diff}(p_i)(Ꞩ_N) = \ [S_f(Ꞩ_N) \uplus\ S_f(Ꞩ_M)]$$
,

where p_i – i-property of Ꞩ$_N$,

$p_i \notin$ $\mathcal{S}_M$.

The equivalent form is

$$\underset{\uplus}{\text{diff}}\,(p_i)[S_f(\mathcal{S}_N)]_M = S_f(\mathcal{S}_N \uplus \mathcal{S}_M)$$

Let's S_f to be defined on the set of $\mathcal{S}_K$ or $\mathcal{S}_{O(K)}$. Then for any $S_f($ $\mathcal{S}_L$ $)$ defined on $\mathcal{S}_L$ ($\mathcal{S}_{O(L)}$), *semantic derivative $S_f($ $\mathcal{S}_N$ $)$ on p_i on union* is

$$S_f^{diff}(p_i)(\mathcal{S}_K) = [S_f(\mathcal{S}_K) \uplus S_f(\mathcal{S}_L)]$$

,

where p_i – i-property of $\mathcal{S}_K$,

$\mathcal{S}_L$ - $\underset{S}{\text{PN}}($ $\mathcal{S}_L$ $(p_i))$, where $\underset{S}{\text{PN}}()$ – **sense punctured neighborhood**.

The equivalent form is

$$\underset{\uplus}{\text{diff}}\,(p_i)[S_f(\mathcal{S}_K)]_L = S_f(\mathcal{S}_K \uplus \mathcal{S}_L)$$

3.6. Derivative on object.

Let's S_f to be defined on the set of $\mathcal{S}_N$ or $\mathcal{S}_{O(N)}$. Then for any $S_f($ $\mathcal{S}_M$ $)$ defined on $\mathcal{S}_M$ ($\mathcal{S}_{O(M)}$), where M<N and M⊆N, *semantic derivative $S_f($ $\mathcal{S}_N$ $)$ on object O_N on disunion* is

$$S_f^{diff}(O_N)(\mathcal{S}_N) = [S_f(\mathcal{S}_N) \uplus S_f(\mathcal{S}_M)]_{\circledcirc = \text{const}}$$

,

where $O_N = \lim\limits_{S}$ $\mathcal{S}_N$.

The equivalent form is

$$\underset{\uplus}{\text{diff}}\,(O_N)[S_f(\mathcal{S}_N)]_M = S_f(\mathcal{S}_N \uplus \mathcal{S}_M) = \circledcirc = \text{const}$$

.

Let's S_f to be defined on the set of $\not{S}_K$ or $\not{S}_{O(K)}$. Then for any $S_f(\not{S}_L)$ defined on $\not{S}_L$ ($\not{S}_{O(L)}$), *semantic derivative* $S_f(\not{S}_K)$ *on object* O_N *on union* is

$$S_f^{diff}(O_N)(\not{S}_K) = [S_f(\not{S}_K) \cupdot S_f(\not{S}_L)]_{\circledcirc = const},$$

and the equivalent form,

$$\underset{\cupdot}{\mathrm{diff}}(O_N)[S_f(\not{S}_K)]_L = S_f(\not{S}_K \cupdot \not{S}_L) = \circledcirc = \mathrm{const}.$$

A semantic derivative on object on disunion and a semantic derivative on object on union are taken as long as $\circledcirc = const$ *.*

3.7. Derivative on *n*-properties.

For S_f defined on the set of $\not{S}_K$ and for S_f defined on the set of $\not{S}_L$, we have the expression for *semantic derivative* $S_f(\not{S}_K)$ *on* $\{p_e\}$:

$$S_f^{diff}(p_1, p_2, p_3, \dots p_e)(\not{S}_K) = [S_f(\not{S}_K) \cupdot S_f(\not{S}_L)] = S_f(\not{S}_M),$$

where p_e – properties of $\not{S}_K$,

$\not{S}_L$ - $\underset{S}{\mathrm{PN}}(\not{S}_L(\{p_e\}))$, where $\not{S}_L(\{p_e\}) = \underset{i=1 \dots e}{\cupdot} \not{S}(p_i)$.

$S_f^{diff}(p_1, p_2, p_3, \dots p_e)(\not{S}_K)$ shows *the value of semantic load of a single* p_i on $\circledcirc(S_f(\not{S}_K))$.

In other words, it determines p_i which *reinforce* (**adding new knowledge**) zero-object, and p_i which change it.

3.8. Sense Gradient.

In the creation of artificial intelligence, there are two key tasks to be considered first:

1. determining the semantic load of a single property on an object,
2. determining the semantic associations of a considered object with other objects.

For this kind of tasks, the gradient of sense space was initiated.

<u>Definition:</u> *The sense gradient of S_f defined on* $\not{S}_K$ is a derivative on *n*-properties:

$$S_f^{diff}(p_1, p_2, p_3, \dots p_e)(\not{S}_K) = [S_f(\not{S}_K) \uplus S_f(\not{S}_L)]_{\circledcirc = const} = S_f(\not{S}_M)$$

,

where $S_f(\not{S}_M)$ - $\underset{S}{\mathrm{grad}}\, S_f$.

The sense gradient shows direction on which a zero-object $S_f(\not{S}_K)$ $(\forall p_i | \lim_{S} \not{S}_M = const)$ *can reinforce itself.*

Let's S_f to be defined on the arbitrary set of $\not{S}_N$. Then the sense module of S_f can be formulated by the following expression:

$$\underset{S}{|S_f|} = \begin{cases} S_f\,, & \not{S}_N \in \{p_i\}, i = \{1,2, \dots n\} \\ \mathbb{S}_f\,, & \{\forall p_i \; \exists p_k \mid p_k \in O_j\}, j = \{1,2, \dots m\}, k, < i \end{cases}$$

.

Accordingly, for $p_k \in O_j$,

$$|S_f^{diff}(p_1, p_2, p_3, \dots p_e)(\not{S}_K)| = |\underset{S}{\mathrm{grad}}\, S_f| = \mathbb{S}_f(\not{S}_M)$$

.

Thus, the module of gradient of the function determines objects-properties that influence on the object of considered sense function S_f.

3.9. Sense Normalizer.

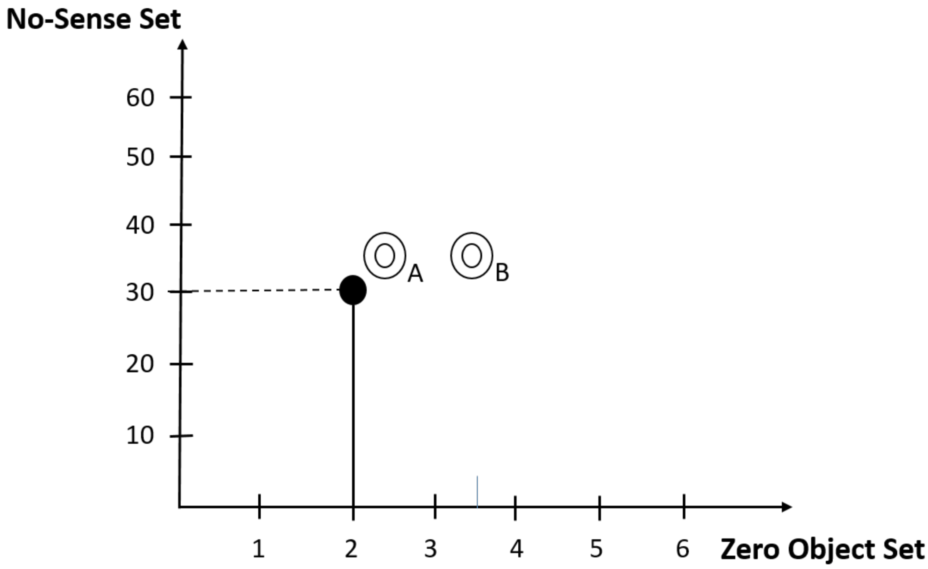
Let's $S_f\ (A_i)\ and\ S_f\ (B_i)$ to be defined on the set of A_i, and B_i respectfully.

Also for a single value of $p_i \in \not{S}_K$ the following expression is true:

$$S_f\ (A_i) \overset{E}{|<=>|} S_f\ (B_i),$$

where $A_i\ , B_i \in \not{S}_K$.

The graphs of both functions $S_f\ (A_i)$ and $S_f\ (B_i)$ are identical,



As the graph above shows, the set of $\{A_i\}$ is identical to the set of $\{B_i\}$. However,

$$\lim_{S} A_i \neq \lim_{S} B_i.$$

Further,

$$S_f\ (A_i)\ \neq S_f\ (B_i),$$

$$S_f - partial\left(\not{S}_K \right) = \begin{cases} ◎_A & , A_i \in \not{S}_K \\ ◎_B & , B_i \in \not{S}_K \end{cases}$$

One of the hardest practical tasks is the task of the transition of $S_f - partial$ to $S_f - complete$.

In Sense Theory, for the solution of the task, we need:

1. to determine a key property (-s) p_k of No-Sense Set (Object No-Sense Set), **(I)**

2. to take a derivative on p_k of both $S_f\ (A_i)$ and $S_f\ (B_i)$. **(II)**

Further, $S_f - partial$ the derivative of which is a sense limit that equals its initial limit is basic $S_f - complete$ function.

Indeed,

$$S_f^{diff}(p_k)(A_i) = \left[S_f(A_i) \uplus S_f(\not{S}_L)\right] = S_f(\not{S}_M)$$

, and

$$S_f^{diff}(p_k)(B_i) = \left[S_f(B_i) \uplus S_f(\not{S}_L)\right] = S_f(\not{S}_M)$$

,

or in the equivalent form,

$$\underset{\uplus}{\text{diff}}\ (p_k)[S_f(A_i)]_L = S_f(A_i \uplus \not{S}_L)$$

, and

$$\underset{\uplus}{\text{diff}}\ (p_k)[S_f(B_i)]_L = S_f(B_i \uplus \not{S}_L)$$

.

In case if:

1. $\lim\limits_{S} \not{S}_M = \circledcirc_A$, then $S_f\ (A_i)$ is $S_f - complete$ function.
2. $\lim\limits_{S} \not{S}_M = \circledcirc_B$, then $S_f\ (B_i)$ is $S_f - complete$ function.

(I) and (II) actions can be executed n-times for a single p_k and n properties $\{p_n\}$ as well.

The process of transition of $S_f - partial$ function to $S_f - complete$ function described in (I) and (II) is a *semantic normalization* or *semantic normalizer*.

Semantic normalizer has the following notation:

$$\text{SN}[\{\circledcirc\}_n]$$

,

where $\{\circledcirc\}_n$ is a set of zero-objects which have identical No-Sense Sets (Object No-Sense Sets).

For the above-mentioned example, semantic normalizer can be expressed as follows:

$$SN[A,B] = \left| \begin{array}{l} S_f(A) - complete\ if\ \lim_{S} \not{S}_M = \circledcirc_A \\ S_f(B) - complete\ if\ \lim_{S} \not{S}_M = \circledcirc_B \end{array} \right.$$

For n-case,

$$SN[\{\circledcirc\}_i]_{i=1,2,\dots n} = \left| \begin{array}{l} S_f - complete, if \lim_{S} \not{S}_M = \circledcirc \text{ , where } \circledcirc \in \{\circledcirc\}_i \\ \{\circledcirc\}_i\,, if\ \lim_{S} \not{S}_M \neq \circledcirc \text{ for any element of } \{\circledcirc\}_i \end{array} \right.$$

3.10. Semantic Resource Identifier (SRI).

As a start, let's formulate a definition of Semantic Resource.

Let's S_f to be defined on the set of A_i. Then,

$S_f(A_i) = \circledcirc_A$, where A_i – sense sequence.

As we know [1], for any sense sequence $\not{S}_N$ ($\not{S}_{O(N)}$) the following expression is true:

$$\circledcirc \Subset \not{S}_N = S_1$$

or

$$\circledcirc \Subset \not{S}_{O(N)} = S_2$$

,

where S_1, S_2 – Sense Sets.

However, we know that the following semantic equivalence

$$\not{S}_N \overset{E}{|\Leftrightarrow|} \not{S}_K$$

,

does not necessary lead to the following “equality”

$$\lim_{S} \not{S}_N = \lim_{S} \not{S}_K$$

.

Thus, for the fulfillment of last equality, *necessary and sufficient*, any n-derivatives on i-property ('s) on $\mathcal{S}_N$ ($\mathcal{S}_K$) are semantically equal:

$$\underset{\circledcirc}{\text{diff}}\,(p_i)[S_f(\mathcal{S}_N)]_M \overset{S}{\equiv} \underset{\circledcirc}{\text{diff}}\,(p_i)[S_f(\mathcal{S}_K)]_L$$

or

$$\underset{\circledcirc}{\text{diff}}\,(p_1, p_{2,} \ldots, p_N)[S_f(\mathcal{S}_N)]_M \overset{S}{\equiv} \underset{\circledcirc}{\text{diff}}\,(p_1, p_2, \ldots, p_K)[S_f(\mathcal{S}_K)]_L .$$

Finally, **Semantic Resource** is any set of $\mathcal{S}_N$ ($\mathcal{S}_{O(N)}$) for which the following expression is true:

$$\lim_{S} \mathcal{S}_N \neq \emptyset_S .$$

<u>Definition:</u> *Semantic Resource Identifier* is a zero-object O_0 of $\mathcal{S}_N$ ($\mathcal{S}_{O(N)}$) for which the following expression is true:

$$\underset{\circledcirc}{\text{diff}}\,[S_f(\mathcal{S}_N)]_M \overset{S}{\equiv} \underset{\ominus}{\text{diff}}\,[S_f(\mathcal{S}_N)]_M .$$

3.11. User Semantic Identifier (USI).

The uniqueness of Sense-To-Sense Network is that every element (user, resource, events, etc.) has its unique sense constituent, zero-object, at a given time.

So, for $\circledcirc_{\text{ivan}}$ we have

$$O_3 = \text{'ivan'}\{'123ABC', 'neuroscientist', 'altruist'\}.$$

Further, consider $S_f(\mathcal{S}_3)$,

where $\mathcal{S}_3$ = $\{'123ABC', 'neuroscientist', 'altruist'\}$.

Let’s calculate *first derivative* of S_f on union and disunion,

$$S_f^{diff(1)}(\not{S}_3) = [S_f(\not{S}_3) \mathbin{\cup_{\circ}} S_f(\not{S}_{K+N})] = S_f(\not{S}_M)$$,

$$S_f^{diff(1)}(\not{S}_3) = [S_f(\not{S}_3) \mathbin{\cup_{\ominus}} S_f(\not{S}_{N-M})] = S_f(\not{S}_K)$$,

where

$$\lim_{S} (S_f(\not{S}_M)) = \overset{S}{\mathrm{const}}$$,

$$\lim_{S} (S_f(\not{S}_K)) = \overset{S}{\mathrm{const}}$$,

$$\lim_{S} \not{S}_M = \lim_{S} \not{S}_K$$.

(A)

For n-derivative,

$$S_f^{diff(n)}(\not{S}_3) = \circledcirc_{ivan}$$.

(B)

Thus,

$$\lim_{S} \not{S}_1 = \overset{S}{\mathrm{const}}$$,

where $\not{S}_1$ - {'123ABC'}.

<u>Definition:</u> *User Semantic Identifier* is a first element of any No-Sense Set on which S_f is completely defined and conditions (A) and (B) are true.

<u>**Axiom of Constancy:**</u>

"For any S_f defined on the set of $\not{S}_N$ ($\not{S}_{O(N)}$) for which (A) and (B) are true:

$$\lim_{S} [\mathrm{SN}[\{\circledcirc\}_i]_{i=1,\ldots n}] = \overset{S}{\mathrm{const}}$$ for any n."

3.12. Network Transport Protocol (NTP).

In S2S Network, data transmission can be realized by some current protocols of transport and application level as well. However, *Proof of Participation Protocol* (PoPP) was taken as a basic transport protocol in S2S Network [3]. PoPP has a series of advantages in comparison with TCP:

1. It *does not require* a handshake procedure for initialization of the process of data transmission. The downloader uses SRI/USI sense values of which are open for the public.
2. It *does not require* control for the sequence of data transmission. Each header has a CRC-value of DATA that is transmitted by a different datagram.
3. It *does not require* additional instruments for the authentication of the sender and recipient as well. All data in S2S Network has unique SRI/USI values.
4. It *does not require* an external protocol for ciphering (deciphering) network data. In S2S Network, all the data traffic is packed by NACA [4].

In comparison with the URI paradigm, the S2S network has own schema of identification of their elements:

$$\text{Arllecta}://[\text{SRI}],[\text{USI}]/[\not{S}_{N}],[\not{S}_{O(N)}]$$

or

$$\text{popp}://\{\circledcirc_{[\,]}\},\{\not{S}_{1}\}/\{\not{S}_{N}\},\{\not{S}_{O(N)}\}$$

.

[Schema A]

In the case of SRI (USI) is a contract's identifier (contract's party's identifier), a downloader will need to enter their contract's party's hash value (contract's hash value) [3].

Schema A is a *direct sense search*.

In many practical cases, a user needs to search for a sense constituent through a ton of properties of an object ('s) that was not undefined earlier. For these cases, the user uses the *reverse search*:

$$\text{Arllecta}:// [\not{S}_{N}],[\not{S}_{O(N)}] /[\text{SRI}],[\text{USI}]$$

or

$$\text{popp://}\ \{Ꞩ_{N}\},\{Ꞩ_{O(N)}\}/\{◎_{[\,]}\},\{Ꞩ_{1}\}$$
.

For example, in case of

$$Ꞩ_{O(3)} = \{O_1, O_2, O_5\} \text{ where } O_2 = Ꞩ_{O(2)} = \{O_3, O_4\}$$
,

we have

$$\text{popp://}\ \{Ꞩ_{O(2)}\}/\{Ꞩ_{O(3)}\}/◎_{[\,]}$$
.

This approach gives a possibility for solving the problem of the *associative relationship* between two or more objects.

It also closes the problem of the *authenticity of an object*.

The problem of *duplicates of the objects* is solved by $\mathrm{SN}[\{◎\}_N]$.

In case of direct sense search, a message broker technology can also be used:

№	Consumer	Producer			
	SRI (USI)	IP: port (1)	IP: port (2)	… …	IP: port (N)
1.	Object 1 ($Ꞩ_1^1$)				registration link
2.	Object 2 ($Ꞩ_1^2$)		registration link		
…	…				
N.	Object N ($Ꞩ_1^N$)	registration link			

In the table above, the registration link may mean that IP: port of object $Ꞩ_1$ is in a private network (under a contract). For getting access to the network, a user needs to register (enter a contract's party's hash value).

4. Conclusion

In this article, we presented the new “sense-focused” decentralized network. Unlike classical peer-to-peer network, **Sense-To-Sense** network is primarily focused on an object's semantic constituents. It radically changes a possible design of different semantical local or global networks with a high level of security of personal data. We hope that our decent work will help other AI researchers in their life endeavors.

To be continued.

Appendix

$\stackrel{S}{=}$

- "semantic equality", binary operation.

Set of A_i is semantically equal to set of B_i if the following expression is true:

$$\lim_{S} A_i = \lim_{S} B_i.$$

$\emptyset_S$ - "empty Sense Set".

Any No-Sense Set (Object No-Sense Set) is empty Sense Set.

$\overset{S}{\text{const}}$

- "semantic constant".

For example, the following expression

$$\lim_{S} (S_f(\not{S}_N)) = \overset{S}{\text{const}}$$

means

$$\underset{\circledcirc}{\overset{n}{\text{diff}}} [S_f(\not{S}_N)]_M = \underset{\ominus}{\overset{n}{\text{diff}}} [S_f(\not{S}_N)]_M = \circledcirc,$$

for any element of $\not{S}_N$.

The equivalent form is

$$S_f^{diff(n)}(\not{S}_N) = \circledcirc.$$

References

[1] E. Mielberg, “Sense Theory, Part 1”, 2018, https://vixra.org/pdf/1905.0105v1.pdf

[2] E. Mielberg, “Sense Theory. Sense Function, Part 2”, 2018, https://vixra.org/pdf/1907.0527v1.pdf

[3] E. Mielberg, “Proof of Participation Protocol”, 2018, https://vixra.org/abs/1904.0067

[4] E. Mielberg, “Neuro-Amorphic Construction Algorithm - NACA”, 2018, https://vixra.org/abs/1904.0039

[5] RDF Primer, W3C, https://www.w3.org/TR/rdf-primer/

[6] “Calculus”, 2009, http://people.math.sc.edu/meade/PROJECT/DRAFTS/SMpart1-31Aug2009.pdf

[7] G. Strang, “Calculuc”, https://ocw.mit.edu/ans7870/resources/Strang/Edited/Calculus/Calculus.pdf

[8] L.H. Loomis, S.Sternberg, “Advanced Calculuc”, 1990,

http://people.math.harvard.edu/~shlomo/docs/Advanced_Calculus.pdf

[9] M. L. Bittinger, D. J. Ellenbogen, S. A. Surgent, “Calculus and Its Applications”, 2012, https://www.sac.edu/FacultyStaff/HomePages/MajidKashi/PDF/MATH_150/Bus_Calculus.pdf

[10] S. Teerapittayanon, H. T. Kung, “DaiMoN: A Decentralized Artificial Intelligence Model Network”, 2019, https://arxiv.org/pdf/1907.08377.pdf

[11] B. Wigley, N. Cary, “The Future is Decentralised”, https://www.undp.org/content/dam/undp/library/innovation/The-Future-is-Decentralised.pdf

[12] Klaus-Tycho Foerster, J. Hirvonen, S. Schmid, J. Suomela, “On the Power of Preprocessing in Decentralized Network Optimization”, 2018, https://www.univie.ac.at/ct/stefan/infocom2019d.pdf