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THE DESCRIPTION OF LOCATIVE DEPENDENCIES IN A NATURAL LANGUAGE PROCESSING MODEL

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Problems of presenting locative groups in an NLP model:

- defining the set of locative semantic relations between words,

- defining the set of words that can be used as locatives,

- describing prepositions with different semantics.

ABBYY Compreno formalism

consists of several patterns:

- morphological,

- syntactic,

- semantic,

- statistical.

Thesaurus-like Semantic Hierarchy

PHYSICAL_OBJECT

→ BEING

  → HUMAN

   → …..

    → PERSON_BY_AGE

     → CHILD

      → BOY

       →boy, мальчик

Figures

- Universal semantic classes - more than **110000**

- English part - about **130000** English notions

- Russian part – about **120000** Russian notions

Semantemes

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FOOD, PLANT, ANIMAL have a semanteme <<Eatable>>.

DEEP SLOTS (DSs)

[Agent]: *[The boy] walks.*

[Locative_FinalPoint]: *The boy walks [home].*

[Ch_Parameter_Speed]: *The boy walks [fast].*

[Specifier_Number]: *Number [1].*

FILLING

[Agent]: BEINGS, ORGANIZATIONS, COUNTRIES

More than **300** slots.

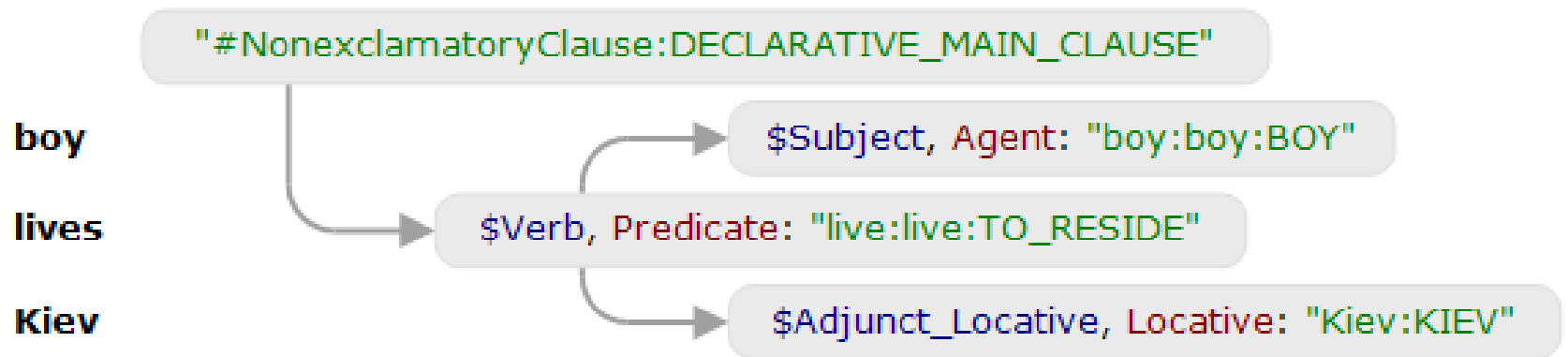# SURFACE SLOTS (SurfSs)

$Subject:

[The boy] walks.

$Object_Indirect_By:

The work is done [by the boy].

The boy lives in Kiev.

boy

lives

Kiev

"#NonexclamatoryClause:DECLARATIVE_MAIN_CLAUSE"

$Subject, Agent: "boy:boy:BOY"

$Verb, Predicate: "live:live:TO_RESIDE"

$Adjunct_Locative, Locative: "Kiev:KIEV"

The semantic description of locative dependencies in the ABBYY Compreno model

1. Locative semantic relations

Locative: *be [on the shelf]*

Locative_InitialPoint: *walk [from the house]*

Locative_FinalPoint: *come [to the door]*

Locative_Route: *walk [along the beach]*

2. Filling of locative Deep Slots

Locative: *in the street*

Metaphoric_Locative: *on the Internet*

Locative_Event: *in a meeting*

[Locative_Class]

[Locative]

[Metaphoric_Locative]

[Locative_Event]

[Locative_InitialPoint_Class]

[Locative_InitialPoint]

[Metaphoric_InitialPoint]

[LocativeEvent_InitialPoint]

[Locative_FinalPoint_Class]

[Locative_FinalPoint]

[Metaphoric_FinalPoint]

[LocativeEvent_FinalPoint]

[Locative]

Filling: <<Place>>

Examples:

Its priority tasks today include building relations with the compatriots [abroad].

Your assistant is still holding 10 cards [under the table].

Only 13 rodent species are found [on the island].

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[Locative_InitialPoint]

Filling: <<Place>>

Examples:

*Don't forget that you can shoot **[from the side]**.*

*The witness saw this **[from the window of her home]**.*

[Locative_FinalPoint]

Filling: <<Place>>

Examples:

*You have come **[home]**.*

*Alice is coming **[to the palace of the queen]**.*

Metaphoric Locative Deep Slots

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Filling: <<MetaphoricPlace>>

Metaphoric_Locative:

When I get an idea I start at once building it up [in my imagination].

Metaphoric_InitialPoint:

Many details had obviously gone [from my memory].

Metaphoric_FinalPoint:

Strange ideas come [into his mind].

Event Locative Deep Slots

Filling: <<EventPlace>>

Locative_Event:

Imagine sitting [in a meeting] or a coffee shop.

LocativeEvent_InitialPoint:

You come [from the meeting] in a hurry...

LocativeEvent_FinalPoint:

Once, by chance, I came [to the exhibition of rare cars].

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Reasons for introducing 3 groups of fillers:

- different syntactic realizations:

many prepositions for 'common' locatives (*in, at, on, under, above, near the box*) and very few prepositions for metaphoric and event locatives (**under the memory/meeting*);

- various cores combine with different locatives differently:

 read [in the book/on the Internet] is more frequent than *read [at home]*.

The syntactic description of locative dependencies in the ABBYY Compreno model

Surface slots

We try to postulate a new SurfS if there is a difference in:

- Government

Surface slots

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- Government

- Linear order

Surface slots

We try to postulate a new SurfS if there is a difference in:

- Government
- Linear order
- Punctuation

Locative SurfSs

- Their government is not unique:

*The book is [**on** the shelf].*

*Please, advise me [**on** the medical training].*

- Nor is the punctuation.

Reasons for special locative SurfSs

- The linear order of the locatives may be different from that of the other circumstances:

[In Hertford, Hereford, and Hampshire], hurricanes hardly ever happen.

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- Locative DSs can be filled with adverbs:

You can do it [here] or [in Ukraine].

- Only locatives can use where-relativizers:

The house [where I live].

*The prepositions [where the problem consists].

'Default' vs 'semantic' prepositions

It is convenient to split all the locative prepositions into two large groups that we call:

- **default** and

- **semantic** prepositions.

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- They usually have a counterpart in another language, that can be used for translation in all the contexts.

'Semantic' prepositions

English

Near the edge / near the pole

=   Russian

Около края / около полюса

The translation analogue of *near* is the same in both contexts.

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'Default' prepositions

- The choice of the preposition depends on the noun.

- The localization they denote approximately corresponds to the localization 'in'.

- There is no one-to-one correspondence between languages.

'Default' prepositions

Russian

На *полюсе* / **на** *краю*

English

At *the pole* / **on** *the edge*

The translation analogues are different.

The distinction between the default and the semantic prepositions

Only 'default' prepositions can correspond to the Metaphoric and Event locative DSs:

- *in the book*: 'Default' preposition, both [Locative] and [Metaphoric_Locative] interpretation;

- *behind the book*: 'Semantic' preposition, only [Locative] interpretation.

Implementation

- 'Semantic' prepositions are introduced high in the hierarchy. This pattern is rarely modified below.

- 'Default' prepositions are introduced low in the hierarchy. Often on the lowest levels.

Translation: 'semantic' prepositions

Each 'semantic' preposition corresponds to a specific component of the semantic structure (semanteme):

He lives behind the fence.

Fragment of the rule applied to the *fence:*

<ECbehind> => <<Behind>>;

Translation: 'semantic' prepositions

Fragment of the rule applied at the synthesis stage in Russian:

<<Behind>> => <ECза_Instrumental>;

The resulting Russian text:

=> *Он живёт за забором.*

The semantic prepositions correspond directly to the semantemes both at the analysis and synthesis stages.

Translation: 'default' prepositions

All 'default' prepositions correspond to one semanteme <<Default_Location>>, which, in turn, activates the 'default locative grammeme' at the necessary word.

Examples:

The boy lives in the East.

The boy lives in Kiev.

Translation: 'default' prepositions

The rule applied to *East* and *Kiev*:

<DefaultLocativeLikeForm> => <<Default_Location>>;

There is no reference to the actual preposition in the sentence. It is enough to know that it is default.

Translation: 'default' prepositions

The rule applied at the synthesis stage:

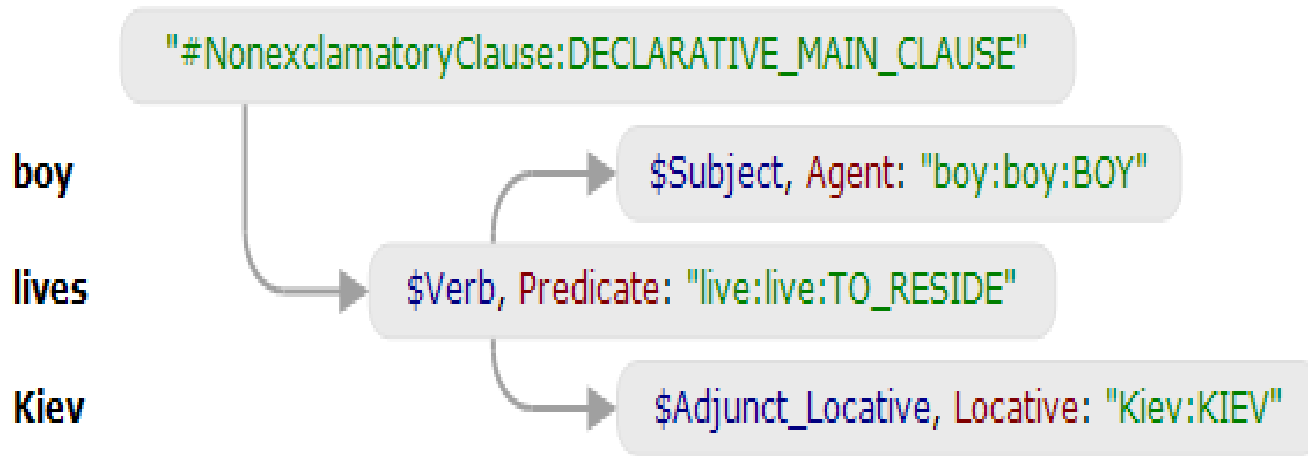<<Default_Location>> => <DefaultLocativeLikeForm>;

The resulting sentences:

Мальчик живет в Киеве.

Мальчик живет на Востоке.

There is no direct reference to the preposition: one and the same English preposition can correspond to different Russian prepositions, specified in the *default preposition pattern*.

The boy lives in Kiev.

Kiev: <DefaultLocativeLikeForm>: Preposition *IN*

<DefaultLocativeLikeForm> => <<Default_Location>>;

<<Default_Location>> => <DefaultLocativeLikeForm>;

Киев: <DefaultLocativeLikeForm>: Preposition *В*

=> *Мальчик живет в Киеве.*

Conclusion

The description of locative groups consists of:

- Locative DSs,

- Restriction of locative DSs' filling with the necessary semantemes,

- Special SurfsSs with two types of grammemes:
  - *'Default' locative forms*,
  - *'Semantic' locative forms*.

Thank you for your attention!

QUESTIONS?