Санкт-Петербургский государственный университет

Semantic analysis: theory, applications and use cases

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Road map

- Math model of a Natural Language (NL)
- Three levels of text analysis
- Semantics vs syntax
- Applications
- Use cases

Math model of a Natural Language

- Backbone of NL: verbs + prepositions
- Verb = F(arg_1, …, arg_n)
- Prepositions: 3D space (*behind*), time space (*during*), cause-and-effect relation *(due to)*
- Class hierarchy (=world picture)
- Basis functions
- Words adjunction

Math model: basis functions

- Caus(x,y) = x causes y
- Cont(x) = x continues
- Hab(x,y) = x has y
- Incep(x) = x begins
- Oper(x,y) = x performs y
- Lab(x,y) = x under action of y
- Prepar(x) = prepare x, x is prepared
- Fin(x) = x finishes, stops

Math model: examples

- Caus(Subj, Fin Lab(Accus, FIRE)) = to extinguish a fire (=cause to stop having Subj under action of fire)
- Caus(Subj, Prepar(FOOD Accus)) = to stew the vegetables (cause the Subj to get cooked)

- Both examples map to the same Russian verb ”тушить” => semantic disambiguation

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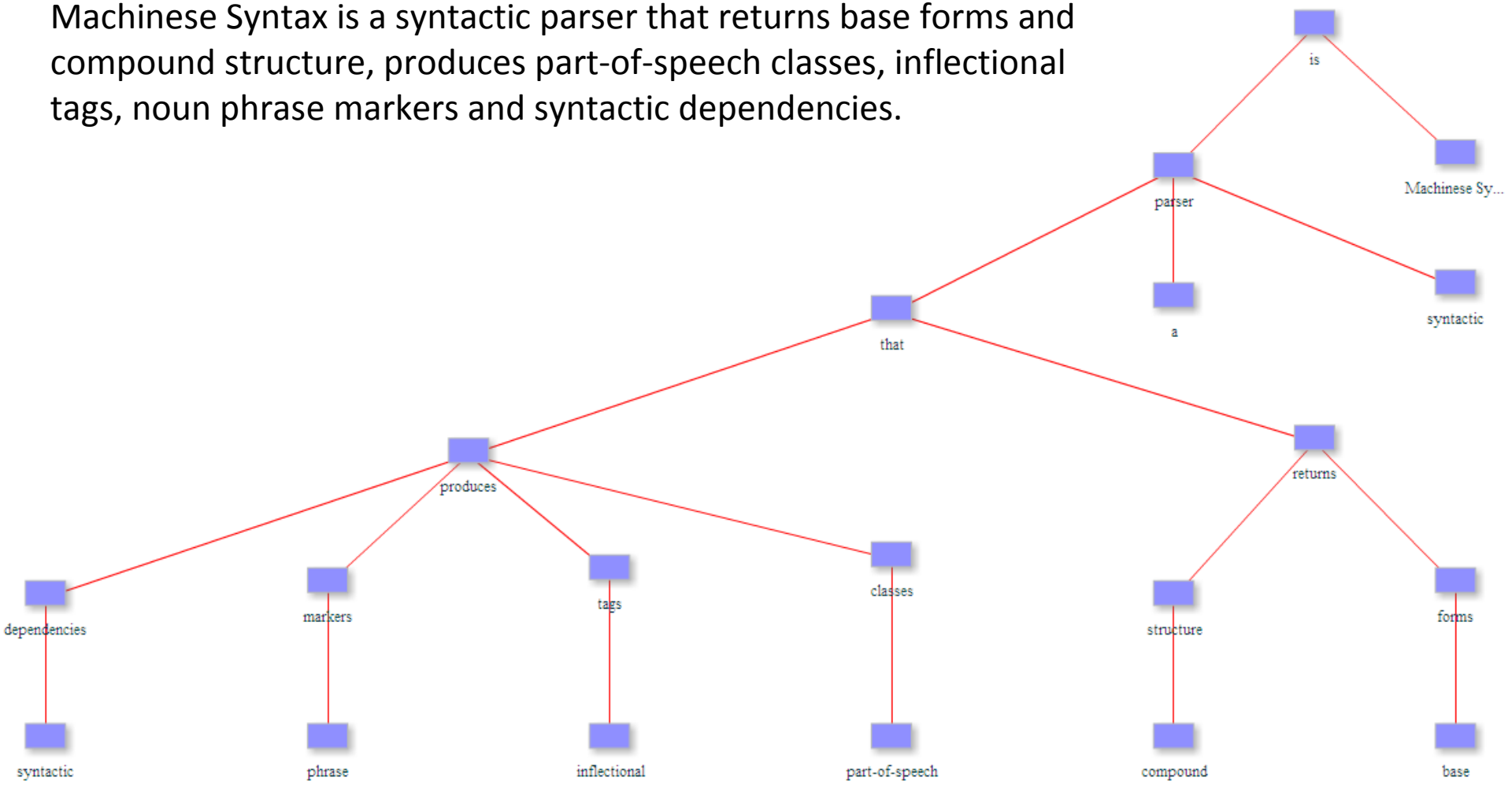
Three levels of analysing text

- Morphological analysis: word level
- Syntactic and semantic analysis: sentence level
- Object properties and relationships, anaphora resolution: text level

- Sentence = $P(f_1(x_1,\ldots,x_n),\ldots,f_n(x_1,\ldots,x_n))$ – superposition of functions

Three levels of analysing text

Machinese Syntax is a syntactic parser that returns base forms and compound structure, produces part-of-speech classes, inflectional tags, noun phrase markers and syntactic dependencies.



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Semantics vs syntax

- Он пришёл **из** вежливости (He came out of courtesy) **WHY?**
- **Из (вежливость)** generates **”WHY?”**

- Он пришёл **из** деревни (He came from a village) **WHERE FROM?**
- **Из(деревня)** generates **”WHERE FROM?”**

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Applications

- Intellectual search systems
- Question-answering systems
- Spell checker
- Summarization
- Sentiment analysis
- Machine Translation
- Knowledge base
- Facts extraction

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Use cases

- Smart street dating: semantic search of the best matching candidates around you
- FAQ mobile agent: automatically suggest solutions to the support requests
- Sentiment recognition: goods evaluation
- Automatic summarization: limit information load on mobile devices

References

[1] Tuzov V. A.: Computer semantics of Russian language. Saint-Petersburg University Press, Saint-Petersburg, 2004 (in Russian).

[2] Kan D. A., Lebedev I.S.: Method of formalizing semantical links between objects in a natural language text. Bulletin of Saint-Petersburg University. Series 10. 2008. Issue 2. pp 56-61 (in Russian).

[3] Kan D. A.: Method for automatic creation of translational semantic dictionary for Machine Translation // XL Conference Control Processes and Stability'09, pp. 429-435 (in Russian).

[4] www.semanticanalyzer.info

Questions

Thank you!