EVALITA 2011

Evaluation of NLP and Speech Tools for Italian

EVALITA 2011

Experiments with a Constraint-based Dependency Parser

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parsit

http://www.parsit.it

Outline

- Parsit at Evalita 2011
- Evaluation and results
- Description of the System
- Example
- How we came to a Constraint-based Parser
- Future Works

Parsit at Evalita 2011

- Scientific Research plays a central role in **Parsit** activities

- **Parsit** technologies will be available for free for partners with researching purposes

- We focus on syntactic parsing of natural language

- The parser architecture used at **Evalita 2011** is one of a series of experiments we have been dedicating to in the past few months

- The parser was tested against the **Evalita 2009** dataset and the results encouraged us to participate to **Evalita 2011**

RESULTS

Results

Arc Accuracy (300 sentences for a total of 7401 tokens)

	LAS	UAS	LAS2
Parsit (M. Grella)	**91.23%**	**96.16%**	**93.87%**
#2	89.88%	93.73%	93.39%
#3	88.62%	92.85%	92.50%
#4	85.34%	91.47%	89.57%

The paper submitted includes some consideration on the difference between the LAS and UAS values

Correct Sentence Accuracy

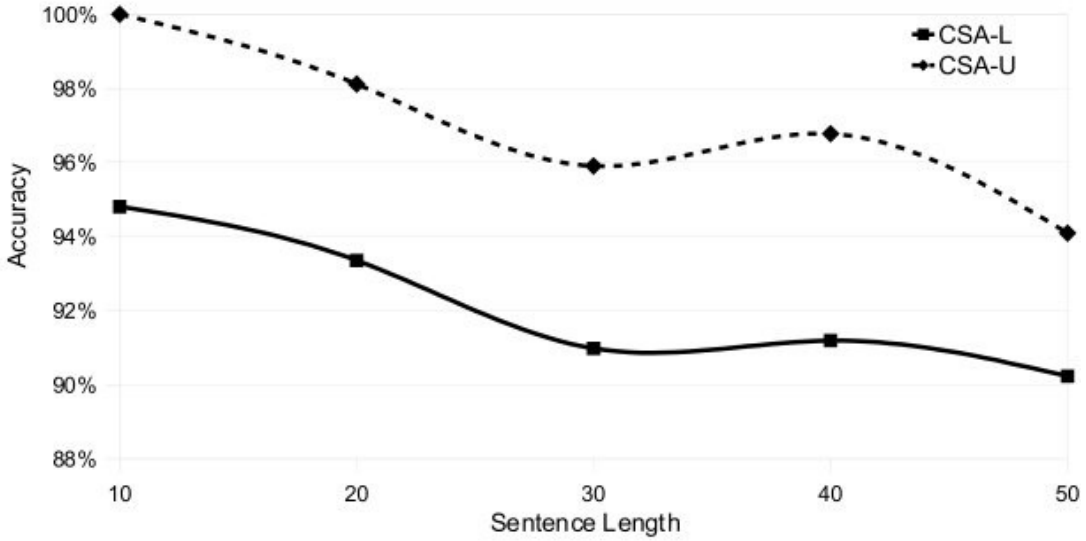
CSA-L	CSA-U
22.33%	57.00%

Average LAS and UAS per sentence

AVG-L	AVG-U
91.66%	96.63%

Results

Average Accuracy relative to sentence length

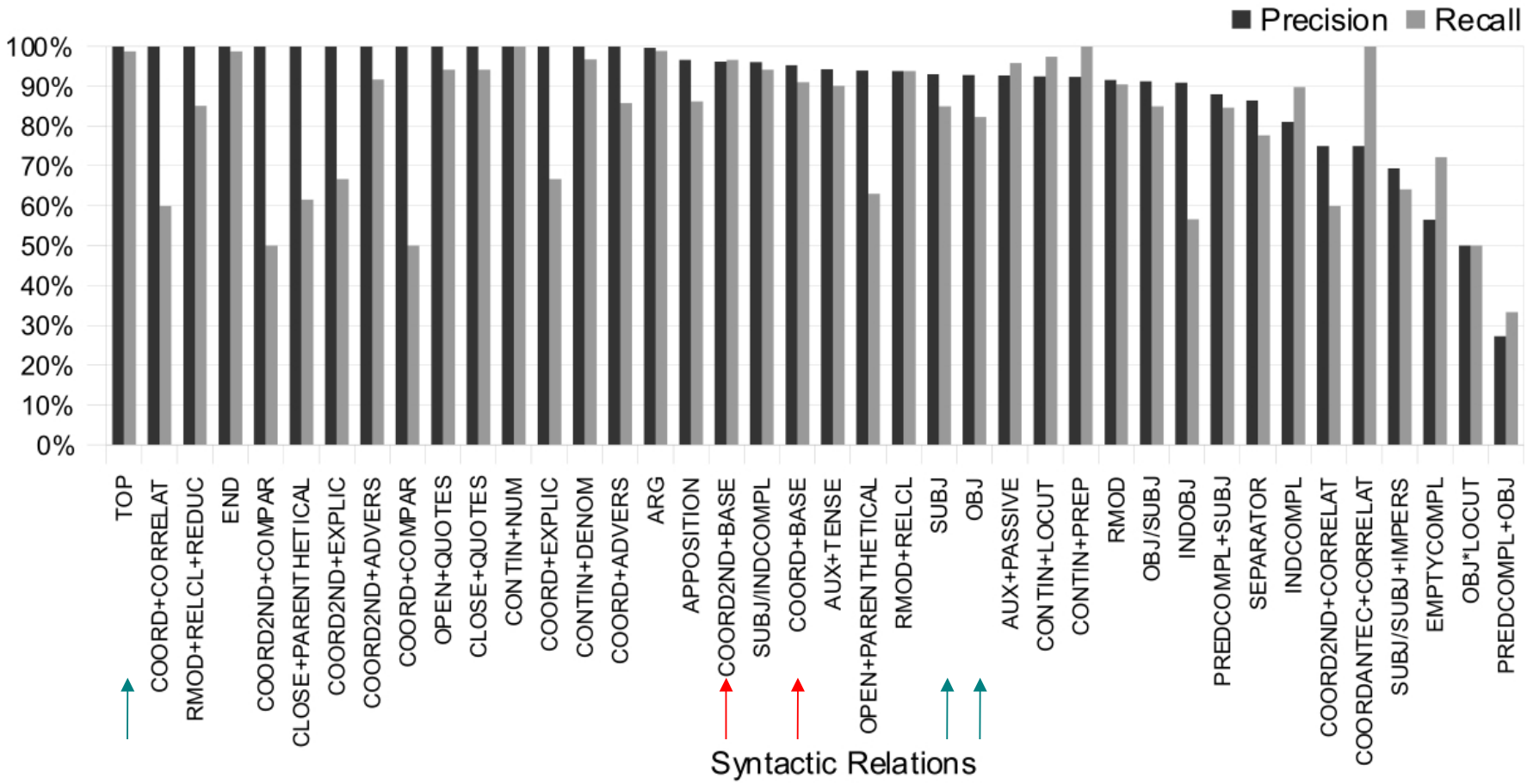


Group	Range	No. of sentences	Portion of dataset
1	1-10	15	5.00%
2	11-20	95	31.67%
3	21-30	108	36.00%
4	31-40	62	20.67%
5	41-50	20	6.67%

We considered meaningful groups 2, 3 only

Results

Recall and Precision of every syntactic relation label attachment



DESCRIPTION OF THE SYSTEM

System - Goals

- Coherence (consistency) of the syntactic trees
  typical of top-down parsers
- High level of accuracy for label assignment
- Robustness
  typical of bottom-up parsers
- Capable of handling non-projectivity
- Morphological analysis without pre POS-tagger

Efficiency has not been considered to be relevant in this specific context.

System - Approach

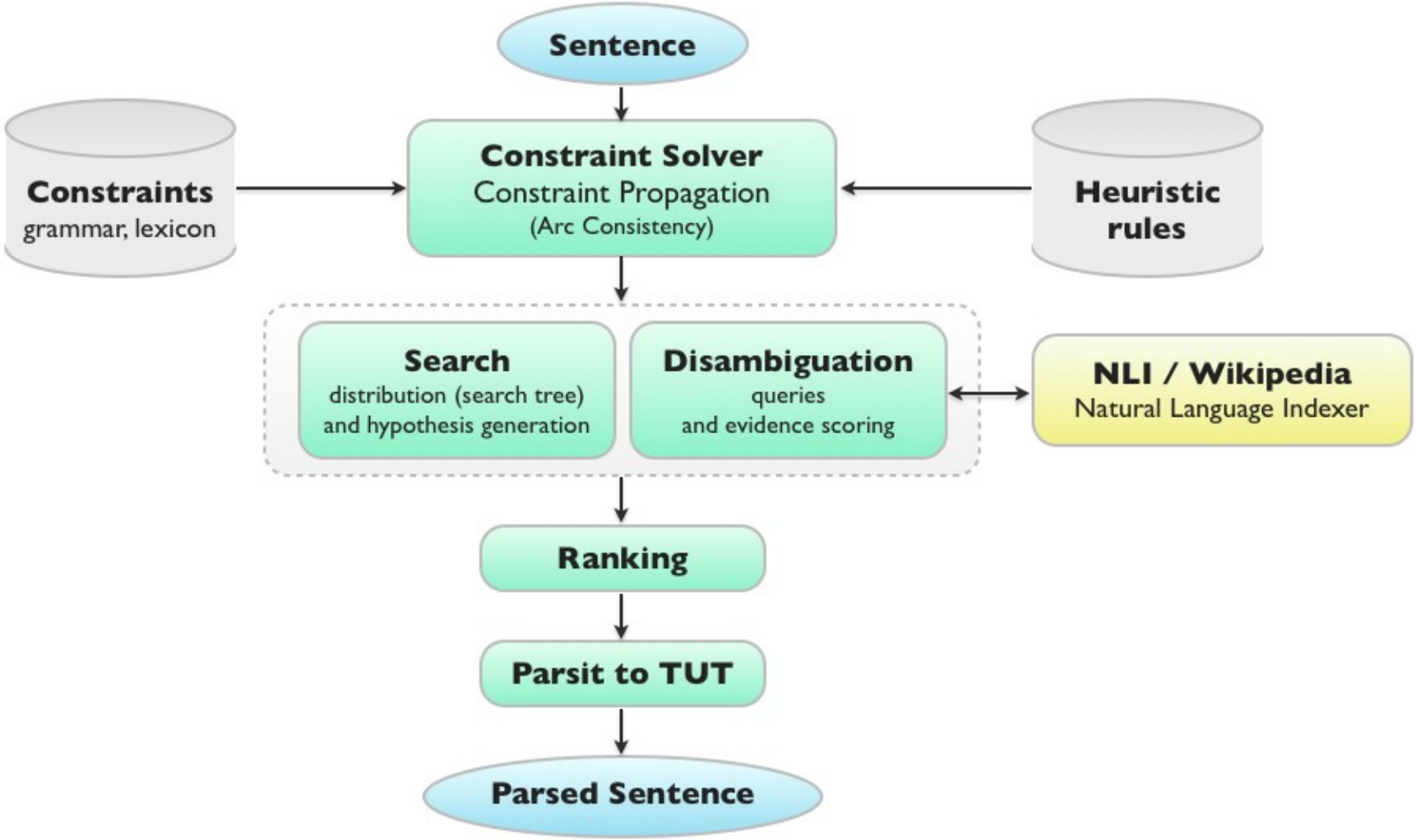
Experiments with a Constraint-based Dependency Parser

View of the parsing process as a finite configurations problem that can be formulated as a constraint satisfaction problem (CSP)

Dependency parsing problem is reduced to the problem of finding a dependency graph for a sentence that satisfies all the constraints defined by the grammar

cf. Maruyama, Harper and Helzerman, Menzel, Schröder, Duchier, Debusmann

System - Architecture



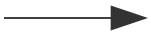
System - Constraint Solver

The Constraint Solver has been implemented in Ada 2005 using Gecode constraint programming library which provides constraint-solving algorithms with state-of-the-art performances.

For a sentence of length n, there are finitely many possible trees involving just n nodes. Out of this large number, we must select those that are grammatical.

Dependency Graph is represented using an Adjacency Matrix.

	ROOT	il	gatto	insegue	il	topo	in	giardino
il								
gatto								
insegue								
il								
topo								
in								
giardino								



	ROOT	il	gatto	insegue	il	topo	in	giardino
il			DET					
gatto				SUBJ				
insegue	TOP							
il						DET		
topo				OBJ				
in								CONN
giardino				RMOD		RMOD		

The constraints propagation technique is applied to restrict possible analyses.

System - Format

TUT Format	Parsit Format
ART → NOUN	ART ← NOUN
PREP → NOUN	PREP ← NOUN
CONJ-SUBORD → VERB	CONJ-SUBORD ← VERB

System - Constraints

The Italian grammar has been expressed for the first time as a set of constraints

Wide coverage lexicon of subcategorization for nouns, adjectives, verbs and adverbs: each lexical entry contains information on category, agreement and valency (i. e. what types of complements are required by the word).

The grammar has been then fine-tuned on the TUT Treebank thanks to our automatic tools written in Python.

```
(deprel DET
     (governor NOUN)
     (dependent ART)
     (< (dependent ID) (governor  ID))
     (morpho-agree dependent governor))
```

```
(deprel SUBJ
     (governor   VERB)
     (dependent SUBJ)
     (complex-morpho-agree dependent governor))
```

System - Search

- The Matrix is now consistent but, with the exception of simple cases, still shows ambiguous dependencies

- Simple search algorithm: spawns sequentially all possible non-ambiguous combinations of dependencies from the Matrix

- All incoherent parse trees are rejected (e.g. in the dependency graph each node has only one incoming edge, there are no cycles and there is precisely one root)

System - Disambiguation

The score of each ambiguous relation in a given solution is computed by counting the number of occurrences of that relation in the Italian version of **Wikipedia** previously analyzed by **TULE parser** [Leonardo Lesmo]

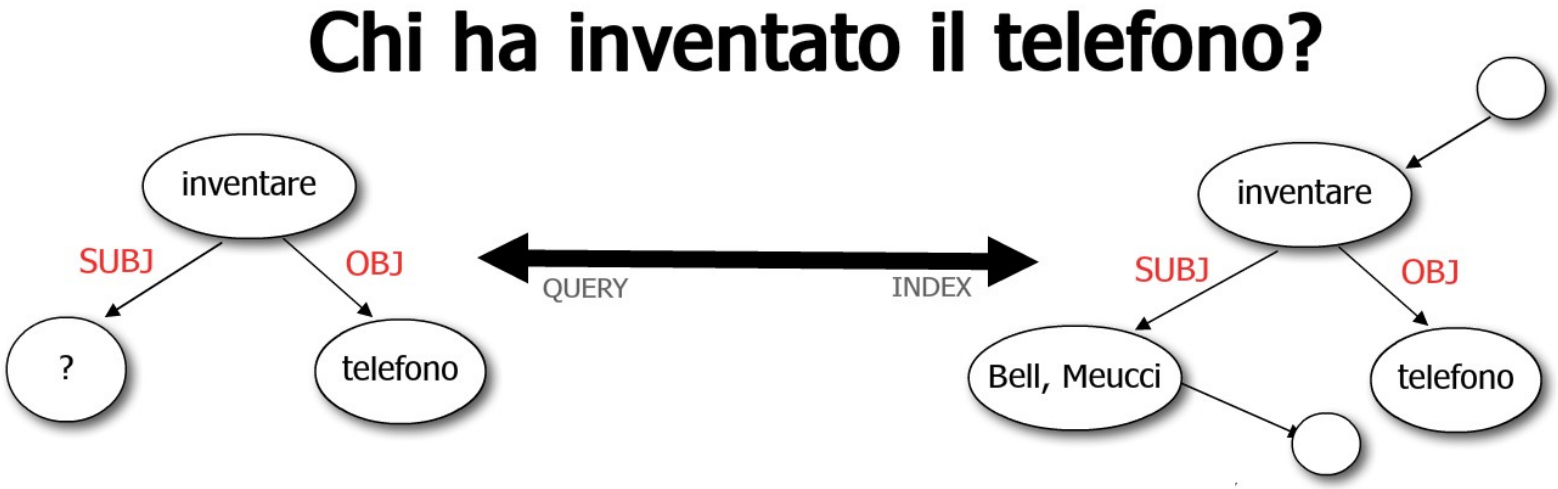
Parsed sentences have been enriched with **Parsit Intra-Paragraph Anaphora Resolution (IPAR)** and indexed by our **Natural Language Indexer (NLI)**

NLI is a component of the high performance **Natural Language Retrieval Architecture (NLRA)** designed and developed by **Parsit** which allows for complex queries on parse trees data through a particular pattern matching technique

Our indexed version of the Italian Wikipedia can be explored at:

http://www.parsit.it/evalita2011

System - Query




```
{"multidep" :
        [
                {"L":"inventare"},
                        {"L" : "telefono", "D": "OBJ"},
                        {"D" : "SUBJ"}
        ]
}
```

EXAMPLE

Example

il gatto insegue il topo in giardino

the cat chases the mouse in the garden

Example - Propagation

	ROOT	il	gatto	insegue	il	topo	in	giardino
il	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
gatto	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
insegue	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
il	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
topo	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
in	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
giardino	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	

Initial configuration – Start propagation

Example - Propagation

	ROOT	il	gatto	insegue	il	topo	in	giardino
il	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
gatto	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
insegue	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
il	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
topo	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
in	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
giardino	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	

Determiner - Arc Constraints

Example - Propagation

	ROOT	il	gatto	insegue	il	topo	in	giardino
il			**DET**					
gatto	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...			TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
insegue	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...			TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
il						**DET**		
topo	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...			TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
in	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
giardino	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	

Determiner - Arc Constraints

Example - Propagation

	ROOT	il	gatto	insegue	il	topo	in	giardino
il			**DET**					
gatto	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...			TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
insegue	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...			TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
il						**DET**		
topo	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...			TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
in	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
giardino	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	

Connective - Arc Constraints

Example - Propagation

	ROOT	il	gatto	insegue	il	topo	in	giardino
il			**DET**					
gatto	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...			TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
insegue	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...			TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
il						**DET**		
topo	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...				TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...
in								**CONN**
giardino	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...	TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		TOP, COORD+BASE, SUBJ, OBJ, RMOD, ARG, ...		

Connective - Arc Constraints

Example - Propagation

	ROOT	il	gatto	insegue	il	topo	in	giardino
il			DET					
gatto				SUBJ, OBJ				
insegue	TOP							
il						DET		
topo				SUBJ, OBJ				
in								CONN
giardino				RMOD		RMOD		

Matrix is consistent

Example - Propagation

	ROOT	il	gatto	insegue	il	topo	in	giardino
il			DET					
gatto				SUBJ, OBJ				
insegue	TOP							
il						DET		
topo				SUBJ, OBJ				
in								CONN
giardino				RMOD		RMOD		

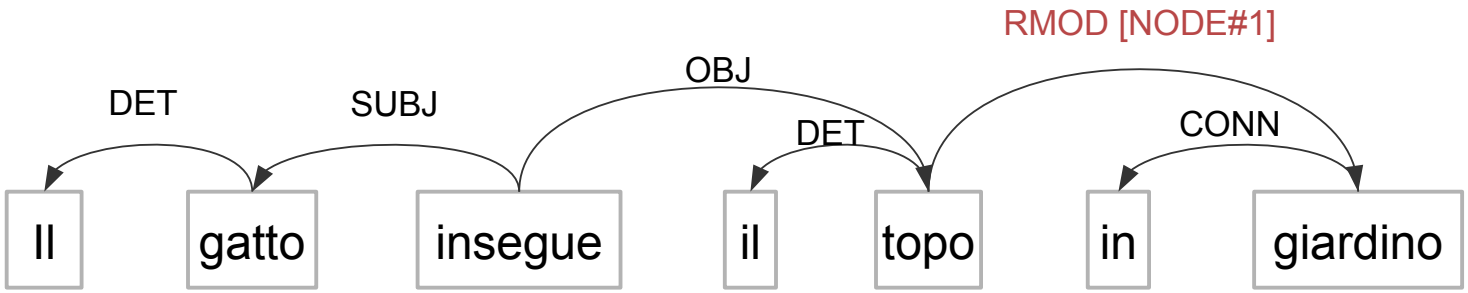
Heuristic Rules

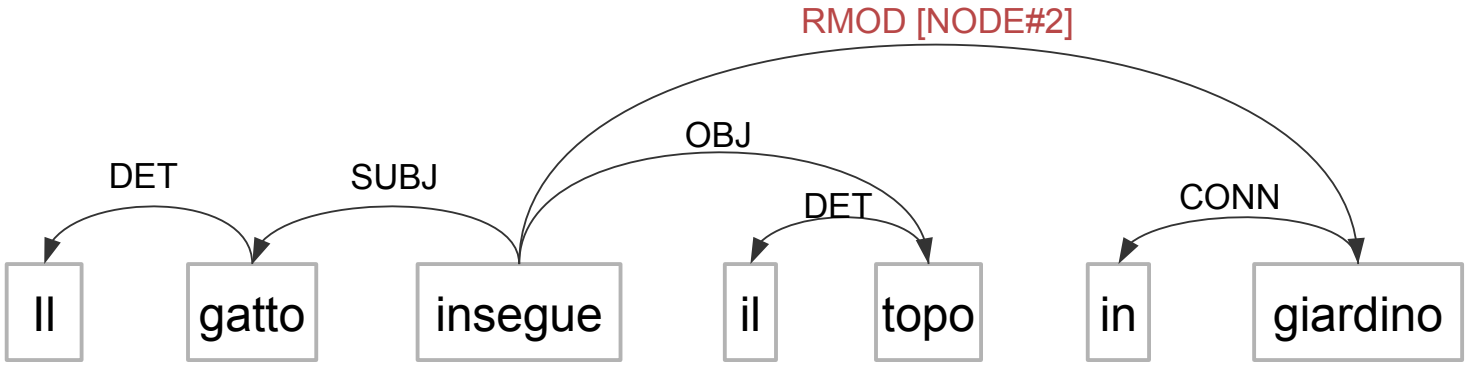
Example - Propagation

	ROOT	il	gatto	insegue	il	topo	in	giardino
il			DET					
gatto				SUBJ				
insegue	TOP							
il						DET		
topo				OBJ				
in								CONN
giardino				RMOD		RMOD		

Still multiple solutions

Example - Search



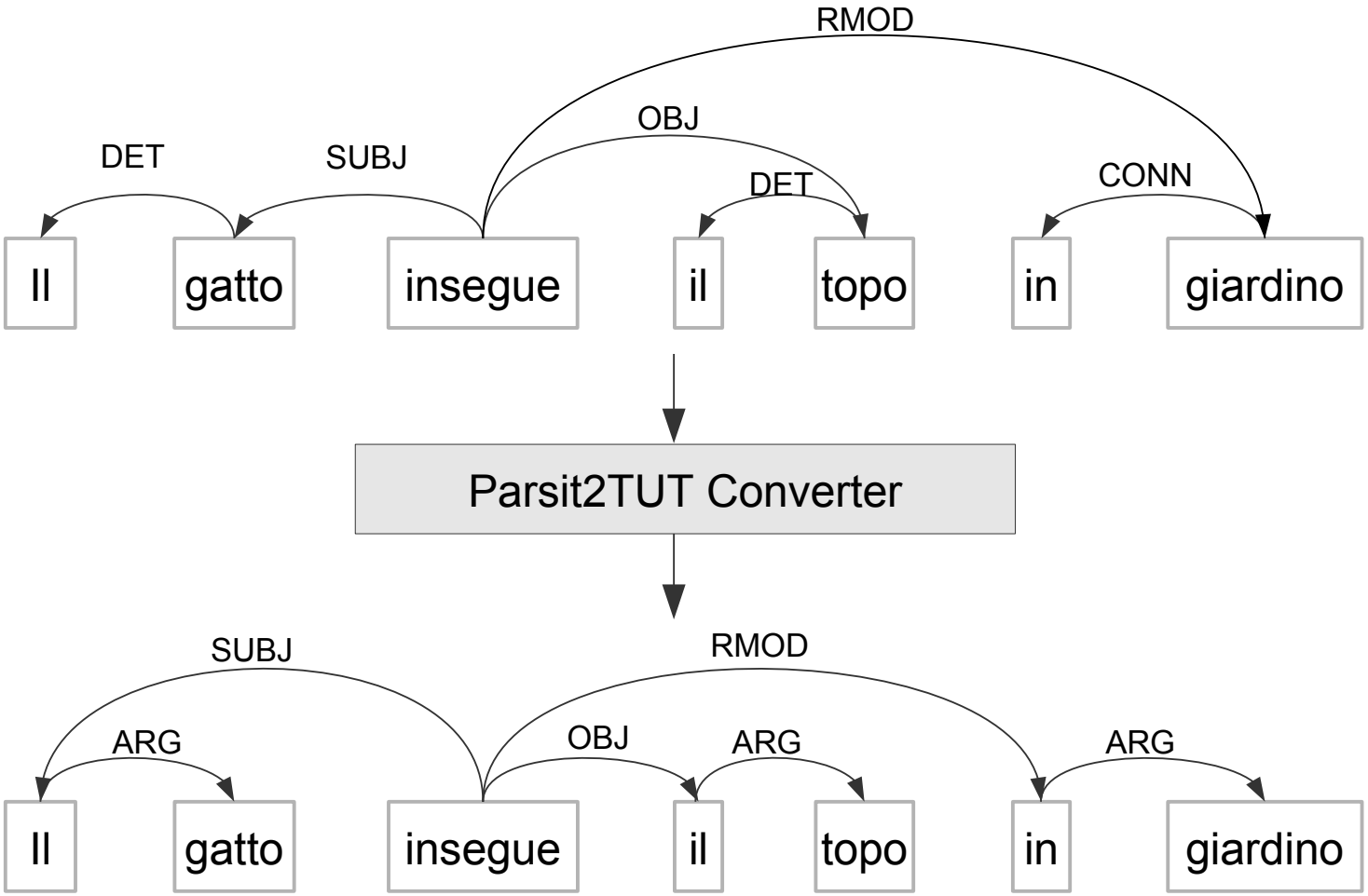


Example - Disambiguation

QUERY NODE#1	SCORE
{"multidep":[{"L":"topo"}, {"multidep":[{"L":"in", "D":"RMOD"}, {"P":"NOUN", "D":"ARG"}]}]}	%
{"multidep":[{"L":"topo"}, {"multidep":[{"L":"in", "D":"RMOD"}, {"L":"giardino", "D":"ARG"}]}]}	%
{"multidep":[{"L":"topo"}, {"multidep":[{"L":"in", "D":"RMOD"}, {"S":"LOC", "D":"ARG"}]}]}	%
{"multidep":[{"P":"NOUN"}, {"multidep":[{"L":"in", "D":"RMOD"}, {"P":"NOUN", "D":"ARG"}]}]}	%
{"multidep":[{"P":"NOUN"}, {"multidep":[{"L":"in", "D":"RMOD"}, {"L":"giardino", "D":"ARG"}]}]}	%
{"multidep":[{"P":"NOUN"}, {"multidep":[{"L":"in", "D":"RMOD"}, {"S":"LOC", "D":"ARG"}]}]}	%
TOTAL	%

QUERY NODE#2	SCORE
{"multidep":[{"L":"inseguire"}, {"multidep":[{"L":"in", "D":"RMOD"}, {"P":"NOUN", "D":"ARG"}]}]}	%
{"multidep":[{"L":"inseguire"}, {"multidep":[{"L":"in", "D":"RMOD"}, {"L":"giardino","D":"ARG"}]}]}	%
{"multidep":[{"L":"inseguire"}, {"multidep":[{"L":"in", "D":"RMOD"}, {"S":"LOC", "D":"ARG"}]}]}	%
{"multidep":[{"P":"VERB"}, {"multidep":[{"L":"in", "D":"RMOD"}, {"P":"NOUN", "D":"ARG"}]}]}	%
{"multidep":[{"P":"VERB"}, {"multidep":[{"L":"in", "D":"RMOD"}, {"L":"giardino", "D":"ARG"}]}]}	%
{"multidep":[{"P":"VERB"}, {"multidep":[{"L":"in", "D":"RMOD"}, {"S":"LOC", "D":"ARG"}]}]}	%
TOTAL	%

Example - Conversion



HOW WE CAME TO A CONSTRAINT-BASED PARSER?

Hybrid Transition-based

Experiments with a Hybrid Transition-based Dependency Parser

- Multi-threaded Multilayer Perceptron (OpenMP has been used)
- Oracle Parsit Strategy
- Online disambiguation (POS tagging during Syntactic Parsing)
- Multilayer Linguistic Supervision (Surface, Morphology, Syntax)

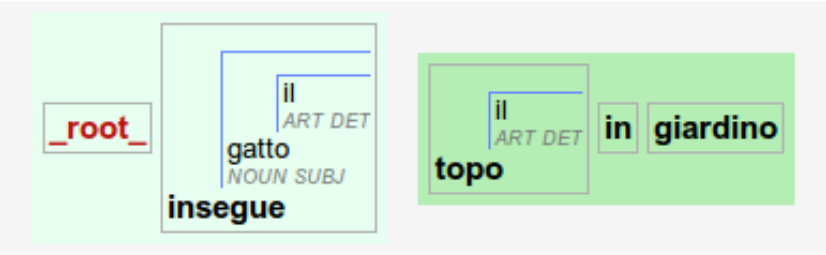
```
"Cade [la neve]"
"Mi piace [la prugna]"
```

Not Object!

Hybrid Transition-based

extremely simplified version!

```
S  ← []
I  ← [w1 , w2 , ..., wn]
A  ← []

while I != [] do
    X ← get_context(S, I, A)
    Y ← estimate_synactions(X, model)

    foreach y in Y do
        if is_permissible(y, S, I)
            if check_linguistic_supervision(y, S, I, A, rules)
                transition(y, S, I, A)
                break
```



FUTURE WORKS

Future works

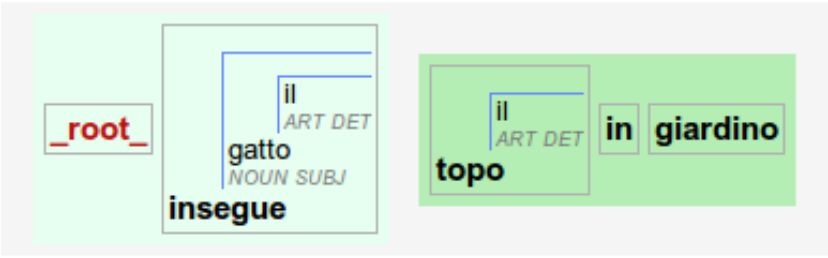
- Accuracy improvements
- Performance improvements
- Hybrid statistical transition-based and constraint-based

Future works

```
S  ← []
I  ← [w1 , w2 , ..., wn]
A  ← []

C  ← make_arc_consistency(I)

while I != [] do
     X ← get_context(S, I, A, C)
     Y ← estimate_synactions(X, model)

     foreach y in Y do
         if is_permissible(y, S, I)
             if is_consistent(y, S, I, A, C)
                 transition(y, S, I, A)
                 update(C, A)
                 break
```

extremely simplified version!

	ROOT	il	gatto	insegue	il	topo	in	giardino
il			DET					
gatto				SUBJ				
insegue	TOP							
il						DET		
topo				OBJ				
in								CONN
giardino				RMOD		RMOD		



THANKS

Please send your questions, opinions and requests to info@parsit.it

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