Learning Morphology of Romance, Germanic, and Slavic languages with the tool *Linguistica*

Helena Blancafort

LREC 2010

Outline

1. Introduction
2. State of the art
3. Linguistica: How it works
4. Experiments and Results
5. Conclusions and further work

Introduction

Motivation

How can we predict the cost of developing a morphosyntactic lexicon for a new language?

Goals

- Evaluate if we can benefit from unsupervised learning of morphology

- Input: Bible parallel corpus, tool *Linguistica* (Goldsmith 2001, 2006)

State of the Art: Induction of morphology

Objective

- induce morphological information from raw data

Affix inventory

- Brent et al. 1995; Kazakov, 1997
- MDL (Rissanen ,1998)

Cluster of stems and affixes

- Schone and Jurafsky 2001;
- Yarowsky andWicentowski 2001

State of the Art II

Using linguistic knowledge or not

Lexicon

- Nakov et al (2003); Oliver (2005)
- Learn all possible endings of an unknown word
- Apply Maximum Likelihood Estimation (Mikheev)

Inflection Rules

- Clément et al. (2004)
- Fosbert et al (2006); Loupy et al. (2008)
- **Pos-tagger** Zanchetta and Baroni (2005)

Linguistica: How it works I

- Knowledge-free
- Input: raw corpus
- Heuristics to generate a probabilistic morphological grammar
- MDL (minimum length description) & EM (expectation-maximization algorithm) to filter out inappropriate analysis

Linguistica: How it works II

Signatures

Paradigm-like clusters with words sharing the same affixes

→ could help to build a morphological grammar

The algorithm:

- Splits a word into stem and affix
- For each stem, list of affixes
- Cluster of stems sharing the same affixes

Linguistica: How it works III

Signatures

NULL.ed.ing.s 68 7889
gather abound account ascend ask belong boil chasten concern confirm consider delay doubt encamp enter exceed explain fail fasten fold gain gather glean greet groan guard hang happen harden insult journey knock lack leap lift listen look minister number obey offer overflow

Linguistica: How it works IV

Main hurdles

1) **Allomorphy**

ES *colgar* -> colg, cuelg
FR *acheter* -> *achet, achèt*

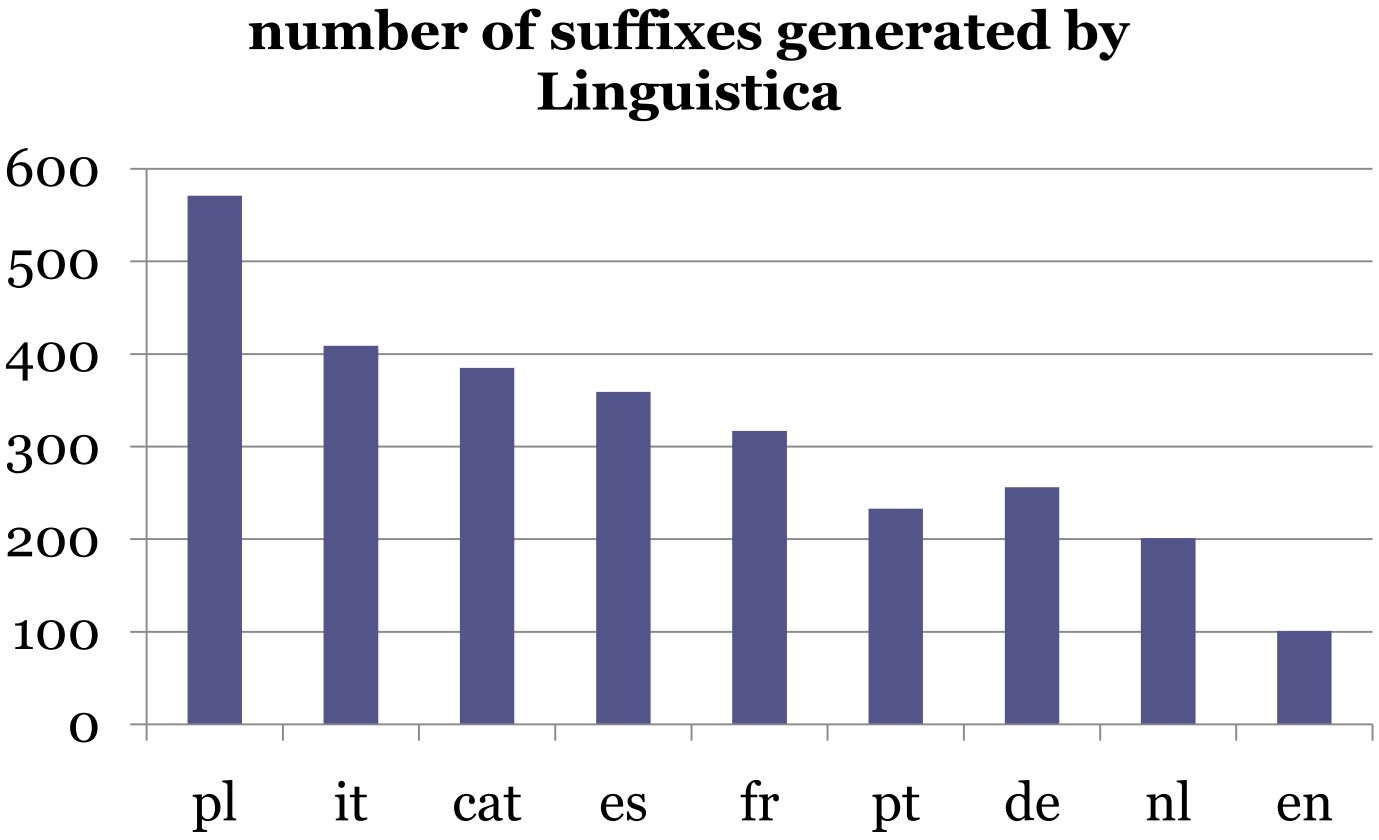
2) **Incomplete paradigms** due to bad segmentation

Spanish verb *anunciar:*

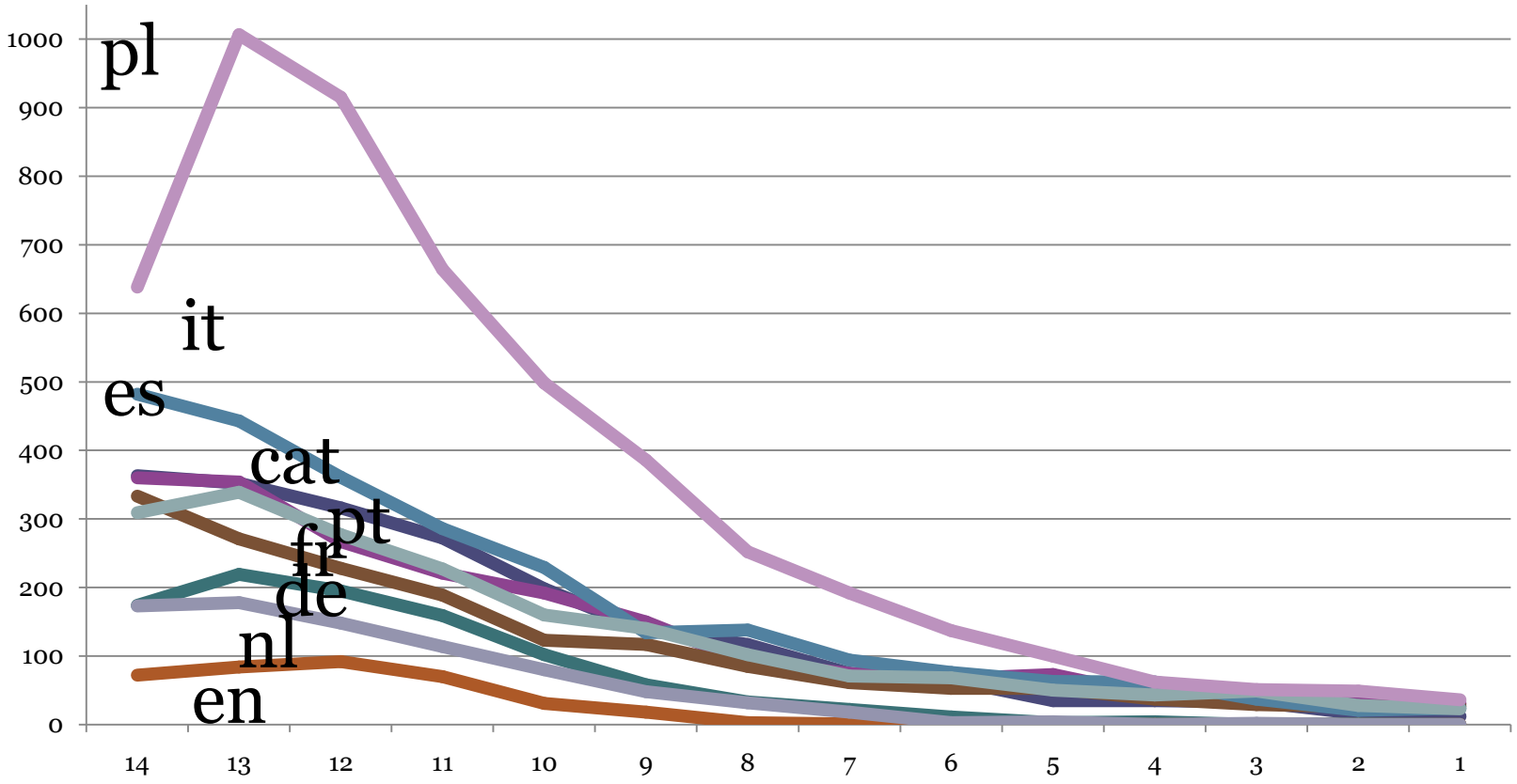
anunci(o, en, etc.), anunciab(a)

3) No distinction between inflectional and derivational suffixes

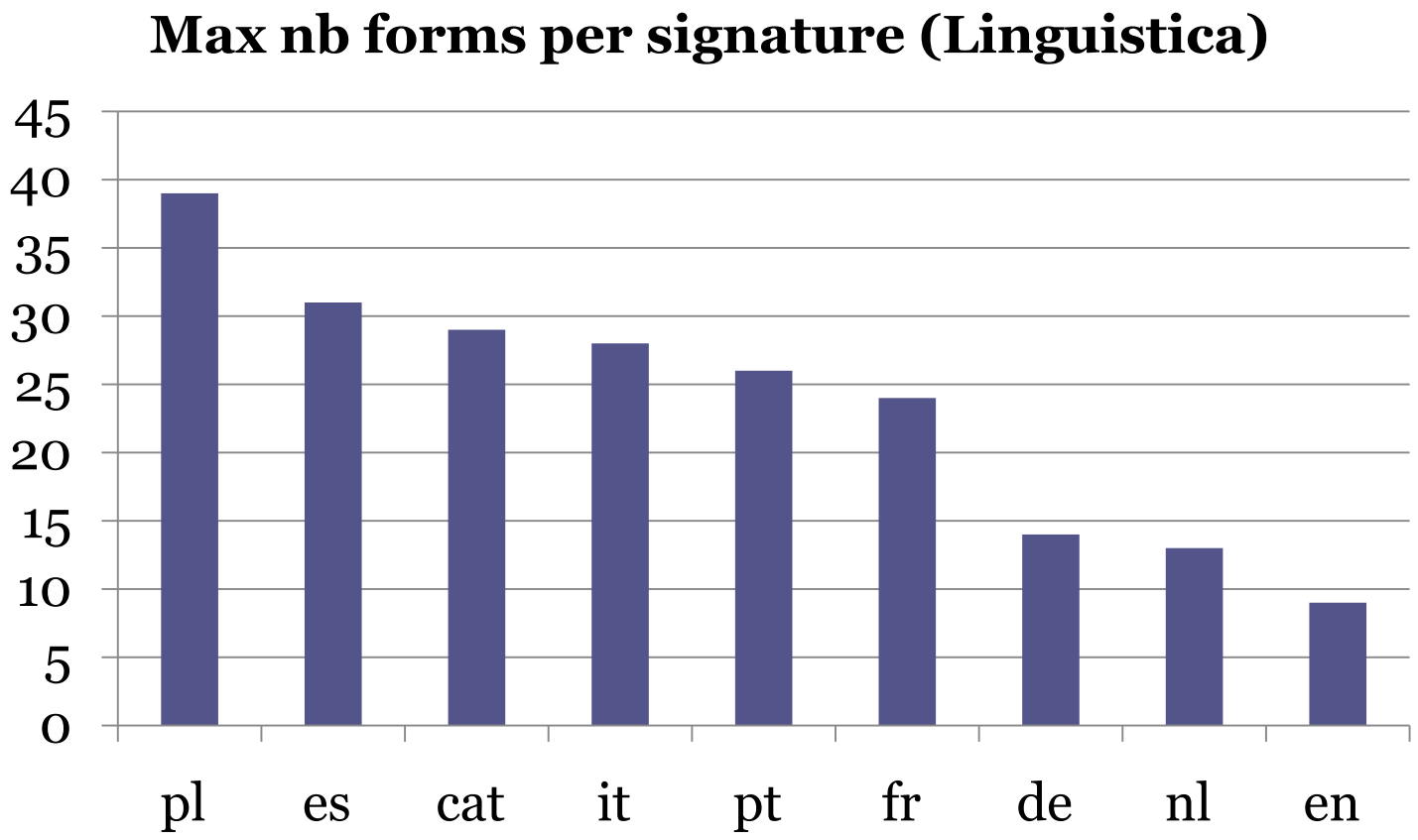
Experiments and Results I



Experiments and Results II
Number of paradigmes and number of suffixes



Experiments and Results III



Experiments and Results IV

Knowledge-free vs. Knowledge based

Max nb forms per signature (Linguistica)	
es	31
it	28
fr	24
de	14
en	9

Max nb forms per paradigm (Multext)	
it	63
fr	62
es	55
de	29
en	14

Experiments and Results V

Longest signatures suggested by Linguistica for a stem

	Affix	Stem	signature
pl	39	da	NULL.ch.cie.dzą.j.je.jmy.jmyż.ją.jąc.li.liście.liśmy .m.my.na.ne.nej.ni.nie.niu.no.ny.ną.rze.sz.wa.w ał.wszy.ć.ł.ła.łby.łbyś.łem.łeś.ło.ły.ń
es	31	anunci	a.ad.ada.adas.adlo.ado.amos.an.ando.ar.ara.arl es.aron.aros.arte.ará.arán.arás.aré.as.ase.asen. e.emos.en.es.o.áis.é.éis.ó
de	14	heil	NULL.e.en.et.ig.los.lose.loser.sam.same.sames. t.te.ten
en	9	light	NULL.ed.en.er.ing.ly.ness.ning.s

Experiments and Results VI

List of most frequent prefixes for German

Prefix	Nb occ.	Prefix	Nb occ.	Prefix	Nb occ.
ge	40	her	13	er	8
aus	30	un	13	*nied	7
ver	21	weg	11	bei	6
hin	20	be	10	heim	6
auf	19	zu	10	über	5
ab	19	*üb	9	durch	5
ein	16	an	9	ent	4

Conclusions and Further Work

- Useful information to **evaluate the richness and complexity of the morphology** of a language
- Unsupervised techniques should be improved with **human input**: handwritten-rules are necessary for dealing with allomorphy and correct bad segmentation (Karasimos & Petropoulo 2010)
- Complete paradigms using the web (Oliver 2005) or
- Output **quality** is **language-dependent**, English better results than other languages (complete verbal paradigms)

Thank you

Grazzi