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L² F - Spoken Language Systems Laboratory

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Integrating a Lexicon-Grammar of Verbal Idioms in STRING Portuguese NLP system

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System Architecture

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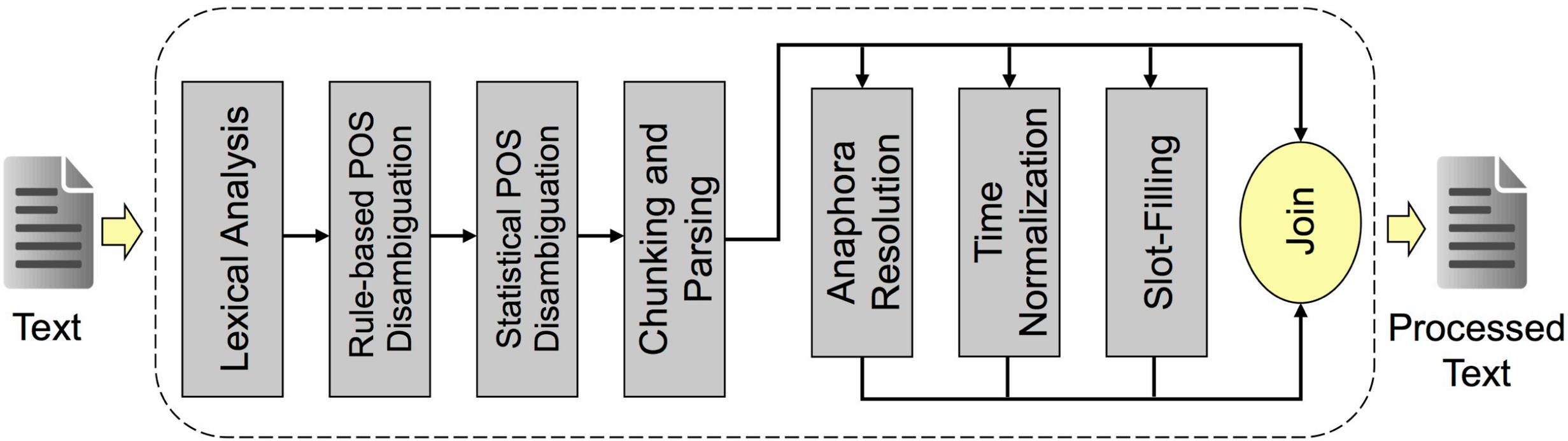
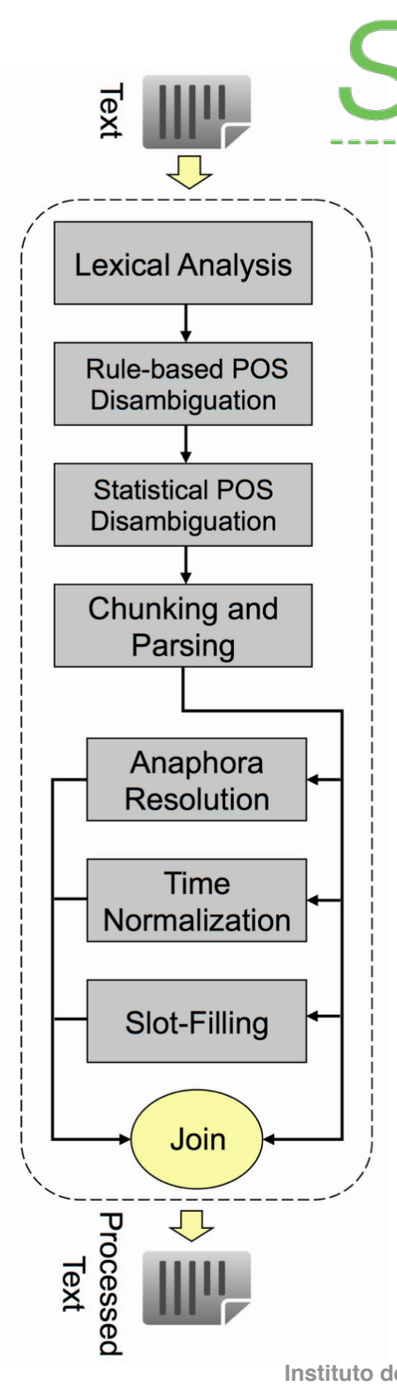
String *statistical and rule-based natural language processing chain*



string.l2f.inesc-id.pt

MWEs in STRING



← unambiguous compounds — *lua-de-mel* ‘honeymoon’

← ambiguous/context dependent compounds — *, a saber,* ‘namely’

← Lexicon-Grammars

perder a cabeça
‘lose one’s mind’

Lexicon-Grammar of Verbal Idioms

Class	Structure	Example	Size
C1	N_0 V C_1	O Pedro matou a galinha dos ovos de ouro	800
CAN	N_0 V (C de N)$_1$ = C_1 a N_2	O Pedro arrefeceu os ânimos (da Maria = à Maria)	200
CDN	N_0 V (C de N)$_1$	O Pedro queria a cabeça da Maria	100
CP1	N_0 V Prep C_1	O Pedro bateu com a porta	900
CPN	N_0 V Prep (C de N)$_1$	O Pedro foi aos cornos do João	100
C1PN	N_0 V C_1 Prep N_2	O Pedro arrastou a asa à Maria	400
CNP2	N_0 V N_1 Prep C_2	O Pedro tirou o relógio do prego	350
C1P2	N_0 V C_1 Prep C_2	O Pedro deitou mãos à obra	400
CPP	N_0 V Prep C_1 Prep C_2	O Pedro foi de cavalo para burro	200
CPPN	N_0 V C_1 Prep C_2 Prep C_3	O Pedro deitou o bebé fora com a água do banho	50
		Total	3,500

Table 1. Lexicon-Grammar of Frozen Sentences of European Portuguese
N and *C* stand for free or frozen noun phrases, respectively; N_0 is the subject, N_1 , N_2 and N_3 the first, second and third complement; *V* is the verb and *Prep* a preposition. Figures are approximate.

Baptista *et al*. 2004, 2005

Lexicon-Grammar of Verbal Idioms

N0=:Nhum	*N0=:N-hum*	V	*Vse*	*NegObrig*	*Prep*	*Det*	C	*N1=: Nhum*	*N1=: N-hum*	*de N = a N*	*de N = Poss*	Example
+	-	<acabar>	-	-	com	a	raça	+	-	+	+	*O Pedro acabou com a raça da Maria*
+	-	<atirar>	+	-	a	os	pés	+	-	+	+	*O Pedro atirou-se aos pés da Maria*
+	-	<chegar>	-	+	a	os	calcanhares	+	-	+	+	*O Pedro não chega aos calcanhares da Maria*
+	-	<cortar>	-	-	em	a	casaca	+	-	+	-	*O Pedro cortava na casaca da Maria*
+	-	<ir>	-	-	a	as	trombas	+	-	+	-	*O Pedro foi às trombas do João*
+	-	<ir>	-	-	em	a	cantiga	+	-	-	+	*O Pedro foi na cantiga da Maria*
+	-	<ir>	-	-	a	a	cara	+	-	+	-	*A Maria foi à cara do Pedro*
+	-	<pegar>	-	-	em	a	deixa	+	-	+	+	*O Pedro pegou na deixa da Maria*
+	-	<rir>	-	-	em	a	cara	+	-	+	+	*O Pedro riu na cara da Maria*
+	-	<rir>	+	-	em	a	cara	+	-	+	+	*O Pedro riu-se na cara da Maria*
-	+	<sair>	-	-	de	o	pelo	+	-	+	-	*O salário sai-lhe do pelo*
-	+	<subir>	-	-	a	a	cabeça	+	-	+	+	*A fama subiu à cabeça do Pedro*
+	-	<viver>	-	-	em	a	sombra	+	+	-	+	*O Pedro vive na sombra da Maria*

Table 2. Class CPN : *N0 V Prep (C de N)1*

Lexical elements presented in basic order; verbs are indicated by <lemma> and other elements by surface form; contractions of preposition and determiner are undone; distributional and transformational properties are represented by binary features: '+/-'. *Vse* : intrinsically reflexive constructions, *NegObrig* : obligatory negation, *deN=aN* : dative restructuring, *deN=Poss* : possessive pronouning.

STRING's Strategy for verbal idioms

- parse sentences as usual
- use syntactic dependencies built until then

- to extract a new dependency FIXED linking the core elements of the verbal idiom
- use this dependency to:
  - by-pass full, ordinary verbs' constructions (WSD)
  - extract the idioms as EVENTs (predicates)
  - extract the semantic roles of the idiom' free argument slots
  - avoid extracting part-whole relations
  - ...

Semi-automatically produced rules

At the last stages of parsing:

O Pedro não chega aos calcanhares do João
'Peter does not reach the heels of John'

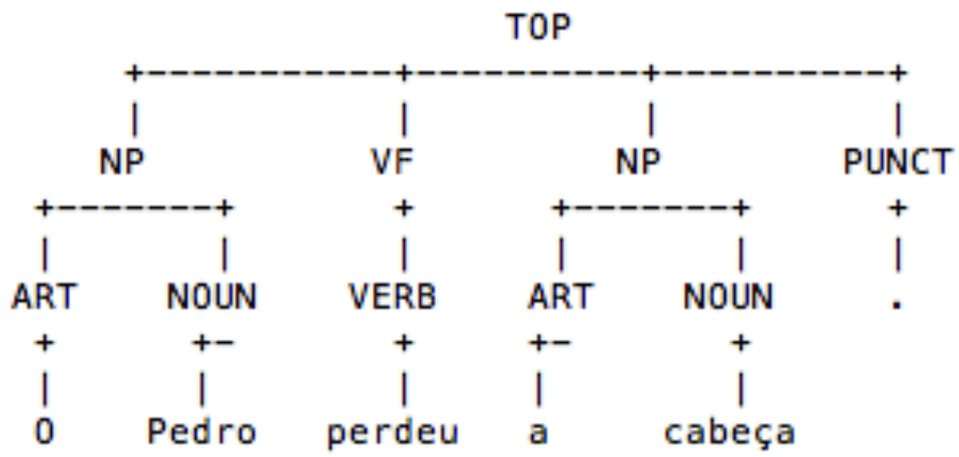
N=:Nhum	N=:N-hum	V	Vse	NegObrig	Prep	Det	C	N≠:Nhum	N≠:N-hum	de N = a N	de N = Poss	Example
+	-	<acabar>	-	-	com	a	raça	+	-	+	+	*O Pedro acabou com a raça da Maria*
+	-	<atirar>	+	-	a	os	pés	+	-	+	+	*O Pedro atirou-se aos pés da Maria*
+	-	<chegar>	-	+	a	os	calcanhares	+	-	+	+	*O Pedro não chega aos calcanhares da Maria*
+	-	<cortar>	-	-	em	a	casaca	+	-	+	-	*O Pedro cortava na casaca da Maria*
+	-	<ir>	-	-	a	as	trombas	+	-	+	-	*O Pedro foi às trombas do João*
+	-	<ir>	-	-	em	a	cantiga	+	-	-	+	*O Pedro foi na cantiga da Maria*
+	-	<ir>	-	-	a	a	cara	+	-	+	-	*A Maria foi à cara do Pedro*
+	-	<pegar>	-	-	em	a	deixa	+	-	+	+	*O Pedro pegou na deixa da Maria*
+	-	<rir>	-	-	em	a	cara	+	-	+	+	*O Pedro riu na cara da Maria*
+	-	<rir>	+	-	em	a	cara	+	-	+	+	*O Pedro riu-se na cara da Maria*
-	+	<sair>	-	-	de	o	pelo	+	-	+	-	*O salário sai-lhe do pelo*
-	+	<subir>	-	-	a	a	cabeça	+	-	+	+	*A fama subiu à cabeça do Pedro*
+	-	<viver>	-	-	em	a	sombra	+	+	-	+	*O Pedro vive na sombra da Maria*

```
if (VDOMAIN(#1,#2[lemma:chegar]) &
PREPD(#3[surface:calcanhares],#4[lemma:a])
& MOD[post](#2,#3) & MOD[pre,neg](#2,#5) )
FIXED(#5,#2,#4,#3)
```

Chunking and dependency parsing
Example: *O Pedro perdeu a cabeça*
Peter lost the head ‘Peter lost his mind’

Terminal — ssh — 104×28

```
x05.l2f.inesc-id.ptjbaptis[8:44] echo "O Pedro perdeu a cabeça." | xip/string.sh -t -tr -f -indent
```




```
MAIN(perdeu)
DETD(Pedro,O)
DETD(cabeça,a)
VDOMAIN(perdeu,perdeu)
SUBJ_PRE(perdeu,Pedro)
CDIR_POST(perdeu,cabeça)
FIXED(perdeu,cabeça)
NE_PEOPLE_INDIVIDUAL(Pedro)
0>TOP{NP{O Pedro} VF{perdeu} NP{a cabeça} .}

x05.l2f.inesc-id.ptjbaptis[8:45]
```

```
if (VDOMAIN(?,#2[lemma:perder])
& CDIR[post](#2,#3[surface:cabeça]))
FIXED(#2,#3)
```

Example: Peter lost the head=Peter lost his mind

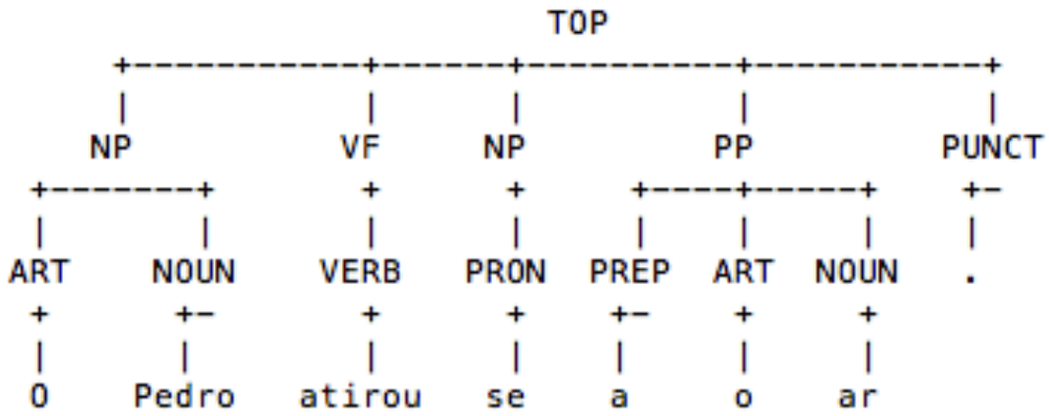
Terminal — ssh — 121×28

```
x05.l2f.inesc-id.ptjbaptis[8:45] more trees.out

TOP(0-23)+[cat:0]
 NP(0-6)-[np:+,noun:+,start:+,first:+]
  ART(0-0)+[def:+,toutmaj:+,maj:+,masc:+,sg:+,art:+,hmmselection:+,!start:+,first:+]
    O(0-0)+[def:+,toutmaj:+,maj:+,masc:+,sg:+,art:+,hmmselection:+,!start:+,first:+]
  NOUN(2-6)-[enp3:+,sem-hpeople:+,sem-hindividual:+,firstname:+,human:+,start_people:+,maj:+,proper:+,ma
sc:+,sg:+,noun:+,hmmselection:+,last:+,first:+]
    Pedro(2-6)-[enp3:+,sem-hpeople:+,sem-hindividual:+,firstname:+,human:+,start_people:+,maj:+,proper:+
,masc:+,sg:+,noun:+,hmmselection:+,last:+,first:+]
 VF(8-13)-[mark_ger:+,fin:+,verb:+]
  VERB(8-13)+[sr-n1-nhum:+,sr-n1-cdir:+,sr-pass-estar:+,sr-pass-ser:+,sr-n1-object-gen:+,sr-n0-agent-gen
:+,mark_ger:+,32c:+,markviper:+,perf:+,ind:+,3p:+,sg:+,verb:+,hmmselection:+,last:+,first:+]
    perdeu(8-13)+[sr-n1-nhum:+,sr-n1-cdir:+,sr-pass-estar:+,sr-pass-ser:+,sr-n1-object-gen:+,sr-n0-agent
-gen:+,mark_ger:+,32c:+,markviper:+,perf:+,ind:+,3p:+,sg:+,verb:+,hmmselection:+,last:+,first:+]
 NP(15-22)-[np:+,noun:+]
  ART(15-15)+[def:+,fem:+,sg:+,art:+,hmmselection:+,first:+]
    a(15-15)+[def:+,fem:+,sg:+,art:+,hmmselection:+,first:+]
  NOUN(17-22)+[sem-pos-soc:+,sem-part:+,sem-cc:+,sem-anmov:+,common:+,fem:+,sg:+,noun:+,hmmselection:+,l
ast:+]
    cabeça(17-22)+[sem-pos-soc:+,sem-part:+,sem-cc:+,sem-anmov:+,common:+,fem:+,sg:+,noun:+,hmmselection
:+,last:+]
 PUNCT(23-23)-[dots:+,punct:+,hmmselection:+,!end:+,last:+]
   .(23-23)-[dots:+,punct:+,hmmselection:+,!end:+,last:+]
 NOUN(-100--10)-[noun:+]
   outro(-100--100)-[noun:+]
x05.l2f.inesc-id.ptjbaptis[8:46]
```

Chunking and dependency parsing
Example: Peter jump in the air ‘Peter got furious’

Terminal — ssh — 117×29




```
MAIN(atirou)
DETD(Pedro,0)
DETD(ar,o)
VDOMAIN(atirou,atirou)
MOD_POST(atirou,ar)
SUBJ_PRE(atirou,Pedro)
CDIR_POST(atirou,se)
CLITIC_POST(atirou,se)
FIXED(atirou,a,ar)
NE_PEOPLE_INDIVIDUAL(Pedro)
EVENT_LEX(atirou,outro)
EVENT_OTHER(atirou)
EVENT_AGENT-GENERIC(atirou,Pedro)
0>TOP{NP{0 Pedro} VF{atirou} NP{se} PP{a o ar} .}

x05.l2f.inesc-id.ptjbaptis[9:00]
```

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