



Linguistic Resources for the automatic annotation of speech

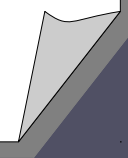
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Any and all constructive comments are welcome.

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Resources for Automatic Annotations of Speech

1.1 Available data

1.1.1 Description

- Repository: <https://www.ortolang.fr>
- Owner: Brigitte Bigi contact@sppas.org
- Permanent URL: <https://hdl.handle.net/11403/sppasresources>

There are 2 types of data in the Ortolang repository, separated into two folders.

The folder `lang` contains linguistic resources that are needed by language-dependent automatic annotations. For each language, it can include lexicons, pronunciation dictionaries, acoustic models and/or syllabification rules. For a given language, these resource files are compressed into a ZIP file. The language name is coded with the iso639-3 code - “fra” for French, “eng” for English, “cmn” for Mandarin Chinese, etc. See <http://www-01.sil.org/iso639-3/> for the full list of all languages and codes.

The folder `annot` includes linguistic resources required by some automatic annotations like for example statistical models. The resources are available in compressed ZIP files, one for each supported annotation.

It should be noted that these resources were initially created to be used by SPPAS <http://www.sppas.org>. They are open source so they can be downloaded without limitation and used by any other annotation tool or anything else. All files can be edited, modified and most of the time re-distributed. Since SPPAS itself is a language-independent annotation program, you can make annotation of a language if given the appropriate language resources for the target language. The annotation accuracy largely depends on the resources.

1.1.2 Download and install

The “Download” button of the main page of the Ortolang website should **not** be used. It will download the whole repository into a corrupted zip file that can’t be un-compressed. Instead, click on the “Browse” button

and download the individual ZIP file(s) you are interested in, from either the `lang` folder or the `annot` folder or both.

To *install manually* the resources into SPPAS software tool, download and un-compress the ZIP file(s) you are interested in into the `resources` folder of the SPPAS package.

To *install automatically* the resources into SPPAS software tool, it is not needed to download them manually. Launch the graphical user interface with the `sppas` command, then click on the “Annotate” button of the menu, then click “Add languages” or “Add annotations” button of the toolbar. It’ll open a dialog in which you’ll check the languages or annotations you want. Then, click the “Install” button. You can also use the program “`sppas/bin/preinstall.py`” in the command-line user interface.

1.2 lang folder

1.2.1 Overview

Automatic annotations proposed by SPPAS are implemented with language-independent algorithms. The main and interesting consequence is that adding a new language into SPPAS only consists in adding the required linguistic resources related to the annotation:

- Text normalization requires lexicons;
- Phonetization requires a pronunciation dictionary;
- Alignment requires an acoustic model;
- Syllabification requires a configuration file with the rules.

In this document, all the table indicate the list of phonemes that are included in the resources required for phonetization, alignment and syllabification of a given language. The first column represents the symbols used by SPPAS and the other columns are intended to help users to better understand what it means.

The encoding of phonemes in SPPAS resources is based on a computer-readable phonetic list of 7-bit printable ASCII characters: X-SAMPA. This Extended Speech Assessment Methods Phonetic Alphabet was developed in 1995 by John C. Wells, professor of phonetics at the University of London. X-SAMPA is a language-independent notation covering the entire International Phonetic Alphabet - IPA repertoire.

A plugin of SPPAS allows to convert time-aligned phonemes from X-SAMPA to IPA.

The acoustic models created by the author, Brigitte Bigi, were trained using the HTK toolbox, version 3.4.1. “HTK has been developed by the Machine Intelligence Laboratory (formerly know as the Speech Vision Robotics Group) at the [Cambridge University Engineering Department](#) (CUED) and [Entropic Ltd](#). Microsoft has now licensed HTK back to CUED and is providing support so that CUED can redistribute HTK and provide development support via the HTK3 web site.” (source: <http://htk.eng.cam.ac.uk/>) Notice that HTK is available for free download after registration and users must first agree to the license. It should be noted that the section 2.2 of the license terms mentions that HTK “*either in whole or in part can not be distributed or sub-licensed to any third party in any form.*”

1.2.2 Contribute

Each of the provided resources is imperfect... and could be improved. How?

1. Edit the file, apply your changes, e-mail your modified version;

2. Send new audio and transcribed data to re-train the acoustic model.

You can also create new resource files and share them! Altruism is resulting a quality of life... you can do it.

1.3 Licenses

Most of the time, the distributed files are under the terms of the GNU General Public License.

However, some of the resources are under the terms of a more restrictive license. Please, take care of it, particularly before re-distributing.

French language

2.1 Download

This chapter describes the linguistic resources included in both the files `fra.zip` and `fraquebec.zip` of the `lang` folder.

2.2 List of phonemes

Consonant Plosives

SPPAS	IPA	Description	Examples
p	p	voiceless bilabial	passé, par, appris
b	b	voiced bilabial	beau, abris, baobab
t	t	voiceless alveolar	tout, thé, patte
d	d	voiced alveolar	doux, deux, addition
k	k	voiceless velar	cabas, psycho, quatre, kelvin
g	g	voiced velar	gain, guerre, second

Consonant Fricatives

SPPAS	IPA	Description	Examples
f	f	voiceless labiodental	fête, pharmacie
s	s	voiceless alveolar	sa, hausse, ce, garçon, option, scie
S	ʃ	voiceless postalveolar	choux, schème, shampooing
v	v	voiced labiodental	vous, wagon, neuf heures
z	z	voiced alveolar	hasard, zéro, transit
Z	ʒ	voiced postalveolar	joue geai

Consonant Nasals

SPPAS	IPA	Description	Examples
m	m	bilabial	mou, homme
n	n	alveolar	nous, bonne

Consonant Liquids

SPPAS	IPA	Description	Examples
l	l	alveolar lateral	lit, ville, fil
R	ʀ	voiced uvular	roue, rhume, arrive

Semivowels

SPPAS	IPA	Description	Examples
j	j	palatal	payer, fille, travail
w	w	voiced labiovelar	oui, web, whisky
H	ɥ	labial-palatal	huit, Puy

Vowels for French (fra dictionary)

SPPAS	IPA	Description	Examples
E	ɛ	open-mid front unrounded	crème, faite, peine, fête, maître, mètre
A/	a	open front unrounded	patte, là
A/	ɑ	open back unrounded	pâte glas
9	œ	open-mid front rounded	sœur, neuf, œuf
i	i	close front unrounded	si, île, régie, y
e	e	close-mid front unrounded	clé, les, chez, aller, pied, journée
O/	o	close-mid back rounded	sot, hôtel, haut
O/	ɔ	open-mid back rounded	sort, minimum
u	u	close back rounded	cou, clown, roue
y	y	close front rounded	tu, sûr, rue
2	ø	close-mid front rounded	ceux, jeûner, deux
@	ə	schwa	le, reposer, faisons
a~	ã	nasal	sans, champ, vent, temps, Jean, taon
U~/	ɛ̃	nasal	vin, pain, brin, printemps
U~/	œ̃	nasal	un, parfum, brun
O~	ɔ̃	nasal	son, nom, bon

Vowels for Quebec French

SPPAS	IPA	Description	Examples
E	ɛ	open-mid front unrounded	crème, faite, peine
a	a	open front unrounded	patte
A	ɑ	open back unrounded	pâte
2	ø	close-mid front rounded	deux
3	ɜ	open-mid central unrounded	fête, maître, mètre
9	œ	open-mid front rounded	sœur, neuf, œuf
i	i	close front unrounded	régie
I	ɪ	near-close front unrounded	île
e	e	close-mid front unrounded	clé, les, chez, aller, pied, journée
o	o	close-mid back rounded	sot, haut, hôtel
O	ɔ	open-mid back rounded	sort, minimum
u	u	close back rounded	cou
U	ʊ	near-close back rounded	clown
y	y	close front rounded	tu, sûr, rue
Y	ɥ	near-close front rounded	thune, truc
@	ə	schwa	
A~	ã	nasal	banc, sans, champ, vent
E~	ɛ̃	nasal	bassin, pain, brin
O~	ɔ̃	nasal	son, nom, bon
U~/	œ̃	nasal	un, parfum, brun

Fillers

SPPAS	Description
laugh	laughter
noise	noises, unintelligible speech
fp	filled pause (“euh”)
dummy	un-transcribed speech

Other phonemes for French

The following list of phonemes are used only in the “fre” dictionary, but not in the “fra” one. There are all represented in the acoustic model, so any of them can be used in any pronunciation dictionary.

SPPAS	IPA	Description	Examples
o	o	close-mid back rounded	sot, hôtel, haut
O	ɔ	open-mid back rounded	sort, minimum
e~	ɛ̃	nasal	vin, pain, brin
9~	œ̃	nasal	un, parfum, brun
N	ŋ	voiced velar	camping, bingo
J	ɲ	palatal	gagne, pignon

2.3 Lexicons

All French lexicons are (c) *Laboratoire Parole et Langage, Aix-en-Provence, France*:

- `fra.vocab` contains a list of 345k different words;
- `fra.stp` contains a list of 65 stop-words;
- `fra.lem` is a list of words with their lemmas and occurrences;
- `fra_num.repl` allows to convert numbers to their written form;
- `fra.repl` allows to convert symbols and abbreviations into a text form.

All of them are distributed under the terms of the *GNU General Public License*.

2.4 Dictionaries

There are 3 dictionnaires for French language:

1. `fra.dict` which is recommended for spontaneous speech;
2. `fre.dict` which is recommended for standard read speech;
3. `fra_quebec.dict` is for Quebec French.

The Quebec French pronunciation dictionary is (c) *Marie-Hélène Côté, Université de Lausanne*. The other two dictionaries are (c) *Laboratoire Parole et Langage, Aix-en-Provence, France*. All of them are distributed under the terms of the *GNU General Public License*.

The 2 French pronunciation dictionaries were created by Brigitte Bigi by collecting and merging several free dictionaries loaded from the web.

In the “fra” one, some pronunciations were added using the LIA_Phon tool. Many words were manually corrected and a large set of missing words and pronunciation variants were manually added. Moreover, the observed frequent pronunciations in conversational corpora were added: it’s mainly about reductions. The following meta-phonemes are used: A/ for both a and A; O/ for both o and O; U~/ for both e~ and 9~. The following phoneme is not used: N, it is replaced by the sequence “n g”.

In the “fre” one, only the “standard” French pronunciations are used. However, the only meta-phoneme is “A/”. Moreover, “N” is used.

The Quebec French dictionary was created by Marie-Hélène Côté, Université de Lausanne. It was converted to the required format (.dict and SAMPA) by B. Bigi. The version currently distributed is limited to 40k words. The full original version (192k words) is available on-demand.

2.5 Acoustic Models

The French acoustic model was created by Brigitte Bigi from various corpora mainly recorded at Laboratoire Parole et Langage. Special thanks are addressed to Roxane Bertrand, Béatrice Priego-Valverde, Sophie Herment, Amandine Michelas, Christine Meunier and Cristel Portes for kindly sharing their corpora. This model was evaluated in (Bigi & Meunier, 2018).

The model was updated in February 2022, by adding 31 minutes of manually time-aligned read speech of the CLeLfPC corpus, and by adding an HMM model the phonemes: o, O, e~, 9~ and N. There's no evaluation of this new version.

The Quebec French acoustic model is based on the HMMs of the French model and the missing vowels were picked up from the Deutch, the English and the Polish models. This initial QF acoustic model created from the HMMs of other languages was then adapted to QF with a corpus Mélanie Lancien created for this purpose. This training subset is made of 273 seconds of speech - 2390 phonemes, an extract of the PFC corpus. The model was evaluated in (Lancien et al., 2020).

Both models are distributed under the terms of the *Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License*.

2.6 Syllabification configuration file

The syllabification configuration file corresponds to the one described in the paper (Bigi et al. 2010). It was adapted to Quebec French by adding the missing vowels. It is distributed under the terms of the *GNU General Public License*.

2.7 Cued Speech

The resources for the automatic generation of Cued Speech keys are under construction. They can only be used in order to help in their development. They are created by Brigitte Bigi in collaboration with Datha: <http://www.datha.io>

The file is a set of rules in order to be used to convert a sequence of phonemes into a sequence of keys.

They are distributed under the terms of the *GNU General Public License*.

2.8 References

Brigitte Bigi, Christine Meunier, Irina Nesterenko, Roxane Bertrand (2010). *Automatic detection of syllable boundaries in spontaneous speech*. In Language Resource and Evaluation Conference (LREC), pp. 3285-3292, La Valetta, Malta.

Brigitte Bigi, Christine Meunier (2018). *Automatic speech segmentation of spontaneous speech*. Revista de Estudos da Linguagem. International Thematic Issue: Speech Segmentation. Volume 26, number 4, pages 1489-1530, e-ISSN 2237-2083.

Mélanie Lancien, Marie-Hélène Côté, Brigitte Bigi (2020). *Developing Resources for Automated Speech Processing of Quebec French*. In Language Resources and Evaluation Conference (LREC), pp. 5323–5328, Marseille, France.

Italian language

3.1 Download

This chapter describes the linguistic resources included in the file `ita.zip` of the `lang` folder.

3.2 List of phonemes

Consonant Plosives

SPPAS	IPA	Description	Examples
p	p	voiceless bilabial	primo, ampio, copertura
b	b	voiced bilabial	banca, cibo
t	t	voiceless alveolar	tranne, mito, Fiat
d	d	voiced alveolar	dove, idra
k	k	voiceless velar	cavolo, acuto, anche, quei
g	g	voiced velar	gatto, agro, glifo, ghetto

Consonant Fricatives

SPPAS	IPA	Description	Examples
f	f	voiceless labiodental	fatto, fosforo
s	s	voiceless alveolar	sano, scatola, presentire
S	ʃ	voiceless postalveolar	scena, sciame, pesci
z	z	voiced alveolar	sbavare, presentare, asma
v	v	voiced labiodental	vado, povero

Consonant Nasals

SPPAS	IPA	Description	Examples
m	m	bilabial	mano, amare, campo
n	n	alveolar	nano, punto, pensare, anfibio
J	ɲ	palatal	gnocco, ogni
N	ŋ	voiced velar	fango, unghia, panchina, dunque

Consonant Liquids

SPPAS	IPA	Description	Examples
l	l	alveolar lateral	lato, lievemente
L	ʎ	palatal lateral	gli, glielo, maglia
r	r	alveolar trill	Roma, quattro, morte

Semivowels

SPPAS	IPA	Description	Examples
j	j	voiced palatal	ieri, più, Jesi
w	w	voiced labiovelar	uovo, fuoco, qui

Vowels

SPPAS	IPA	Description	Examples
E	ɛ	open-mid front unrounded	elica, cioè
a	a	open front unrounded	alto, sarà
o	ɔ	open-mid back rounded	otto, posso, sarò
o	o	close-mid back rounded	ombra, come
e	e	close-mid front unrounded	vero, perché
i	i	close front unrounded	imposta, colibrì, zie
u	u	close back rounded	ultimo, caucciù, tuo
a~	ã	nasal	-
e~	ẽ	nasal	-
O~	õ	nasal	-

Affricates

SPPAS	IPA	Description	Examples
tʂ	tʃ	voiceless postalveolar	Cennini, cinque, ciao
ts	t͡s	voiceless alveolar	sozzo canzone marzo

SPPAS	IPA	Description	Examples
dz	$\widehat{d}z$	voiced alveolar	zaino zelare mezzo
dZ	$\widehat{d}ʒ$	voiced postalveolar	giungla, magia, fingere

Fillers

SPPAS	Description
laugh	laughter
noise	noises, unintelligible speech
dummy	un-transcribed speech
fp	filled pause (eh, ah)

3.3 Lexicons

All Italian lexicons are (c) *Laboratoire Parole et Langage, Aix-en-Provence, France*:

- `ita.vocab` contains a list of 389k different words;
- `ita_num.repl` allows to convert numbers to their written form;
- `ita.repl` allows to convert symbols and abbreviations into a text form.

All of them are distributed under the terms of the *GNU General Public License*.

3.4 Pronunciation dictionary

The Italian dictionary was downloaded in 2011 from the [Festival synthesizer tool](#). A large amount of the phonetization were manually corrected by Brigitte Bigi and a large set of missing words and pronunciation variants were added manually.

It is distributed under the terms of the *GNU General Public License*.

3.5 Acoustic Model

The Italian acoustic model was created during the Evalita 2011 evaluation campaign, from the CLIPS Map-Task corpus (3h30), and updated during the Evalita 2014 evaluation campaign.

It is distributed under the terms of the *Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License*.

Three nasalized vowels were added (2021, September) but not currently used in the pronunciation dictionary.

3.6 Syllabification configuration file

The syllabification configuration file corresponds to the rules defined in the paper (Bigi and Petrone, 2014). This file is distributed under the terms of the *GNU General Public License*.

3.7 References

Brigitte Bigi, Caterina Petrone (2014). *A generic tool for the automatic syllabification of Italian*. In Proceedings of the First Italian Conference on Computational Linguistics CLiC-it 2014 and of the Fourth International Workshop EVALITA 2014, pp. 73-77, Pisa, Italy.

Brigitte Bigi (2014). *The SPPAS participation to Evalita 2014*. In Proceedings of the First Italian Conference on Computational Linguistics CLiC-it 2014 and the Fourth International Workshop EVALITA 2014, Pisa, Italy.

Brigitte Bigi (2012). *The SPPAS participation to Evalita 2011*. Lecture Notes in Artificial Intelligence, LNAI-7689, pp. 312-321. Rome, Italy.

Spanish language

4.1 Download

This chapter describes the linguistic resources included in the file `spa.zip` of the `lang` folder.

4.2 List of phonemes

Consonant Plosives

SPPAS	IPA	Description	Examples
p	p	voiceless bilabial	pozo, topo, perro
b	b	voiced bilabial	bestia, embuste, vaca
t	t	voiceless alveolar	tamiz, átomo
d	d	voiced alveolar	dedo, cuando, aldaba
k	k	voiceless velar	caña, laca, quise, kilo
g	g	voiced velar	gato, lengua, gatouerra

Consonant Fricatives

SPPAS	IPA	Description	Examples
f	f	voiceless labiodental	fase, café
j\	ʃ	voiced palatal fricative	ayer, haya
s	s	voiceless alveolar	saco, zapato, cientos, espita
z	z	voiced alveolar	isla, mismo, deshuesar
S	ʃ	voiceless postalveolar	English, abacaxi, Shakira
T	θ	voiceless dental	cereal, encima, zorro, enzima, paz
x	x	voiceless velar	jamón, eje, reloj, general

Consonant Nasals

SPPAS	IPA	Description	Examples
m	m	bilabial	madre, campo, convertir
n	n	alveolar	nido, anhelo, sin, álbum
J	ɲ	palatal	ñandú, cañón, enyesar

Consonant Liquids

SPPAS	IPA	Description	Examples
l	l	alveolar lateral	lino, alhaja, principal
L	ʎ	palatal lateral	llave, pollo, roughly
r	r	alveolar trill	rumbo, carro, amor
4	ɾ	alveolar flap	caro, bravo, eterno

Semivowels

SPPAS	IPA	Description	Examples
j	j	voiced palatal	aliada, cielo, amplio
w	w	voiced labiovelar	cuadro, fuego

Vowels

SPPAS	IPA	Description	Examples
a	a	open front unrounded	azahar
o	o	close-mid back rounded	boscoso
e	e	close-mid front unrounded	vehemente
i	i	close front unrounded	dimitir, mía
u	u	close back rounded	cucurucho, dúo

Affricates

SPPAS	IPA	Description	Examples
tS	tʃ	voiceless postalveolar	chubasco, acechar

Fillers

SPPAS	Description
laugh	laughter
noise	noises, unintelligible speech
dummy	un-transcribed speech

4.3 Lexicons

All Spanish lexicons are (c) *Laboratoire Parole et Langage, Aix-en-Provence, France*:

- `spa.vocab` contains a list of 22k different words;
- `spa_num.repl` allows to convert numbers to their written form;
- `spa.repl` allows to convert symbols and abbreviations into a text form.

All of them are distributed under the terms of the *GNU General Public License*.

4.4 Pronunciation Dictionary

The pronunciation dictionary was downloaded from the [CMU web page](#) in 2013. Brigitte Bigi converted the CMU phoneset to X-SAMPA, and changed the format of the file. It is distributed under the terms of the *GNU General Public License*.

4.5 Acoustic Model

The acoustic model was trained from Glissando corpus. We address special thanks to Juan-Maria Garrido for giving us access to this corpus. It is distributed under the terms of the *Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License*.

GARRIDO, J. M. - ESCUDERO, D. - AGUILAR, L. -CARDEÑOSO, V. - RODERO, E. - DE-LA-MOTA, C. - GONZÁLEZ, C. - RUSTULLET, S. - LARREA, O. - LAPLAZA, Y. - VIZCAÍNO, F. - CABRERA, M. - BONAFONTE, A. (2013). *Glissando: a corpus for multidisciplinary prosodic studies in Spanish and Catalan*, Language Resources and Evaluation, DOI 10.1007/s10579-012-9213-0.

Catalan language

5.1 Download

This chapter describes the linguistic resources included in the file `cat.zip` of the `lang` folder.

5.2 List of phonemes

Consonant Plosives

SPPAS	IPA	Description	Examples
p	p	voiceless bilabial	pala
b	b	voiced bilabial	bala, via
t	t	voiceless alveolar	tela
d	d	voiced alveolar	donar
k	k	voiceless velar	cala
g	g	voiced velar	gala

Consonant Fricatives

SPPAS	IPA	Description	Examples
D	ð	voiced dental	cada
G	ɣ	voiceless velar	alga, mages
f	f	voiceless labiodental	fals
s	s	voiceless alveolar	si, sala
z	z	voiced alveolar	desde
S	ʃ	voiceless postalveolar	caixa
Z	ʒ	voiced postalveolar	mújol
v	v	voiced labiodental	va, vol

SPPAS	IPA	Description	Examples
T	θ	voiceless dental	circus

Consonant Nasals

SPPAS	IPA	Description	Examples
m	m	bilabial	mena
n	n	alveolar	nen
J	ɲ	palatal	any
N	ŋ	voiced velar	lingot, lingual

Consonant Liquids

SPPAS	IPA	Description	Examples
l	l	alveolar lateral	líquid
L	ʎ	palatal lateral	llamp
r	r	alveolar trill	carro
4	ɾ	alveolar flap	cara

Semivowels

SPPAS	IPA	Description	Examples
j	j	voiced palatal	iaia, naciós, iogurt
w	w	voiced labiovelar	veu, veuran

Vowels

SPPAS	IPA	Description	Examples
E	ɛ	open-mid front unrounded	sec, veça
a	a	open front unrounded	sac
O	ɔ	open-mid back rounded	soc
o	o	close-mid back rounded	sóc
e	e	close-mid front unrounded	séc, cec
i	i	close front unrounded	sic, ric
u	u	close back rounded	suc
@	ə	schwa	contra, estada
U	ɯ	near-close near-back rounded	òpols

Affricates

SPPAS	IPA	Description	Examples
dZ	ɖ̟	voiced postalveolar	metge
tS	tʃ	voiceless postalveolar	cotxe

Fillers

SPPAS	Description
laugh	laughter
noise	noises, unintelligible speech
dummy	un-transcribed speech

5.3 Lexicons

All Catalan lexicons are (c) *Laboratoire Parole et Langage, Aix-en-Provence, France*:

- `cat.vocab` contains a list of 94k different words;
- `cat.repl` allows to convert symbols and abbreviations into a text form.

All of them are distributed under the terms of the *GNU General Public License*.

Help is welcome to create a `cat_num.repl` allowing SPPAS to convert numbers to their written form.

5.4 Pronunciation dictionary

The catalan pronunciation dictionary was downloaded in 2014 from the Ralf catalog of dictionaries for the Simon ASR system at <http://spirit.blau.in/simon/import-pls-dictionary/>. It was then converted (format and phoneset) by Brigitte Bigi. Some new words were also added and phonetized manually by Eva Bosch i Roura. New entries were added from observed pronunciations in Glissando corpus.

It is distributed under the terms of the *GNU General Public License*.

5.5 Acoustic Model

The acoustic model was trained from Glissando corpus. It is distributed under the terms of the *Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License*.

We address special thanks to Juan-Maria Garrido for giving us access to the Glissande corpus:

GARRIDO, J. M. - ESCUDERO, D. - AGUILAR, L. -CARDEÑOSO, V. - RODERO, E. - DE-LA-MOTA, C. - GONZÁLEZ, C. - RUSTULLET, S. - LARREA, O. - LAPLAZA, Y. - VIZCAÍNO, F. - CABRERA, M. - BONAFONTE, A. (2013). *Glissando: a corpus for multidisciplinary prosodic studies in Spanish and Catalan*, Language Resources and Evaluation, DOI 10.1007/s10579-012-9213-0.

English language

6.1 Download

This chapter describes the linguistic resources included in the file `eng.zip` of the `lang` folder.

6.2 List of phonemes

The following list of phonemes includes both the British English and the American English. The acoustic model contains all of them. However, only the American English pronunciation dictionary is provided. The given examples are for American English.

SPPAS is based on the X-SAMPA standard. See <https://en.wikipedia.org/wiki/X-SAMPA> for details.

Consonant Plosives

SPPAS	IPA	Description	Examples
p	p	voiceless bilabial	pie, spy, cap
b	b	voiced bilabial	buy, cab
t	t	voiceless alveolar	tie, sty, cat, atom
d	d	voiced alveolar	dye, cad, do
k	k	voiceless velar	sky, crack, quick
g	g	voiced velar	guy, bag, luggage

Consonant Fricatives

SPPAS	IPA	Description	Examples
D	ð	voiced dental	thy, breathe, father
f	f	voiceless labiodental	phi, caff, fan

SPPAS	IPA	Description	Examples
s	s	voiceless alveolar	sigh, mass
S	ʃ	voiceless postalveolar	shy, cash, emotion
z	z	voiced alveolar	zoo, has
Z	ʒ	voiced postalveolar	equation, pleasure, vision, beige
v	v	voiced labiodental	vie, have
T	θ	voiceless dental	thigh, math
h	h	voiceless glottal	high, ahead

Consonant Nasals

SPPAS	IPA	Description	Examples
m	m	bilabial	my, smile, cam
n	n	alveolar	nigh, snide, can
N	ŋ	voiced velar	sang, sink, singer

Consonant Liquids

SPPAS	IPA	Description	Examples
l	l	alveolar lateral	lie, sly, gal
4	r	alveolar flap	lyda, maddy, makita
r\	ɹ	alveolar approximant	red, try, very

Semivowels

SPPAS	IPA	Description	Examples
j	j	voiced palatal	yes, yacht, william
w	w	voiced labiovelar	wye, swine, why

Vowels

SPPAS	IPA	Description	Examples
E	ɛ	open-mid front unrounded	dress, bed, fell, men
A:	ɑ:	open back unrounded	palm, father, bra
A	ɒ	open back rounded	lot, pod, John
O:	ɔ:	open-mid back rounded	thought, Maud, dawn, fall
V	ʌ	open-mid back unrounded	strut, mud, dull, gun
i	i	close front unrounded	happy, serious
i:	i:	close front unrounded	fleece, seed, feel, sea
u:	u:	close back rounded	goose, food, chew, do

SPPAS	IPA	Description	Examples
@	ə	schwa	a, baccus
I	ɪ	near-close near-front unrounded	kit, lid, fill, bin
u	u	close back rounded vowel	absolute, assume
U	ʊ	near-close near-back rounded	foot, full, woman
{	æ	near-open front unrounded	trap, pad, shall, ban

Affricates

SPPAS	IPA	Description	Examples
dZ	ɟ͡ʒ	voiced postalveolar	giant, badge, jam
tS	t͡ʃ	voiceless postalveolar	China, catch

Other symbols

SPPAS	IPA	Examples
aI	aɪ	price, ride, file, pie
aU	aʊ	mouth, loud, down, how
eI	eɪ	face, fail, vein, pay
OI	ɔɪ	choice, void, foil, boy
@U	oʊ	goat, code, foal, go
3:r	ɜ:r	liner, foundered, current

Recently added (not documented yet)

SPPAS	IPA	Description
@U		
E@		
3:	ɜ	open-mid central unrounded vowel
I@		
l=		/l/ syllabic
n=		/n/ syllabic
Q	ɒ	open back rounded vowel

Fillers

SPPAS	Description
laugh	laughter
noise	noises, unintelligible speech
dummy	un-transcribed speech

6.3 Lexicons

All English lexicons are (c) *Laboratoire Parole et Langage, Aix-en-Provence, France*:

- `eng.vocab` contains a list of 120k different words;
- `eng.stp` is a list of 150 stop-words;
- `eng_num.repl` allows to convert numbers to their written form;
- `eng.repl` allows to convert symbols and abbreviations into a text form.

All of them are distributed under the terms of the *GNU General Public License v3*.

6.4 Pronunciation dictionary

The pronunciation dictionary is for North American English. It was downloaded in 2011 from the [CMU web page](#). This Carnegie Mellon Pronouncing Dictionary (version 0.6) is Copyright (C) 1993-2008 by Carnegie Mellon University. We acknowledge CMU for distributing freely this resource and allowing its re-distribution.

Brigitte Bigi converted the original CMUdict encoded with ARPAbet into X-SAMPA and converted the format of the file in HTK-ASCII.

6.5 Acoustic Model

The first version of the acoustic model was context-dependent (better accuracy) but did not contain the fillers. This model distributed in SPPAS resources was downloaded in 2014 from the VoxForge project at <http://www.voxforge.org/>. For the second model, the monophones were extracted to create a new context-independent model in which the fillers (i.e. laugh, noise and dummy) were added. The model was under the terms of the “GNU Public License”.

In 2022, a new context-independent acoustic model was trained and phonemes for British English are introduced. This model is under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License

Polish language

7.1 Download

This chapter describes the linguistic resources included in the file `pol.zip` of the `lang` folder.

7.2 List of phonemes

Consonant Plosives

SPPAS	IPA	Description	Examples
p	p	voiceless bilabial	paw, pan
b	b	voiced bilabial	bal, ból
t	t	voiceless (post)dental	tak, tata
d	d	voiced (post)dental	dom, dawać
k	k	voiceless velar	kot, kawa
g	g	voiced velar	gar, gwiazda

Consonant Fricatives

SPPAS	IPA	Description	Examples
f	f	voiceless labiodental	fan, fotel, faza
s	s	voiceless (post)dental	sabat, subaru, sen
s\	ç	voiceless alveolo-palatal	świerszcz, śpi, się, siwy
s\	ʃ	voiceless alveolar with retroflex hook	
z	z	voiced (post)dental	za, ząb
z\	ʒ	voiced alveolo-palatal	źrebak, zima, ziemia
z\	ʒ̄	voiced retroflex	
Z	ʒ	voiced alveolar	że, żaba, rzeka

SPPAS	IPA	Description	Examples
v	v	voiced labiodental	wrak, lawenda
x	x	voiceless velar	hak, chór
S	ʃ	voiceless postalveolar	szum, sztama, Szczecin, Warszawa

Consonant Nasals

SPPAS	IPA	Description	Examples
m	m	bilabial	mój, mama
n	n	(post)dental	nos, nowy
nʼ	ɳ	retroflex	
N	ŋ	velar	bank, gang
n\	ɲ	alveolo-palatal	

Consonant Liquids

SPPAS	IPA	Description	Examples
l	l	lateral (post)dental	las, lato
r	r	alveolar trill/flap	rok, rata, krok

Semivowels / Approximants

SPPAS	IPA	Description	Examples
j	j	front approximant	ja, jajo, już
w	w	back approximant	ławka, łyk, łyże

Vowels

SPPAS	IPA	Description	Examples
a	a	open front unrounded	pat, ptak, Ala, adres
E	ɛ	open-mid front unrounded	test, ten, Ewa, deszcz
O	ɔ	open-mid back rounded	pot, kot, Ola, ogród, ogórek
i	i	close front unrounded	miś, Irena, instytut
ɪ	ɨ	near-close central unrounded	ryba, mysz, być
u	u	close back rounded	bum, uwaga, tutaj, wóz
y	y	close front rounded	mysz

Nasal vowels

SPPAS	IPA	Examples
E~	ɛ̃	węże, kęsy
o~	ɔ̃	wąż, mąż, wąsy

Affricates

SPPAS	IPA	Description	Examples
t^S	tʃ	voiceless alveolar	czas, czy, czwartek
t^s	tʃ̠	voiceless (post)dental	co, cały, Francja
t^s\	tʃ̟	voiceless alveolo-palatal	ćwiczenie, pamięć
d^z	dʒ	voiced (post)dental	dzwon, sadza
d^z\	dʒ̠	voiced alveolo-palatal	dźwięk, dziwny, niedziela
d^Z	dʒ̟	voiced alveolar	dżem, drożdże, dżuma, dżungla

Fillers

SPPAS	Description
laugh	laughter
noise	noises, unintelligible speech
dummy	un-transcribed speech

7.3 Lexicons

All Polish lexicons are (c) *Laboratoire Parole et Langage, Aix-en-Provence, France*:

- `pol.vocab` contains a list of 500k different words;
- `pol_num.repl` allows to convert numbers to their written form;
- `pol.repl` allows to convert symbols and abbreviations into a text form.

All of them are distributed under the terms of the *GNU General Public License*.

7.4 Pronunciation Dictionary

The Polish pronunciation dictionary was downloaded in 2015 from the Ralf catalog of dictionaries for the Simon ASR system at <http://spirit.blau.in/simon/import-pls-dictionary/>.

It was then converted (format and phoneset) and corrected by Brigitte Bigi, thanks to the help of Katarzyna Klessa <http://katarzyna.klessa.pl/>. An update was done in 2017 to correct systematic errors.

It is distributed under the terms of the *GNU General Public License*.

7.5 Acoustic Model

The acoustic model was created by Brigitte Bigi. We address special thanks to Katarzyna Klessa for giving us access to a corpus.

It is distributed under the terms of the *Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License*.

7.6 References

Brigitte Bigi, Katarzyna Klessa (2015). *Automatic Syllabification of Polish*. In 7th Language and Technology Conference: Human Language Technologies as a Challenge for Computer Science and Linguistics, pp. 262-266, Poznań, Poland.

Portuguese language

8.1 Download

This chapter describes the linguistic resources included in the file `por.zip` of the `lang` folder.

8.2 List of phonemes

Consonant Plosives

SPPAS	IPA	Description	Examples
p	p	voiceless bilabial	pacto
b	b	voiced bilabial	bato
t	t	voiceless alveolar	tacto
d	d	voiced alveolar	dato
k	k	voiceless velar	cacto
g	g	voiced velar	gato

Consonant Fricatives

SPPAS	IPA	Description	Examples
f	f	voiceless labiodental	facto
s	s	voiceless alveolar	saca
S	ʃ	voiceless postalveolar	chato
z	z	voiced alveolar	zaca
Z	ʒ	voiced postalveolar	jacto
v	v	voiced labiodental	vaca
x	x	voiceless velar	rabão

Consonant Nasals

SPPAS	IPA	Description	Examples
m	m	bilabial	mato
n	n	alveolar	nato
N	ŋ	voiced velar	hong-kong
J	ɲ	palatal	pinha

Consonant Liquids

SPPAS	IPA	Description	Examples
l	l	alveolar lateral	galo
L	ʎ	palatal lateral	galho
r	r	alveolar trill	pira
R	ʀ	voiced uvular	rato

Semivowels

SPPAS	IPA	Description	Examples
j	j	voiced palatal	yoga
w	w	voiced labiovelar	uísqe

Vowels

SPPAS	IPA	Description	Examples
E	ɛ	open-mid front unrounded	ego, eira
a	a	open front unrounded	parto
O	ɔ	open-mid back rounded	pôde
i	i	close front unrounded	hidra
e	e	close-mid front unrounded	pega, elo
o	o	close-mid back rounded	bola
u	u	close back rounded	hotel
y	y	close front rounded	emile
I	ɪ	near-close near-front unrounded	dois
U	ʊ	near-close near-back rounded	ido

Nasal vowels

SPPAS	IPA	Examples
a~	ã	anis
u~	ũ	humberto, unha

Fillers

SPPAS	Description
laugh	laughter
noise	noises, unintelligible speech
dummy	un-transcribed speech

8.3 Lexicons

All Portuguese lexicons are (c) *Laboratoire Parole et Langage, Aix-en-Provence, France*:

- `por.vocab` contains a list of 414k different words;
- `por_num.repl` allows to convert numbers to their written form;
- `por.repl` allows to convert symbols and abbreviations into a text form.

All of them are distributed under the terms of the *GNU General Public License*.

8.4 Pronunciation Dictionary

The Portuguese pronunciation dictionary was downloaded from the Ralf catalog of dictionaries for the Simon ASR system at <http://spirit.blau.in/simon/import-pls-dictionary/>. It was then converted (format and phoneset) and corrected by Brigitte Bigi.

It is re-distributed under the terms of the *GNU General Public License*.

8.5 Acoustic Model

The acoustic model was *NOT* trained from data. Monophones of other models were cut and pasted to create this one, mainly from the Spanish and the French models. The Portuguese model is distributed under the terms of the *Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License*.

New Portuguese data is welcome! Because data implies a better acoustic model then better alignments...

German language

9.1 Download

This chapter describes the linguistic resources included in the file `deu.zip` of the `lang` folder.

9.2 List of phonemes

Consonant Plosives

SPPAS	IPA	Description	Examples
p	p	voiceless bilabial	
b	b	voiced bilabial	
t	t	voiceless alveolar	
d	d	voiced alveolar	
k	k	voiceless velar	
g	g	voiced velar	

Consonant Fricatives

SPPAS	IPA	Description	Examples
f	f	voiceless labiodental	
s	s	voiceless alveolar	
S	ʃ	voiceless postalveolar	
z	z	voiced alveolar	
Z	ʒ	voiced postalveolar	
v	v	voiced labiodental	
x	x	voiceless velar	
h	h	voiceless glottal	

SPPAS	IPA	Description	Examples
C	ç	voiceless palatal fricative	ich , nicht

Consonant Liquids

SPPAS	IPA	Description	Examples
l	l	alveolar lateral	
R	ʀ	voiced uvular	

Consonant Nasals

SPPAS	IPA	Description	Examples
m	m	bilabial	
n	n	alveolar	
N	ŋ	voiced velar	

Semivowels

SPPAS	IPA	Description	Examples
j	j	voiced palatal	
w	w	voiced labiovelar	software

Vowels

SPPAS	IPA	Description	Examples
E	ɛ	open-mid front unrounded	
E:	ɛ:	open-mid front unrounded	
O	ɔ	open-mid back rounded	
U	ʊ	near-close near-back rounded	
i	i	close front unrounded	
i:	i:	close front unrounded	
u:	u:	close back rounded	
@	ə	schwa	
I	ɪ	near-close near-front unrounded	
a	a	open front unrounded	
a:	a:	open front unrounded	
2:	ø	close-mid front rounded	
9	œ	open-mid front rounded	
6	ɐ	near-open central vowel	besser
e	e	close-mid front unrounded	

SPPAS	IPA	Description	Examples
o:	o:	close-mid back rounded	
y	y	close front rounded	
y:	y:	close front rounded	
Y	ʏ	near-close near-front rounded vowel	hübsch

Affricates

SPPAS	IPA	Description	Examples
tʃ	tʃ	voiceless postalveolar	
ts	ts	voiceless alveolar	
dʒ	dʒ	voiced postalveolar	

Other symbols

SPPAS	IPA	Examples
?	?	
aI	aɪ	
aU	aʊ	
OY	ɔʏ	

Fillers

SPPAS	Description
laugh	laughter
noise	noises, unintelligible speech
fp	filled pause (äh, eh)
dummy	un-transcribed speech

9.3 Lexicons

All German lexicons are (c) *Laboratoire Parole et Langage, Aix-en-Provence, France*:

- `deu.vocab` contains a list of 383k different words;
- `deu.repl` allows to convert symbols and abbreviations into a text form.

All of them are distributed under the terms of the *GNU General Public License*.

Help is welcome to create the file `deu_num.repl` allowing SPPAS to convert numbers to their written form

9.4 Pronunciation Dictionary

The German pronunciation dictionary was downloaded from the Ralf catalog of dictionaries for the Simon ASR system at <http://spirit.blau.in/simon/import-pls-dictionary/>. It was then converted (format and phoneset) and corrected by Brigitte Bigi.

It is re-distributed under the terms of the *GNU General Public License*.

9.5 Acoustic model

The model is distributed under the terms of the *Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License*.

Mandarin chinese language

10.1 Download

This chapter describes the linguistic resources included in the file `cmn.zip` of the `lang` folder.

10.2 List of phonemes

Help is welcome to improve the quality of both Mandarin Chinese resources and of this documentation.

These resources are distributed without any warranty.

Consonant Plosives

SPPAS	IPA	Description	Examples
p	p	voiceless bilabial	ㄆ, ㄆㄆㄆ
p_h	p ^h	voiceless bilabial aspirated	ㄆˊ, ㄆˊ, ㄆˊ
t	t	voiceless alveolar	ㄊ, ㄊ
t_h	t ^h	voiceless alveolar aspirated	ㄊˊ
k	k	voiceless velar	ㄎ, ㄎ
k_h	k ^h	voiceless velar aspirated	ㄎˊ, ㄎˊ

Consonant Fricatives

SPPAS	IPA	Description	Examples
f	f	voiceless labiodental	ㄈ, ㄈ, ㄈ
s	s	voiceless alveolar	ㄙ, ㄙ

SPPAS	IPA	Description	Examples
s'	ʂ	voiceless alveolar with retroflex hook	ʂ, ʂ
z'	ʐ	voiced alveolar with retroflex hook	ʐ, ʐ
S	ʃ	voiceless postalveolar	ʃ, ʃ
x	x	voiceless velar	x, x
ss			ʃ, ʃ

Consonant Nasals

SPPAS	IPA	Description	Examples
m	m	bilabial	m, m, m
n	n	alveolar	n, n, n
N	ŋ	voiced velar	ŋ, ŋ, ŋ

Consonant Liquids

SPPAS	IPA	Description	Examples
l	l	alveolar lateral	l, l

Vowels

SPPAS	IPA	Description	Examples
a	a	open front unrounded	a, a, a, a, a
o	o	close-mid back rounded	o, o
e	e	close-mid front unrounded	A, e
i	i	close front unrounded	i, i, i i
i_d	ɿ	close front unrounded dental	ɿ, ɿ
i'	ɿ̥	close front unrounded retroflex	ɿ̥, ɿ̥
u	u	close back rounded	u, u, u
y	y	close front rounded	y, y, y
@'	ə̥	schwa with retroflex hook	ə̥, ə̥

Affricates

SPPAS	IPA	Description	Examples
ts	t͡s	voiceless alveolar	t͡s, t͡s
tss			t͡s, t͡s
ts_h	t͡sʰ	voiceless alveolar aspirated	t͡sʰ, t͡sʰ
ts'		voiceless alveolar retroflex hook	t͡ʂ, t͡ʂ
ts_h'			t͡ʂ, t͡ʂ

SPPAS	IPA	Description	Examples
ts_hs			ʈ, ʈʰ

Fillers

SPPAS	Description
laugh	laughter
noise	noises, unintelligible speech
dummy	un-transcribed speech

10.3 Lexicons

All lexicons are (c) *Laboratoire Parole et Langage, Aix-en-Provence, France*:

- `cmn.vocab` contains a list of 110k different words;
- `cmn_num.repl` allows to convert numbers to their written form;
- `cmn.repl` allows to convert symbols and abbreviations into a text form.

All of them are distributed under the terms of the *GNU General Public License*.

10.4 Pronunciation dictionary

The pronunciation dictionary was manually created for the syllables by Zhi Na. We address special thanks to her for sharing her work.

It is distributed under the terms of the *GNU General Public License*.

10.5 Acoustic model

The acoustic model was created by Brigitte Bigi from 2 corpora: the first one at Shanghai by Zhi Na, and another one by Hongwei Ding. We address special thanks to hers for giving us access to their data. Both recordings are a Chinese version of the Eurom1 corpus. See the following publication for details:

Daniel Hirst, Brigitte Bigi, Hyongsil Cho, Hongwei Ding, Sophie Herment, Ting Wang (2013). *Building OMProDat: an open multilingual prosodic database*, Proceedings of Tools and Resources for the Analysis of Speech Prosody, Aix-en-Provence, France, Eds B. Bigi and D. Hirst, ISBN: 978-2-7466-6443-2, pp. 11-14.

Notice that the current model was trained from a very small amount of data: this will impact on the results. Do not expect to get good performances for the automatic alignment.

More Mandarin Chinese data are welcome! Because more data implies a better acoustic model then better alignments...

The model is distributed under the terms of the *Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License*.

Southern Min (or Min Nan)

11.1 Download

This chapter describes the linguistic resources included in the file `nan.zip` of the `lang` folder.

11.2 List of phonemes

Consonant Plosives

SPPAS	IPA	Description
b	b	voiced bilabial
d	d	voiced alveolar
p	p	voiceless bilabial
p_h	p ^h	voiceless bilabial aspirated
t	t	voiceless alveolar
t_h	t ^h	voiceless alveolar aspirated
k	k	voiceless velar
k_h	k ^h	voiceless velar aspirated
g	g	voiced velar

Consonant Fricatives

SPPAS	IPA	Description
f	f	voiceless labiodental
s	s	voiceless alveolar
S	ʃ	voiceless postalveolar
x	x	voiceless velar
ss		

SPPAS	IPA	Description
v	v	voiced labiodental
z	z	voiced alveolar
h	h	voiceless glottal

Consonant Nasals

SPPAS	IPA	Description
m	m	bilabial
n	n	alveolar
N	ŋ	voiced velar

Consonant Liquids

SPPAS	IPA	Description
l	l	alveolar lateral

Semivowels

SPPAS	IPA	Description
w	w	voiced labiovelar

Vowels

SPPAS	IPA	Description
a	a	open front unrounded
o	o	close-mid back rounded
O	ɔ	open-mid back rounded
e	e	close-mid front unrounded
i	i	close front unrounded
u	u	close back rounded
y	y	close front rounded
@	ə	schwa

Nasal vowels

SPPAS	IPA
a~	ã

SPPAS	IPA
e~	ẽ
o~	õ
O~	õ
u~	ũ
i~	ĩ

Affricates

SPPAS	IPA	Description
ts	t͡s	voiceless alveolar
ts_h	t͡s ^h	voiceless alveolar aspirated
dz	d͡z	voiced alveolar

Fillers

SPPAS	Description
laugh	laughter
noise	noises, unintelligible speech
dummy	un-transcribed speech

11.3 Lexicons

The lexicon is (c) *Laboratoire Parole et Langage, Aix-en-Provence, France*: `nan.vocab` contains a list of 1000 different words; it is distributed under the terms of the *GNU General Public License*.

11.4 Pronunciation Dictionary

The pronunciation dictionary was constructed from the most frequent observed pronunciations of the corpus described below.

It is distributed under the terms of the *GNU General Public License*.

11.5 Acoustic Model

It is distributed under the terms of the *Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License*.

The acoustic model was trained from a corpus of spontaneous speech. We address special thanks to Sheng-Fu Wang for giving us access to his corpus.

S-F Wang, J. Fon (2013). *A Taiwan Southern Min spontaneous speech corpus for discourse prosody*, Proceedings of Tools and Resources for the Analysis of Speech Prosody, Aix-en-Provence, France, Eds B. Bigi and D. Hirst, ISBN: 978-2-7466-6443-2, pp. 20-23.

Cantonese language

12.1 Download

This chapter describes the linguistic resources included in the file `yue.zip` of the `lang` folder.

12.2 List of phonemes

Consonant Plosives

SPPAS	IPA	Description
p	p	voiceless bilabial
p_h	p ^h	voiceless bilabial aspirated
t	t	voiceless alveolar
t_h	t ^h	voiceless alveolar aspirated
k	k	voiceless velar
k_h	k ^h	voiceless velar aspirated
k_w	k ^w	voiceless velar labialized
k_h_w	k ^{hw}	voiceless velar aspirated labialized

Consonant Fricatives

SPPAS	IPA	Description
f	f	voiceless labiodental
s	s	voiceless alveolar
S	ʃ	voiceless postalveolar
h	h	voiceless glottal

Consonant Nasals

SPPAS	IPA	Description
m	m	bilabial
n	n	alveolar
N	ŋ	voiced velar

Consonant Liquids

SPPAS	IPA	Description
l	l	alveolar lateral

Semivowels

SPPAS	IPA	Description
j	j	palatal
w	w	voiced labiovelar

Vowels

SPPAS	IPA	Description
E:	ɛ:	open-mid front unrounded
a:	a:	open front unrounded
9:	œ:	open-mid front rounded
O:	ɔ:	open-mid back rounded
o	o	close-mid back rounded
e	e	close-mid front unrounded
8	ø	close-mid central rounded vowel
i:	i:	close front unrounded
u:	u:	close back rounded
y:	y:	close front rounded
6	ɐ	near-open central vowel
I	ɪ	near-close near-front unrounded
U	ʊ	near-close near-back rounded
@	ə	schwa

Affricates

SPPAS	IPA	Description
ts	$\widehat{t}s$	voiceless alveolar
ts_h	$\widehat{t}s^h$	voiceless alveolar aspirated
tS	$\widehat{t}\int$	voiceless postalveolar
tS_h	$\widehat{t}\int^h$	voiceless postalveolar aspirated

12.3 Lexicons

Lexicons are (c) *Laboratoire Parole et Langage, Aix-en-Provence, France*:

- `yue.vocab` contains a list of 47k different character-based words;
- `yue_chars.vocab` is a list of 12k characters;
- `yue.repl` and `yue_chars.repl` allow to convert symbols and abbreviations into a text form.

Both are distributed under the terms of the *GNU General Public License*.

12.4 Pronunciation dictionaries

The 2 dictionaries were constructed with the most frequently observed pronunciations of a conversational corpus.

12.5 Acoustic Model

The Cantonese acoustic model is copyrighted: (C) *DSP and Speech Technology Laboratory, Department of Electronic Engineering, the Chinese University of Hong Kong*.

This is a monophone Cantonese acoustic model, based on Jyutping of the Linguistic Society of Hong Kong (LSHK). Each state is trained with 32 Gaussian mixtures. The model is trained with HTK 3.4.1. The corpus for training is CUSENT, also developed in our laboratory.

Generally speaking, you may use the model for non-commercial, academic or personal use.

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We also have other well-trained Cantonese acoustic models. If you would like to use the models and/or the CUSENT corpus for commercial applications or development, please contact Professor Tan LEE for appropriate license terms.

The character pronunciation comes from Jyutping phrase box from the Linguistic Society of Hong Kong.

“The copyright of the Jyutping phrase box belongs to the Linguistic Society of Hong Kong. We would like to thank the Jyutping Group of the Linguistic Society of Hong Kong for permission to use the electronic file in our research and/or product development.”

If you use this model for academic research, please cite:

Tan Lee, W.K. Lo, P.C. Ching, Helen Meng (2002). *Spoken language resources for Cantonese speech processing*, Speech Communication, Volume 36, Issues 3–4, Pages 327-342

- Website: <http://dsp.ee.cuhk.edu.hk>
- Email: tanlee@ee.cuhk.edu.hk

12.6 References

Roxana Fung, Brigitte Bigi (2015). *Automatic word segmentation for spoken Cantonese*. In Oriental CO-COSDA and Conference on Asian Spoken Language Research and Evaluation (O-COCOSDA/CASLRE), pp. 196-201.

Japanese language

13.1 Download

This chapter describes the linguistic resources included in the file `jpn.zip` of the `lang` folder.

13.2 Lexicon, Dictionary and Acoustic model

The linguistic resources for Japanese language are kindly shared by the authors of the Julius CSR engine.

For more detail, please contact `csrc@astem.or.jp`, or access the Julius website: http://julius.osdn.jp/en_index.php?q=index-en.html#about_models

Korean language

14.1 Download

This chapter describes the linguistic resources included in the file `kor.zip` of the `lang` folder. Korean resources are under construction. Help is needed.

14.2 List of phonemes

Consonant Plosives

SPPAS	IPA	Description	Examples
b	b	voiced bilabial	ㄷ, ㄷㄷ
p	p	voiceless bilabial	ㅍ
p_h	p ^h	voiceless bilabial aspirated	ㅍ, ㅍㅍ
p_>	p̚	voiceless bilabial ejective	ㅍ̚
t	t	voiceless alveolar	ㄷ
t_h	t ^h	voiceless alveolar aspirated	ㄷ
t_>	t̚	voiceless alveolar ejective	ㄷ, ㄷ
d	d	voiced alveolar	ㄷ, ㄷ, ㄷ
k	k	voiceless velar	ㄱ, ㄱㄱㄱ
k_h	k ^h	voiceless velar aspirated	ㄱ
k_>	k̚	voiceless velar ejective	ㄱ, ㄱㄱ
g	g	voiced velar	ㄱ, ㄱ, ㄱ

Consonant Fricatives

SPPAS	IPA	Description	Examples
s	s	voiceless alveolar	ㅅ, ㅆ, ㅅㅅ
s_>	ɕ	voiceless alveolar ejective	ㅅ̚

Consonant Nasals

SPPAS	IPA	Description	Examples
m	m	bilabial	ㅁ, ㅂ, ㅃ
n	n	alveolar	ㄴ, ㄷㄴ
N	ŋ	voiced velar	ㅇㅇ, ㄹㅇ, ㄷㅇ

Consonant Liquids

SPPAS	IPA	Description	Examples
l	l	alveolar lateral	ㄹ, ㄹ, ㄹ
4	r	alveolar flap	ㄹ, ㄹㄹ, ㄹㄹ

Semivowels

SPPAS	IPA	Description	Examples
j	j	voiced palatal	ㅈ, ㅊ, ㅉ, ㅊ, ㅉ
w	w	voiced labiovelar	ㅊ, ㅊ, ㅊ, ㅊ, ㅊ

Vowels

SPPAS	IPA	Description	Examples
E	ɛ	open-mid front unrounded	ㅔ, ㅖ
A	ɑ	open back unrounded	ㅓ, ㅕ
i	i	close front unrounded	ㅛ, ㅜ
e	e	close-mid front unrounded	ㅚ, ㅜ
o	o	close-mid back rounded	ㅝ, ㅟ
u	u	close back rounded	ㅛ, ㅜ
2	ø	close-mid front rounded	ㅙ
V	ʌ	open-mid back unrounded	ㅓ, ㅕ
M	ɯ	close back unrounded	ㅓ, ㅕ

Affricates

SPPAS	IPA	Description	Examples
dz	ᄃ	voiced alveolar	?
dZ	ᄃ̤	voiced postalveolar	?
tS_>	ᄃ̥	voiceless postalveolar ejective	?
tS_h	ᄃ̥ ^h	voiceless postalveolar aspirated	?

Fillers

SPPAS	Description
laugh	laughter
noise	noises, unintelligible speech
dummy	un-transcribed speech

14.3 Lexicons

All lexicons are (c) *Laboratoire Parole et Langage, Aix-en-Provence, France*:

- `kor.vocab` contains a list of 33k different words;
- `kor.repl` allows to convert symbols and abbreviations into a text form.

All of them are distributed under the terms of the *GNU General Public License*.

Help is needed to create the file `kor_num.repl` allowing SPPAS to convert numbers to their written form

14.4 Pronunciation dictionary

The Korean pronunciation dictionary was manually created and is still under construction. **Any help is welcome!**

It is distributed under the terms of the *GNU General Public License*.

14.5 Acoustic Model

The acoustic model was *NOT* trained from data. Monophones of other models were cut and pasted to create this one, mainly the English and Taiwanese models.

Korean data are welcome! Because data implies a better acoustic model then better alignments...

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Naija language

15.1 Download

This chapter describes the linguistic resources included in the file `pcm.zip` of the `lang` folder.

This work was financed by the French Agence Nationale pour la Recherche (ANR-16-CE27-0007), in the context of the [NaijaSynCor project](#).

The iso-639-3 code of Naija language is PCM.

15.2 List of phonemes

Consonant Plosives

SPPAS	IPA	Description	Examples
p	p	voiceless bilabial	public, palaver
b	b	voiced bilabial	bye, bojuboju, boli
t	t	voiceless alveolar	two, tree, tranga
d	d	voiced alveolar	drop, дума, this
k	k	voiceless velar	ketu, cut, quick
g	g	voiced velar	gain, girl, guy

Consonant Fricatives

SPPAS	IPA	Description	Examples
f	f	voiceless labiodental	farm, phone, view
s	s	voiceless alveolar	centre, safe, zero
S	ʃ	voiceless postalveolar	cheque, sabi, ship
z	z	voiced alveolar	used, diesel, eze

SPPAS	IPA	Description	Examples
v	v	voiced labiodental	visit, view
h	h	voiceless glottal	happy, hope, who
T	θ	voiceless dental	thing, ethnic, three
D	ð	voiced dental	

Consonant Nasals

SPPAS	IPA	Description	Examples
m	m	bilabial	make, milk, magaji
n	n	alveolar	knock, name, nitel
N	ŋ	voiced velar	bongo, sings

Consonant Liquids

SPPAS	IPA	Description	Examples
l	l	alveolar lateral	load, lokodan
r\	ɹ	alveolar approximant	radio, root, wrap

Semivowels

SPPAS	IPA	Description	Examples
j	j	voiced palatal	uni, yes, europe
w	w	voiced labiovelar	one, wait, wowo

Vowels

SPPAS	IPA	Description	Examples
E	ɛ	open-mid front unrounded	air, early, egg, men
a	a	open front unrounded	our, ask, above
O	ɔ	open-mid back rounded	us, onion, all, oba
i	i	close front unrounded	each, even, ile, is
e	e	close-mid front unrounded	alone, eko
o	o	close-mid back rounded	obodo, ojo
u	u	close back rounded	ugu, una, upo

Nasal vowels

SPPAS	IPA	Examples
a~	ã	auntie, african, commander
e~	ẽ	fiyen, britain, town
E~	ɛ̃	calendar, men, accent
i~	ĩ	admin, ani, benin
O~	õ	election, lokodan, million
u~	ũ	remove, segun, broken

Affricates

SPPAS	IPA	Description
tS	tʃ	voiceless postalveolar
dZ	dʒ	voiced postalveolar

Others

SPPAS	IPA	Examples
aI	aɪ	I, write, type
aU	aʊ	out, town
OI	ɔɪ	oil, boy
eI	eɪ	a, eight, age

Fillers

SPPAS	Description
laugh	laughter
noise	noises, unintelligible speech
dummy	un-transcribed speech

15.3 Pronunciation Dictionary

The dictionary was originally created by extracting the lexicon of the corpus published in annex of (Deuber 2005). New words with their orthographic variants and pronunciations were added to the dictionary by team of four transcribers, native speakers of the language.

It is distributed under the terms of the *GNU General Public License*.

15.4 Acoustic Model

A first version of the Naija acoustic model was created in 2017-07 by Brigitte Bigi with the SPPAS training scripts.

An initial model was created on the basis of other language prototypes. Such prototypes were mostly extracted from the English acoustic model. For the missing models of phonemes, the nasals /O~/, /a~/, /e~/, /i~/ and /u~/ were picked off Southern Min language, and /E~/ was extracted from French language using /U~/ prototype. The vowels /a/ and /e/ were extracted from the French model; and finally /O/ and /o/ from the Italian one. The fillers were also added to the model in order to be automatically time-aligned too: silence, noise, laughter.

The acoustic model was then trained with a set of 8 files (totalling 3 min 29 seconds in length.) manually phonetized and time-aligned.

The currently distributed acoustic model was trained at the end of the project, in 2020, thanks to all the manual transcription of the whole corpus (see Bigi et al., submitted).

The model is distributed under the terms of the *Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License*.

15.5 References

Brigitte Bigi, Abiola S. Oyelere, Bernard Caron (submitted). *Resources for Automated Speech Segmentation of the African Language Naija (Nigerian Pidgin)*. LNAI, Springer.

Brigitte Bigi, Bernard Caron, Abiola S. Oyelere (2017). *Developing Resources for Automated Speech Processing of the African Language Naija (Nigerian Pidgin)*. In 8th Language and Technology Conference: Human Language Technologies as a Challenge for Computer Science and Linguistics, pp. 441-445, Poznań, Poland.

Bengali language

16.1 Download

This chapter describes the linguistic resources included in the file `ben.zip` of the `lang` folder.

The iso-639-3 code of Bengali language is BEN.

16.2 List of phonemes

Consonant Plosives

	SPPAS	IPA	Description	Examples
	b	b	voiced bilabial	
	b_h	b ^h	voiced bilabial aspirated	
	c	c	voiceless palatal	
	c_h	c ^h	voiceless palatal aspirated	
	d	d	voiced alveolar	
	d_h	d ^h	voiced alveolar aspirated	
d ḍ	voiced retroflex	ḍ_h	q ^h	voiced retroflex aspirated
	g	g	voiced velar	
	g_h	g ^h	voiced velar aspirated	
	ɟ	ɟ	voiced palatal	
	ɟ_h	ɟ ^h	voiced palatal aspirated	
	k	k	voiceless velar	
	k_h	k ^h	voiceless velar aspirated	
	p	p	voiceless bilabial	
	p_h	p ^h	voiceless bilabial aspirated	
	t	t	voiceless alveolar	
	t_h	t ^h	voiceless alveolar aspirated	
	ṭ	ṭ	voiceless retroflex	

SPPAS	IPA	Description	Examples
t_h	t ^h	voiceless retroflex aspirated	

Notice that J and J_h were both in the first version of the pronunciation dictionary but are no longer in the current version. They remain in the acoustic model, so they can be used for Phonetization.

Affricates

SPPAS	IPA	Description	Examples
dZ	ɖ̞	voiced postalveolar	
dZ_h	ɖ̞ ^h	voiced postalveolar aspirated	

Consonant Fricatives

SPPAS	IPA	Description	Examples
f	f	voiceless labiodental	
h	h	voiceless glottal	
s	s	voiceless alveolar	
S	ʃ	voiceless postalveolar	
v	v	voiced labiodental	
z	z	voiced alveolar	
Z	ʒ	voiced postalveolar	

Consonant Nasals

SPPAS	IPA	Description	Examples
m	m	bilabial	
n	n	alveolar	
N	ŋ	voiced velar	

Consonant Liquids

SPPAS	IPA	Description	Examples
l	l	alveolar lateral	
r	r	alveolar trill	
r ɽ voiced retroflex flap	r_h	t ^h	voiced retroflex flap aspirated

Semivowels

SPPAS	IPA	Description	Examples
j	j	voiced palatal	
w	w	voiced labiovelar	

Vowels

SPPAS	IPA	Description	Examples
@	ə	schwa	
a	a	open front unrounded	
{	æ	near-open front unrounded vowel	
e	e	close-mid front unrounded	
i	i	close front unrounded	
O	ɔ	open-mid back rounded	
o	o	close-mid back rounded	
u	u	close back rounded	

Nasal vowels (~)

SPPAS	IPA	Description	Examples
a~	ã	open front unrounded nasal vowel	
e~	ẽ	close-mid front unrounded nasal vowel	
i~	ĩ	close front unrounded nasal vowel	
O~	õ	open-mid back unrounded nasal vowel	
o~	õ	close-mid back unrounded nasal vowel	
u~	ũ	close back unrounded nasal vowel	

Fillers

SPPAS	Description
laugh	laughter
noise	noises, unintelligible speech
dummy	un-transcribed speech
fp	filled pause

16.3 Pronunciation Dictionary

The pronunciation dictionary is **Copyright 2015, 2016 Google Inc. All Rights Reserved.**, with a CC-4.0 license. It was downloaded in October 2021, from: <https://github.com/google/language-resources/tree/master/bn/data/>

The phonemes have been converted to X-SAMPA and the file format to HTK-ASCII by Brigitte Bigi. Pronunciations were revised by Moumita PAKRASHI of Centre for Linguistic Science and Technology, Indian Institute of Technology Guwahati.

The dictionary is re-distributed under the terms of its original *Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License*.

16.4 Acoustic Model

This is the second version of the acoustic model. It was trained with a set of 6 manually time-aligned files (totalling about 18 seconds of speech) and 1,300 orthographically transcribed files (totalling 36 minutes of speech).

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Persian language

17.1 Download

This chapter describes the linguistic resources included in the file `pes.zip` of the `lang` folder.

The iso-639-3 code of Persian language is PES. The resources are under-construction. Any help is welcome.

17.2 List of phonemes

Consonant Plosives

SPPAS	IPA	Description	Examples
b	b	voiced bilabial	
d	d	voiced alveolar	
k	k	voiceless velar	
g	g	voiced velar	
p	p	voiceless bilabial	
q	q	voiceless uvular	
t	t	voiceless alveolar	
G\	g	voiced uvular	
?	ʔ	glottal stop	

Consonant Fricatives

SPPAS	IPA	Description	Examples
f	f	voiceless labiodental	
h	h	voiceless glottal	
s	s	voiceless alveolar	

SPPAS	IPA	Description	Examples
S	ʃ	voiceless postalveolar	
v	v	voiced labiodental	
x	x	voiceless velar	
z	z	voiced alveolar	
Z	ʒ	voiced postalveolar	

Consonant Nasals

SPPAS	IPA	Description	Examples
m	m	bilabial	
n	n	alveolar	

Consonant Liquids

SPPAS	IPA	Description	Examples
l	l	alveolar lateral	
r	r	alveolar trill	

Affricates

SPPAS	IPA	Description	Examples
dZ	ʤ	voiced postalveolar	
tS	ʧ	voiceless postalveolar	

Semivowels

SPPAS	IPA	Description	Examples
j	j	voiced palatal	

Vowels

SPPAS	IPA	Description	Examples
a	a	open front unrounded	
A	ɒ	open back rounded	
e	e	close-mid front unrounded	
i	i	close front unrounded	
o	o	close-mid back rounded	

SPPAS	IPA	Description	Examples
u	u	close back rounded	
y	y	close front rounded	

Fillers

SPPAS	Description
laugh	laughter
noise	noises, unintelligible speech
fp	filled pause (“euh”)
dummy	un-transcribed speech

17.3 Acoustic Model

The acoustic model was created by Brigitte Bigi from the HMM prototypes extracted from other languages (mainly French and Spanish). The model was then trained with 3 minutes of manually time-aligned data and 26 minutes of manually phonetized data.

UBPA at 40ms of the initial model based on prototypes is 89.83% and UBPA of the final model is 89.96%.

Versions history

18.1 Changes

18.1.1 Version 1 - June, 2020

- Linguistic resources for Text Normalization, Phonetization, Alignment and Syllabification of SPPAS for the following languages: cat, cmn, deu, eng, fra, fraquebec, hun, ita, jpn, kor, nan, pcm, pol, por, spa, vie, yue.
- Data resources for face detection, face landmark and LPC automatic annotations of SPPAS.

18.1.2 Version 2 - July 2020

- Updated data for face detection and face landmark.

18.1.3 Version 3 - Sept 2020

- Updated linguistic resources of Polish language.
- Add of this documentation.

18.1.4 Version 4 - Feb 2021

- A DNN model is added into Face Detection package
- The file fra.txt of LPC package is modified – corrected by experts
- Lightness of LPC package hand pictures is adjusted

18.1.5 Version 5 - Sept 2021

- New acoustic model of Italian: it's no longer a context-dependent model. It's a monophone model like for the other languages. The French HMMs of “a~” and “O~”, and the Naija HMM of “e~” were added to the hmmdefs.

- The LPC file fra.txt is renamed cueConfig-fra.txt.
- The keys of the LPC vowels are coded with characters “b”, “s”, “m”, “c”, “t” instead of numbers. It's not compatible with versions 3.x of SPPAS.
- The keys of the LPC consonant are coded differently, we now use the same than the previously defined ones for English.

18.1.6 Version 6 - Nov 2021

- New resources for Bengali language: vocabulary, pronunciation dictionary and acoustic model.

Appendix

19.1 About this document

19.1.1 Author

This document was written by Brigitte Bigi, CNRS researcher at Laboratoire Parole et Langage, Aix-en-Provence, France. More about her: <http://www.sppas.org/bigi/> All references mentioned in this document can be downloaded at this address.

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