Automatic Extraction of Parallel Speech Corpora from Dubbed Movies

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Parallel Speech Corpora

Spoken parallel corpora are useful in building speech-to-speech applications.

Costly: Laborious with respect to translation and interpretation

Available corpora:

- Contain unexpressive speech (e.g. interpreted)
- Do not capture spontaneous spoken language traits (e.g. read)
- Lack one-to-one alignment between words/sentences (e.g. constrained conversations)

Dubbed movies as a resource

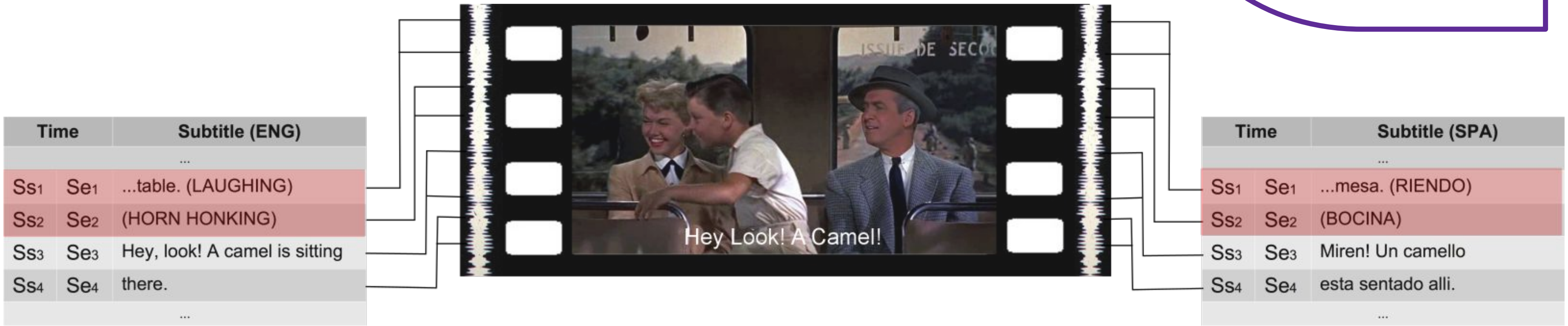
Popular movies, documentaries, TV shows are dubbed in many countries*.

A good resource for obtaining bilingual data:

(1) Available parallel audio data in dubbed movies.

(2) Transcripts available with time information in subtitles.

Expressive Speech!

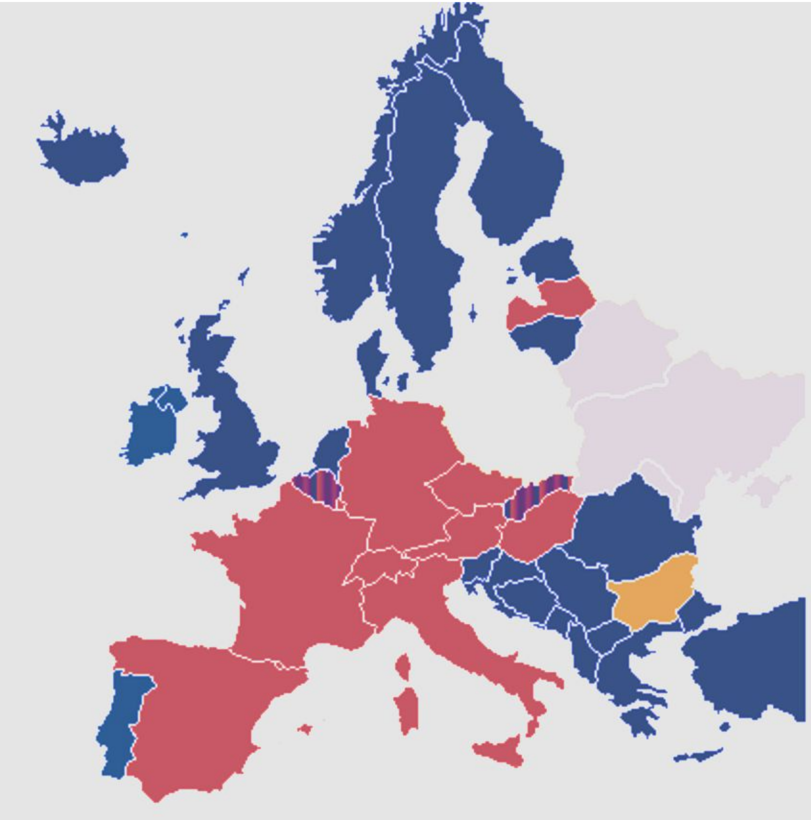


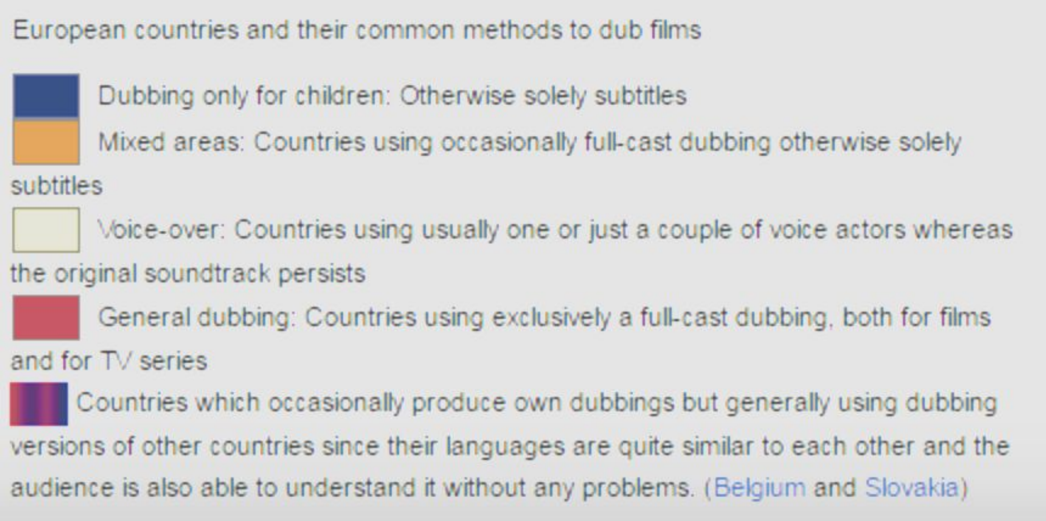
Time		Subtitle (ENG)
		…
Ss_1	Se_1	...table. (LAUGHING)
Ss_2	Se_2	(HORN HONKING)
Ss_3	Se_3	Hey, look! A camel is sitting
Ss_4	Se_4	there.
		…

Time		Subtitle (SPA)
		…
Ss_1	Se_1	...mesa. (RIENDO)
Ss_2	Se_2	(BOCINA)
Ss_3	Se_3	Miren! Un camello
Ss_4	Se_4	esta sentado alli.
		…

Movie still from *The Man Who Knew Too Much* (1956) © Universal Pictures

Example: Dubbing in European Countries





European countries and their common methods to dub films

🟦 Dubbing only for children: Otherwise solely subtitles

🟧 Mixed areas: Countries using occasionally full-cast dubbing otherwise solely subtitles

⬜ Voice-over: Countries using usually one or just a couple of voice actors whereas the original soundtrack persists

🟥 General dubbing: Countries using exclusively a full-cast dubbing, both for films and for TV series

▨ Countries which occasionally produce own dubbings but generally using dubbing versions of other countries since their languages are quite similar to each other and the audience is also able to understand it without any problems. (Belgium and Slovakia)

Image source: Wikipedia - Dubbing (filmmaking)

Proposed Method

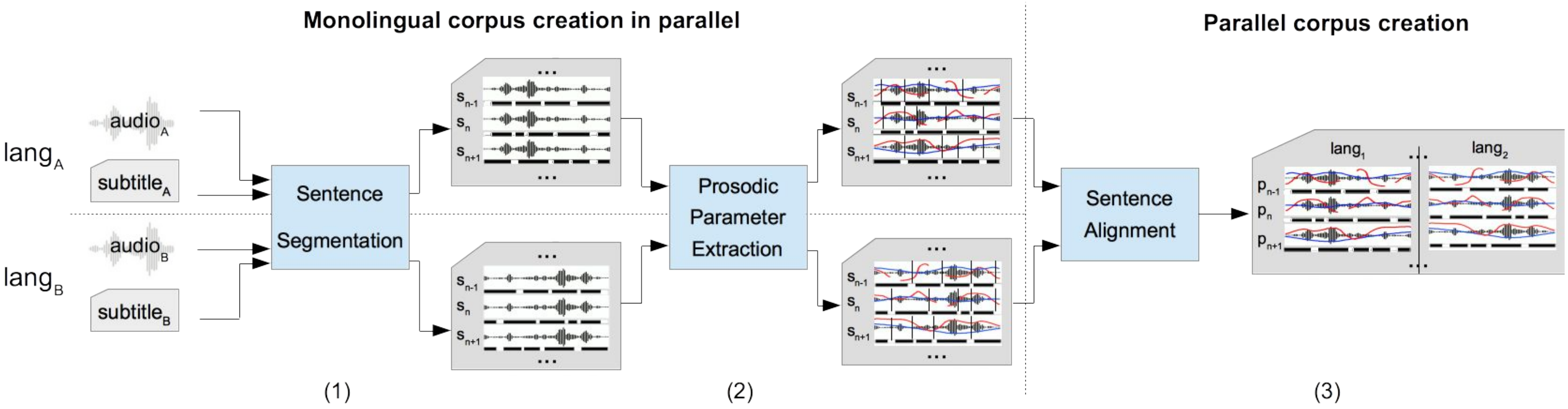
Automatic extraction of segmented parallel sentences with prosodic parameters

→ Input: Bilingual audio and subtitles pair
→ Output: Aligned bilingual sentences annotated with prosodic features

Key points:

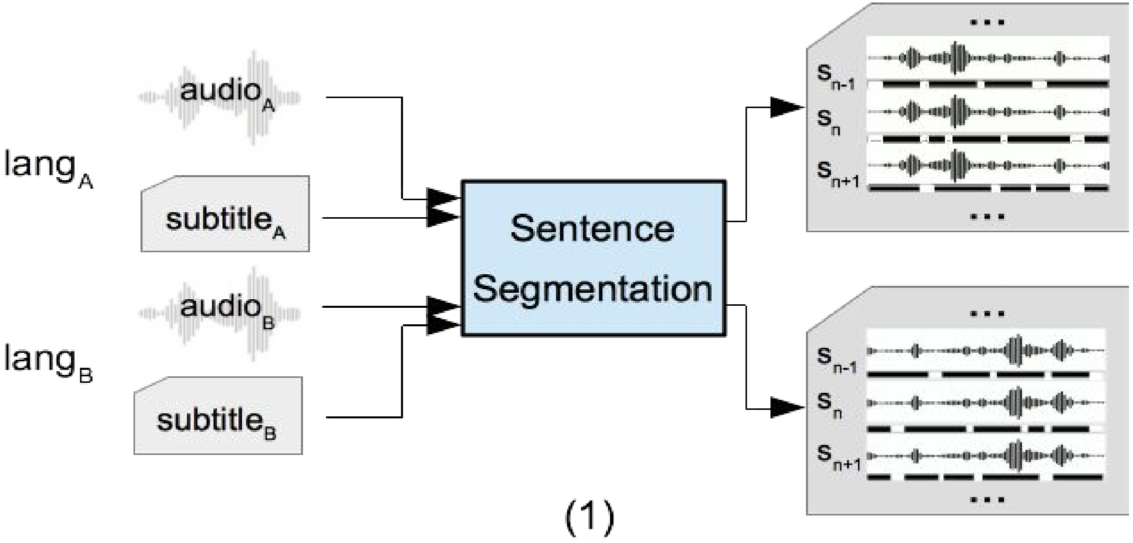
1. Supports any language pair
2. Contains expressive speech
3. Aligned at sentence level

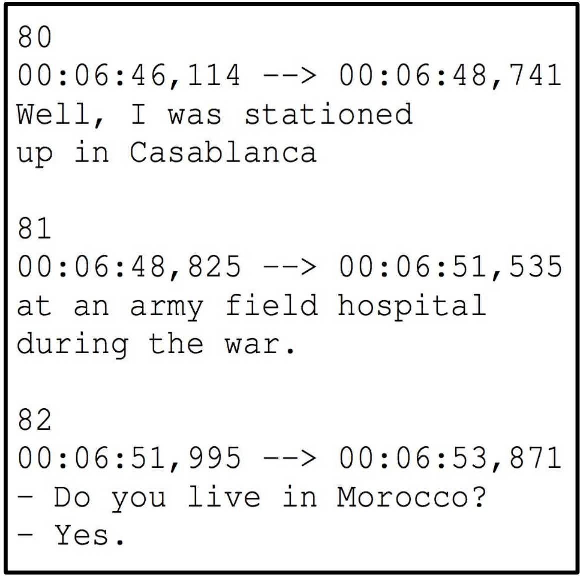
Methodology Overview



Stage 1: Sentence Segmentation

Use subtitle time-information to find script location in audio





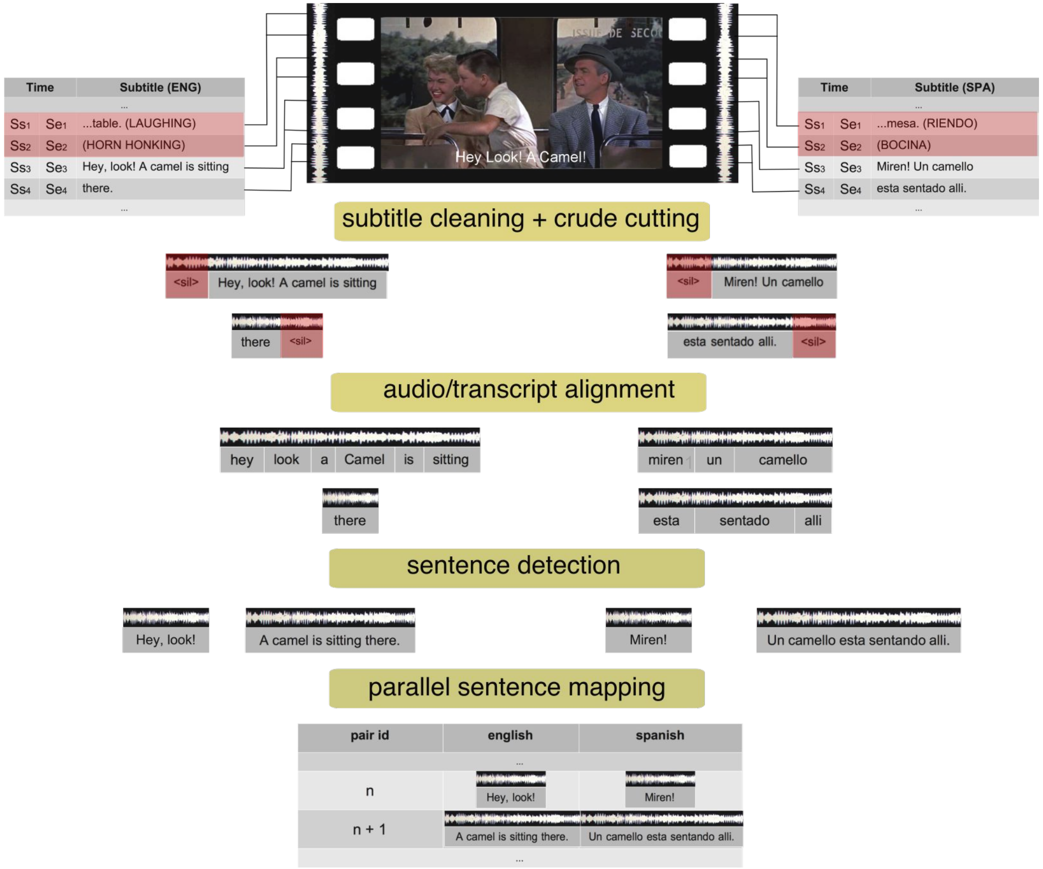
```
80
00:06:46,114 --> 00:06:48,741
Well, I was stationed
up in Casablanca

81
00:06:48,825 --> 00:06:51,535
at an army field hospital
during the war.

82
00:06:51,995 --> 00:06:53,871
- Do you live in Morocco?
- Yes.
```

SRT subtitle file

Stage 1: Sentence Segmentation



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Ss_3	Se_3	Miren! Un camello
Ss_4	Se_4	esta sentado alli.
		...

subtitle cleaning + crude cutting

audio/transcript alignment

sentence detection

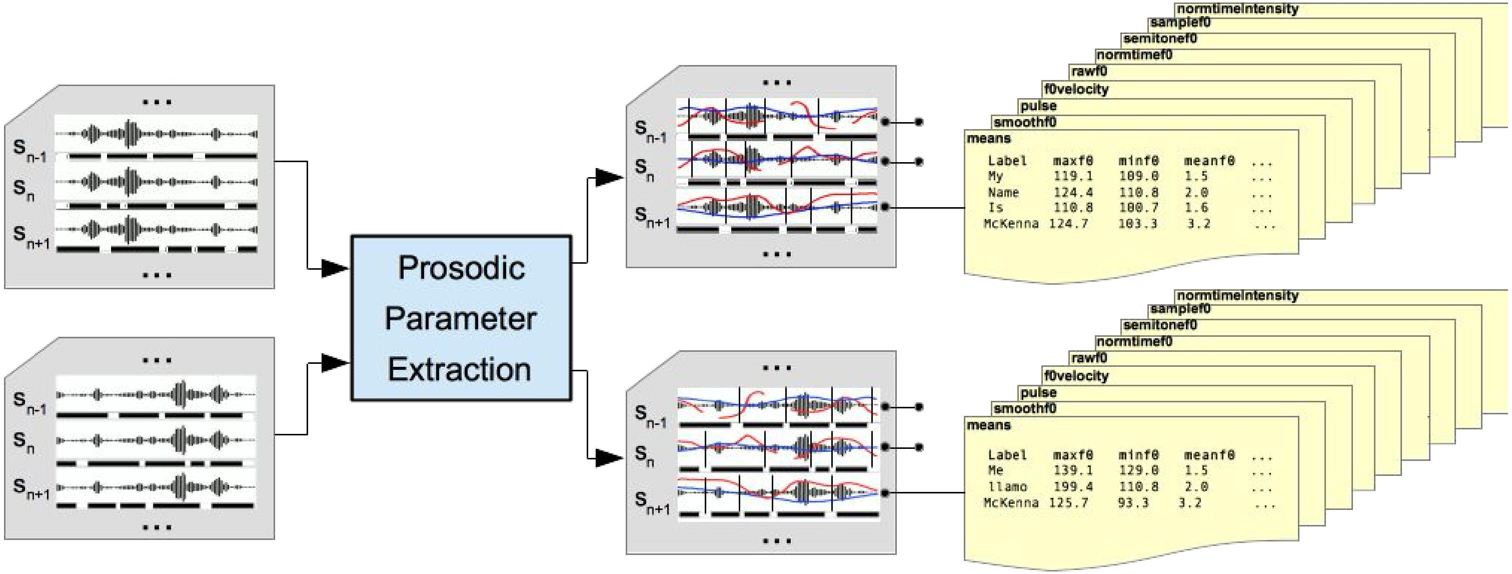
parallel sentence mapping

pair id	english	spanish
	...	
n	Hey, look!	Miren!
n + 1	A camel is sitting there.	Un camello esta sentando alli.
	...	

[1] VoxSigma® Scribe.

Stage 2: Prosodic Parameter Extraction

ProsodyPro[1] library used for prosodic feature extraction



Label	maxf0	minf0	meanf0	...
My	119.1	109.0	1.5	...
Name	124.4	110.8	2.0	...
Is	110.8	100.7	1.6	...
McKenna	124.7	103.3	3.2	...

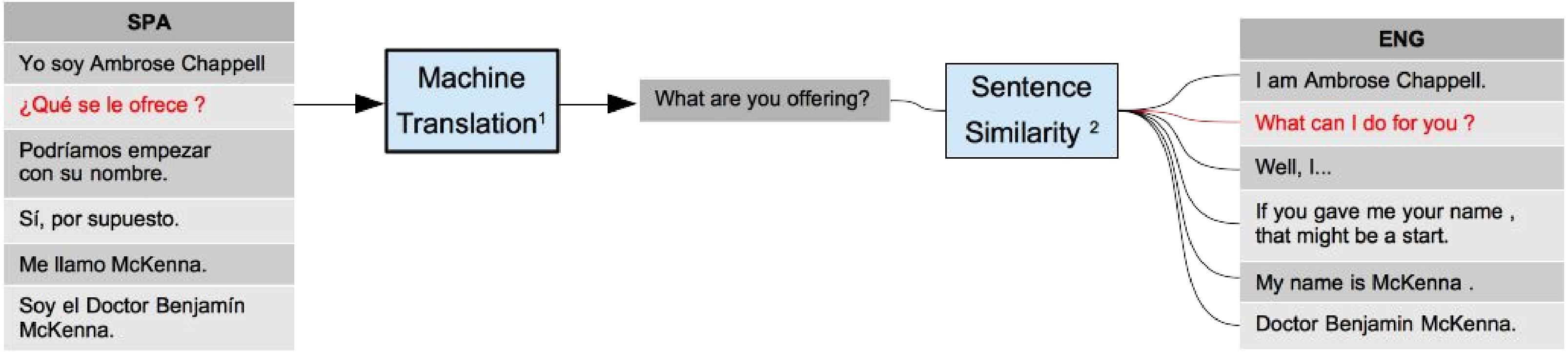
Label	maxf0	minf0	meanf0	...
Me	139.1	129.0	1.5	...
llamo	199.4	110.8	2.0	...
McKenna	125.7	93.3	3.2	...

(2)

[1] Yi Xu. 2013

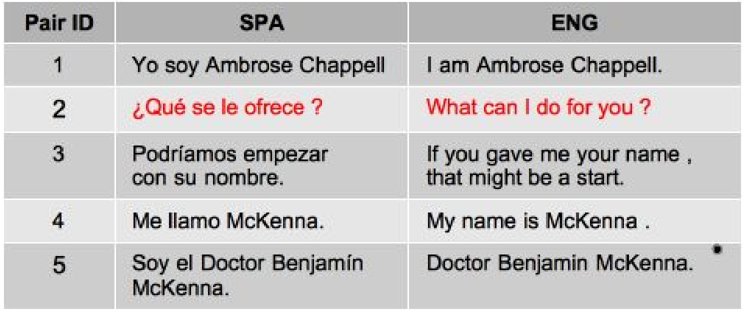
Stage 3: Parallel Sentence Alignment

Goal: Given sentence s_1 in lang. 1 find corresponding sentence s_2 in lang.2



SPA
Yo soy Ambrose Chappell
¿Qué se le ofrece ?
Podríamos empezar con su nombre.
Sí, por supuesto.
Me llamo McKenna.
Soy el Doctor Benjamín McKenna.

ENG
I am Ambrose Chappell.
What can I do for you ?
Well, I...
If you gave me your name , that might be a start.
My name is McKenna .
Doctor Benjamin McKenna.



Pair ID	SPA	ENG
1	Yo soy Ambrose Chappell	I am Ambrose Chappell.
2	¿Qué se le ofrece ?	What can I do for you ?
3	Podríamos empezar con su nombre.	If you gave me your name , that might be a start.
4	Me llamo McKenna.	My name is McKenna .
5	Soy el Doctor Benjamín McKenna.	Doctor Benjamin McKenna.

[1] *Yandex Translate*

[2] *Meteor* library (Denkowski and Lavie, 2014)

Applying the Methodology

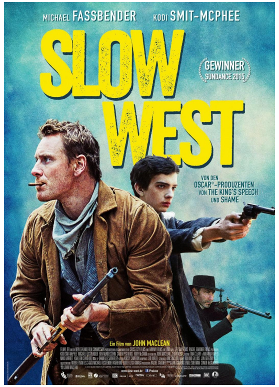
Three movies processed:

- The Man Who Knew Too Much (1956)
- Slow West (2015)
- The Perfect Guy (2015)

Films originally in English, dubbed to Spanish.

Audio extracted from DVD using *Libav*[1]

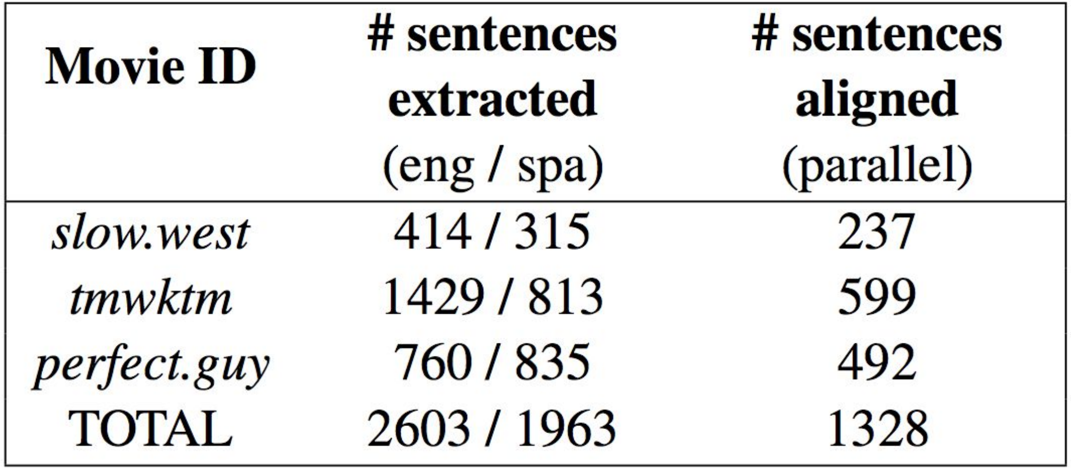
English and Spanish subtitles obtained from *opensubtitles*[2].


MICHAEL FASSBENDER
KODI SMIT-MCPHEE
SLOW WEST
GEWINNER SUNDANCE 2015
VON DEN OSCAR-PRODUZENTEN VON THE KING'S SPEECH UND SHAME
Ein Film von JOHN MACLEAN

[1] https://libav.org/

[2] https://www.opensubtitles.org

Currently obtained corpus



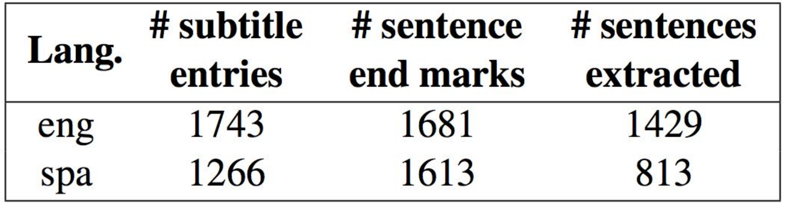
Movie ID	# sentences extracted (eng / spa)	# sentences aligned (parallel)
slow.west	414 / 315	237
tmwktm	1429 / 813	599
perfect.guy	760 / 835	492
TOTAL	2603 / 1963	1328

Shortcomings

- ➢ Copyright restrictions for distributing the corpus.

Main bottlenecks in capturing data:

1. Audio-text alignment performance
   - ○ 15% sentences lost in original language.
   - ○ 49% sentences lost in dubbed language.
2. Translation difference in dubbed audio and subtitles
   - ○ Hinders audio-text alignment
3. Background noise



Lang.	# subtitle entries	# sentence end marks	# sentences extracted
eng	1743	1681	1429
spa	1266	1613	813

Processing *The Man Who Knew Too Much*

Sub-dub differences

Extracted	English (Sub + audio)	Spanish Sub	Spanish Dub
yes	Daddy , you're sure I've never been to Africa before ?	Papá , ¿estás seguro de que nunca estuve antes en África ?	Papa, estás seguro que no habíamos estado ya en África?
no	It looks familiar.	Me parece conocido.	Todo esto ya lo conozco.
yes	You saw the same scenery last summer driving to Las Vegas .	Viste el mismo panorama el verano pasado cuando manejamos a Las Vegas .	Vimos un paisaje muy parecido cuando fuimos a Las Vegas
yes	Where Daddy lost all that money at the crap ...	Claro , donde papá perdió todo ese dinero en la mesa	Ah claro, donde papá perdió toda el dinero en la mesa de juego?
no	Hey, look!	¡Miren!	Hey mirad!
no	A Camel.	¡Un camello!	Un camello!
yes	Of course this isn't really Africa, honey.	Y esto no es realmente África .	Realmente esto no es África, cariño.
yes	It's the French Morocco .	Es el Marruecos francés .	Es el Marruecos Francés.
yes	Well , it's northern Africa .	Es África del Norte.	Bueno, es África del Norte.
yes	Still seems like Las Vegas .	Aún se parece a Las Vegas .	Pues, sigue pareciéndose a Las Vegas.

Conclusions

- Automatic building of multimodal bilingual corpora from dubbed media
  - Speech, text, prosody
  - Conversational speech → Useful for speech-to-speech translation applications
- Works on any language pair (with trained acoustic model)
- No further training needed
- Code available at http://www.github.com/TalnUPF/movie2parallelDB

Future Work

1. Switch from proprietary audio-text aligner software to open source
   - ➢ E.g. p2fa (based on CMU Sphinx ASR system)
2. XML based structure as corpus metadata
   - ➢ Instead of directory structure only
3. Speaker diarization
   - ➢ Identifying the speaker of each sentence
4. Extend and publish the corpus
   - ➢ Depending on agreement with Copyright holders

Questions?

Suggestions?

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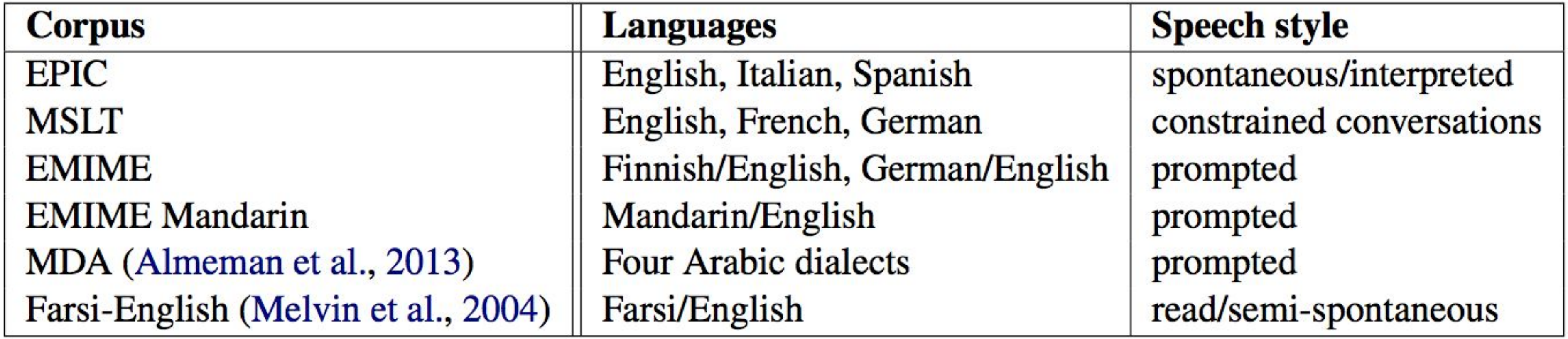
taln

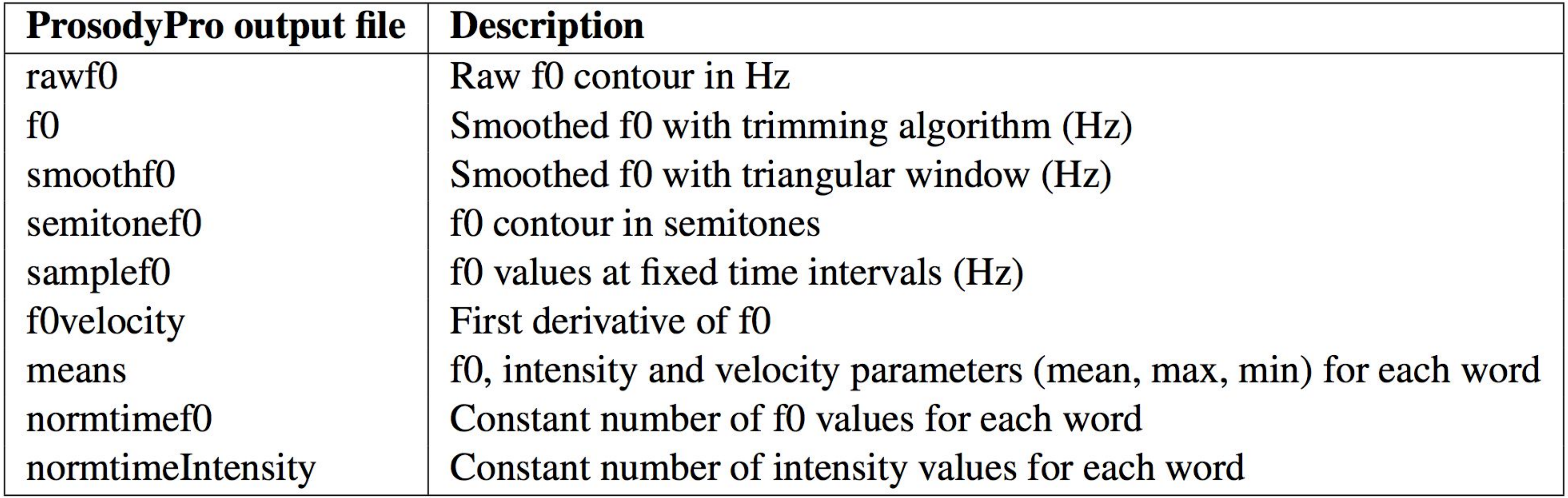
Appendix A: State of the Art Corpora



Corpus	Languages	Speech style
EPIC	English, Italian, Spanish	spontaneous/interpreted
MSLT	English, French, German	constrained conversations
EMIME	Finnish/English, German/English	prompted
EMIME Mandarin	Mandarin/English	prompted
MDA (Almeman et al., 2013)	Four Arabic dialects	prompted
Farsi-English (Melvin et al., 2004)	Farsi/English	read/semi-spontaneous

Table 1: Some available parallel speech corpora.

Appendix B: ProsodyPro Files



ProsodyPro output file	Description
rawf0	Raw f0 contour in Hz
f0	Smoothed f0 with trimming algorithm (Hz)
smoothf0	Smoothed f0 with triangular window (Hz)
semitonef0	f0 contour in semitones
samplef0	f0 values at fixed time intervals (Hz)
f0velocity	First derivative of f0
means	f0, intensity and velocity parameters (mean, max, min) for each word
normtimef0	Constant number of f0 values for each word
normtimeIntensity	Constant number of intensity values for each word

Some of the files generated by ProsodyPro