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Where are we in semantic concept extraction for Spoken Language Understanding?

Sahar Ghannay[1], Antoine Caubrière[2], Salima Mdhaffar[2], Gaëlle Laperrière[2]
Bassam Jabaian[2], Yannick Estève[2]

[1] *LISN - Paris-Saclay University, France*
[2] *LIA - Avignon University, France*

Introduction

Context

Spoken Language Understanding has seen a lot of progress recently

Emergence of the End-to-End (E2E) approach based on deep neural networks

Self-supervised training with unlabeled data open new perspectives

Our study is in the context of the challenging french MEDIA task

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Our study is in the context of the challenging french MEDIA task

Goal

Observe the recent progress on MEDIA with both E2E and cascade approaches
Improve the state-of-the-art by using self-supervised pre-trained models

The French MEDIA task

The MEDIA corpus

Telephone speech for a French hotel booking task ***[Bonneau-Maynard, et al. 2005]***

Simulation of dialog system recorded with the “wizard-of-oz” method

One of the most challenging SLU corpora ***[Béchet & Raymond, 2019]***

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Corpus specification

Annotation according to 76 semantic concepts (*location-town*, *stay-nbNight*, *nb-reservation*, ...)

Data	Nb Words	Nb Utterances	Nb Concepts	Nb Hours
Train	94.2k	13.7k	31.7k	10h46
Dev	10.7k	1.3k	3.3k	01h13
Test	26.6k	3.7k	8.8k	02h59

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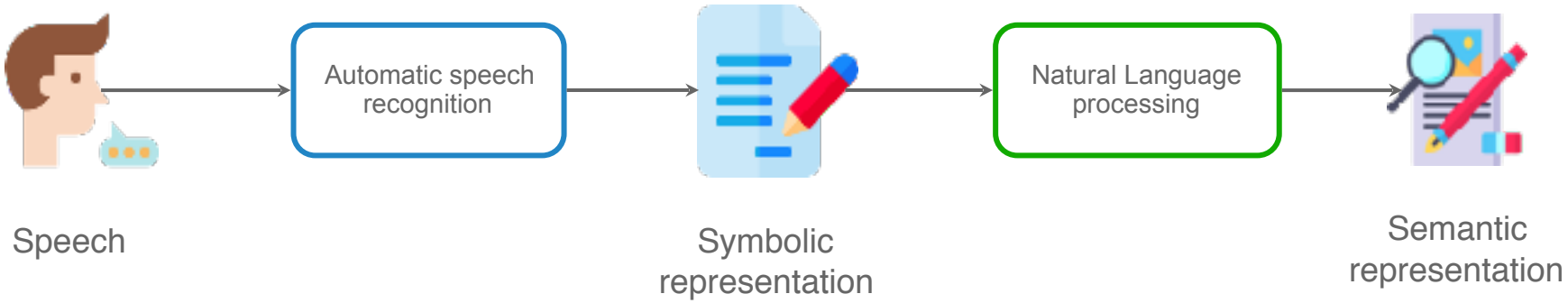
Evaluation metrics

CER : Evaluates concepts only

CVER : Evaluates concepts and value

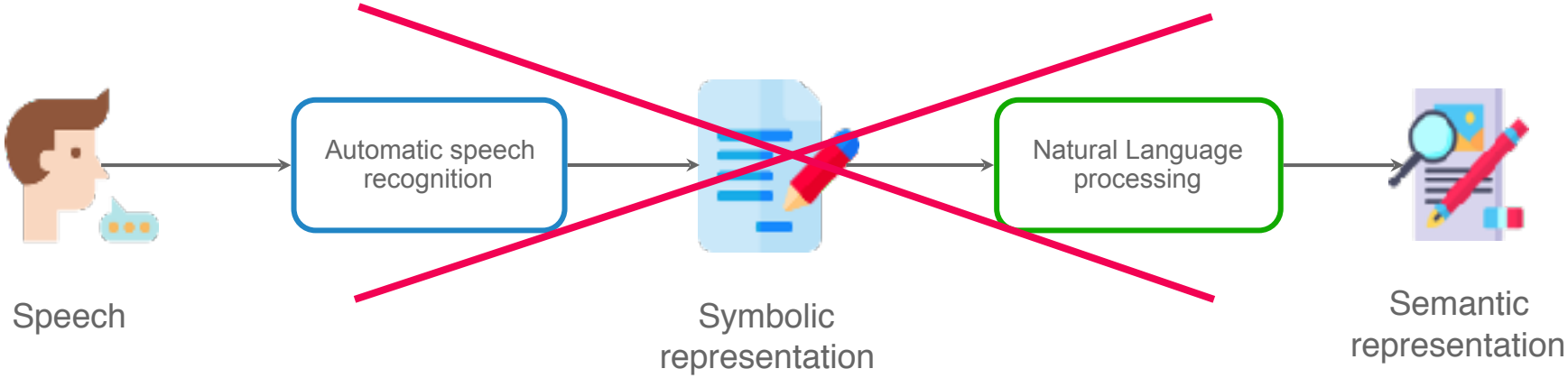
Cascade vs E2E approach

Cascade approach



Cascade vs E2E approach

E2E approach



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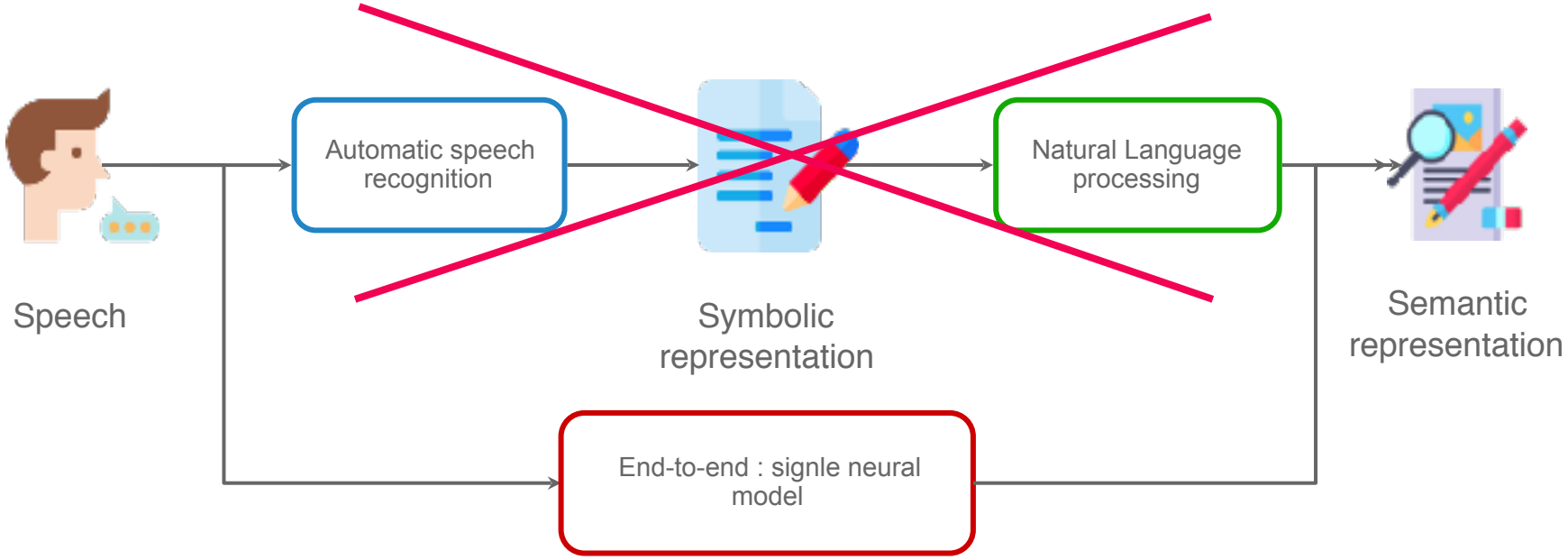


Cascade approach

Semantic labeling using BIO format

Hello **<command-task** i want to book **>** **<nbNight** a night **>**

A label predicted for each words

Hello	**O**
i	**B-comm**
want	**I-comma**
to	**I-comma**
book	**I-comma**
a	**B-nbNig**
night	**I-nbNigh**

Recent advances

System	CER	CVER
HMM-DNN + Neural NLU *[Simonnet et al. 2018]*	20.2	26.0
HMM-DNN + CRF *[Simonnet et al. 2018]*	20.2	25.3
HMM-TDNN + CRF *[Caubrière et al. 2019]*	**16.1**	**20.4**

E2E approach

Semantic labeling using boundaries

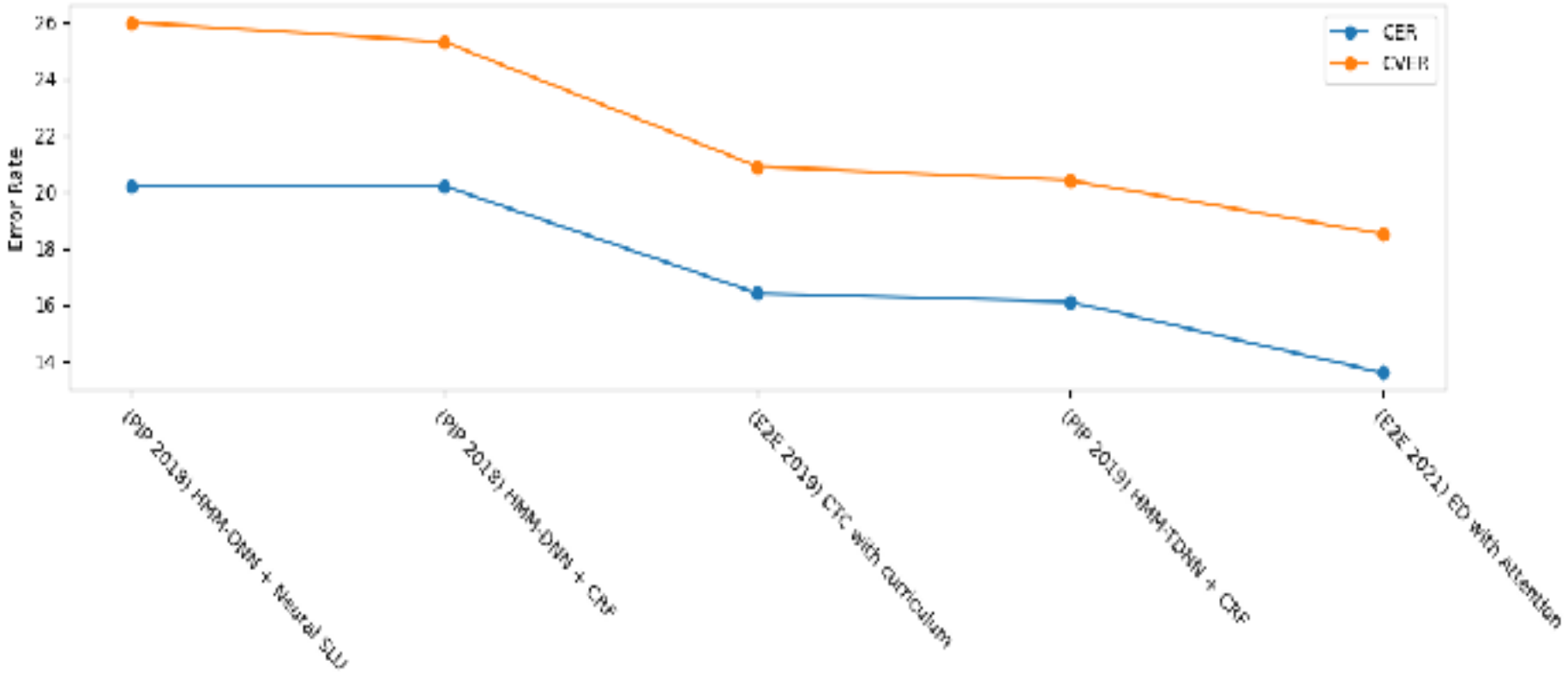
Hello **<command-task** i want to book **>** **<nbNight** a night **>**

Add concepts boundaries in the sequences to be produced

Recent advances

System	CER	CVER
CTC approach with curriculum *[Caubrière et al. 2019]*	16.4	20.9
Encoder-decoder with Attention *[Pelloin et al. 2021]*	**13.6**	**18.5**

SoA in time



Confidence Interval

Confidence degree: 95%

Confidence margin: CER = 0.7% ; CVER = 0.8%

Improving the SoA

Our proposal

Use of pre-trained models with a large amount of data

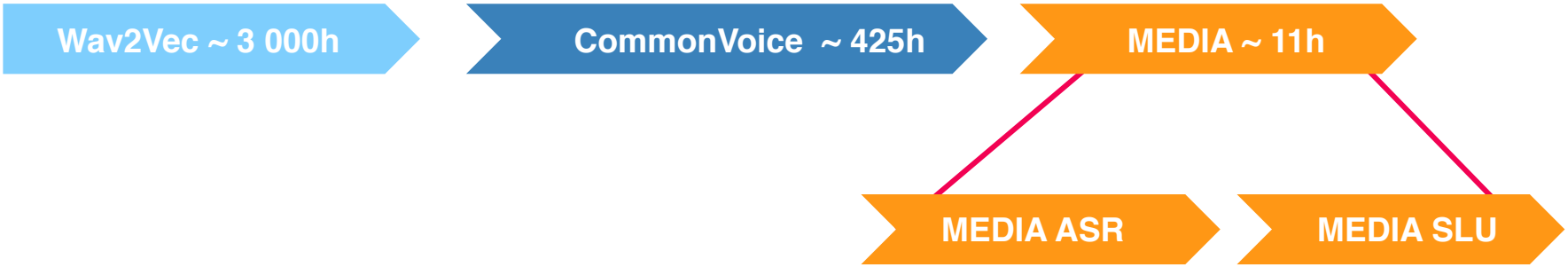
Compare E2E and cascade approach

E2E approach with Wav2Vec

Use a french self-supervised pre-trained Wav2Vec 2.0 model ***[Evain et al. 2021]***

Finetune the model with first French Common Voice and then MEDIA task

Split the MEDIA task into the two subtasks ASR and SLU



E2E Wav2Vec Results

Beam search decoding

5-gram language model trained with MEDIA manual transcription

System	CER	CVER
W2V • M-slu	18.8	23.6
W2V • common Voice • M-slu	15.8	20.4
W2V • common Voice • M-asr • M-slu	**14.5**	**18.8**

Cascade with CamemBert

ASR component performance

System	WER
Last pipeline ASR (HMM-TDNN) ***[Caubrière et al. 2019]***	9.3
W2V • common Voice • M-asr	**8.5**

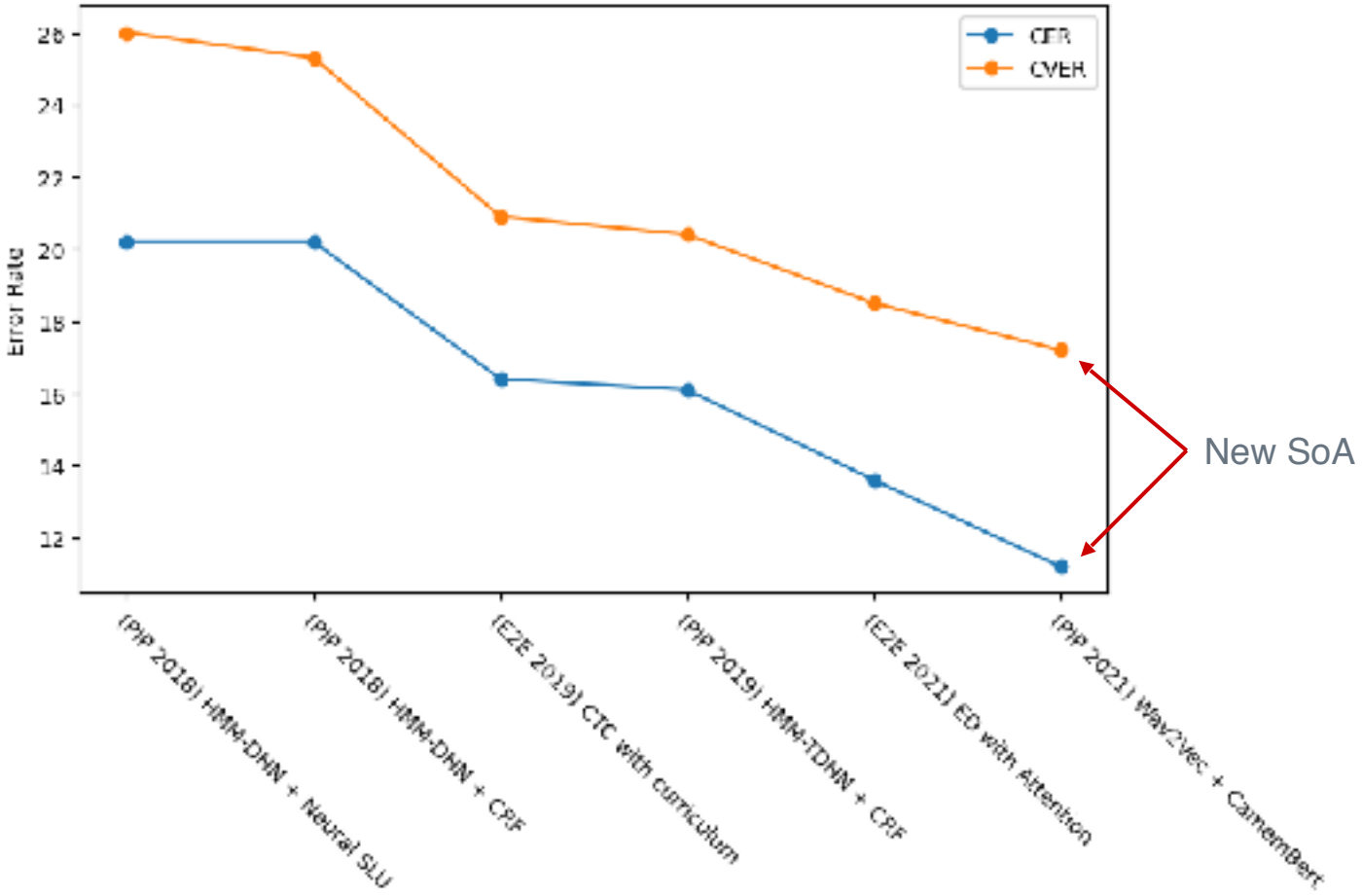
NLU component: CamemBert

Pretrained on the French CCnet corpus composed of 135 GB of raw text ***[Martin et al. 2020]***

Finetuning on the manual transcription of MEDIA

System	CER	CVER
W2V • common Voice • M-asr + CamemBert	**11.2**	**17.2**
Manual transcription + CamemBert ***[Ghannay et al. 2020]***	**7.56**	**X**

Cascade with CamemBert



Conclusion

We presented an overview of recent advances on the French SLU task: MEDIA

We compare both End-to-End and cascade approaches

Recently E2E approaches get very good results on MEDIA (CER 13.6%) ***[Pelloin et al. 2021]***

We proposed a cascade approach based on components pre-trained with unlabelled data

We combine Wav2Vec as ASR and CamemBert as NLU systems

We significantly outperformed the last E2E approach by reach a CER of 11.2

Thank you

The goal of this work

Observe recent advances for the MEDIA task

Improve the state of the art with self-supervised pretrained models