



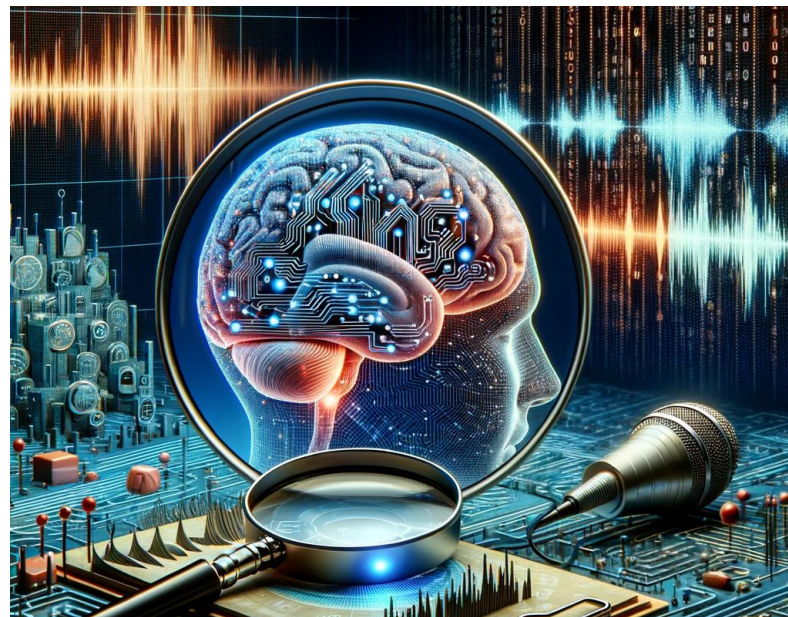
University of
Zurich ^{UZH}

Department of Computational Linguistics

BA/MA projects at the Department of CL

Elisa Pellegrino and Jeannette Roth

December 11, 2024





BA Thesis (Study regulations §25 - §28)

- ◆ **Credits:** 15 ECTS, compulsory, graded
- ◆ **Duration:** 1 semester
- ◆ **Submission Deadlines:** June 1 (spring semester) / December 1 (fall semester)
- ◆ **Thesis:** Individual, no co-authorship
- ◆ **Supervisor:** Master's degree or higher. Commitment for supervision is the prerequisite for booking the module Bachelor's thesis.
- ◆ **Booking:** Via Student Portal in the standard booking period

MA Thesis (Study regulations §30 - §33)

- ◆ **Credits:** 30 ECTS, compulsory, graded
- ◆ **Duration:** 2 semesters
- ◆ **Submission Deadlines:** June 1 (spring semester) / December 1 (fall semester)
- ◆ **Thesis:** Individual, no co-authorship
- ◆ **Supervisor:** PhD or higher. Commitment for supervision is the prerequisite for booking the module Master's thesis.
- ◆ **Booking:** Via Student Portal in the standard booking period



Process and Organisation

Before booking

In the semester before your thesis

Think about a topic idea or a field you're interested in

Check on the website which researchers at the Department work on these topics

Contact your future supervisor with your idea

OR VISIT INFO EVENT



Agree on a topic

Booking

Fill the form "Topic_Sheet_Final_Thesis.pdf" and upload the signed form to Student-Uploads_Topic-Sheets

Book the module (Bachelor's or Master's Thesis)

Fill in the form that the Office of Student Affairs will send you by email with your provisional title. You will receive this email about one week after the end of the booking period.

Work on your Thesis

Submitting

Deadline to submit:
1st of June (Spring Semester)
or 1st of December (Fall Semester)

Fill in the form that the Office of Student Affairs will send you by email with your definitive title. You will receive this email about one week after the submission date. In case of a Master's thesis: upload the thesis via the provided link.

Wait for grade

Result

If you submitted in time and if your supervisor gives you a passing grade (i.e. 4 or more), your thesis is accepted.

Congratulations!



You can find more information via these links:

Faculty of Arts and Social Sciences:

<https://www.phil.uzh.ch/en/studies/studyessentials/graduation.html>

[https://www.phil.uzh.ch/dam/jcr:092773b8-9a44-44a4-a666-c81c6c8f8aa1/STO
_Allgemeiner_Teil_EN.pdf](https://www.phil.uzh.ch/dam/jcr:092773b8-9a44-44a4-a666-c81c6c8f8aa1/STO_Allgemeiner_Teil_EN.pdf) (study regulations)

Computational Linguistics:

<https://www.cl.uzh.ch/en/studies/studies-BA-MA/teaching/bachelor-thesis.html>

<https://www.cl.uzh.ch/en/studies/studies-BA-MA/teaching/master-thesis.html>



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Department of Computational Linguistics

Today: more than 30 projects



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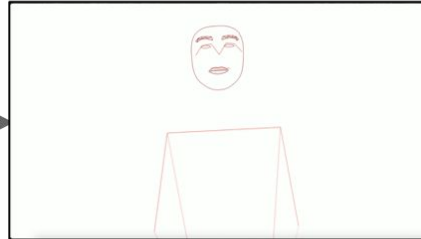
Department of Computational Linguistics

“Language, Technology and Accessibility” group

Sign Language Technology



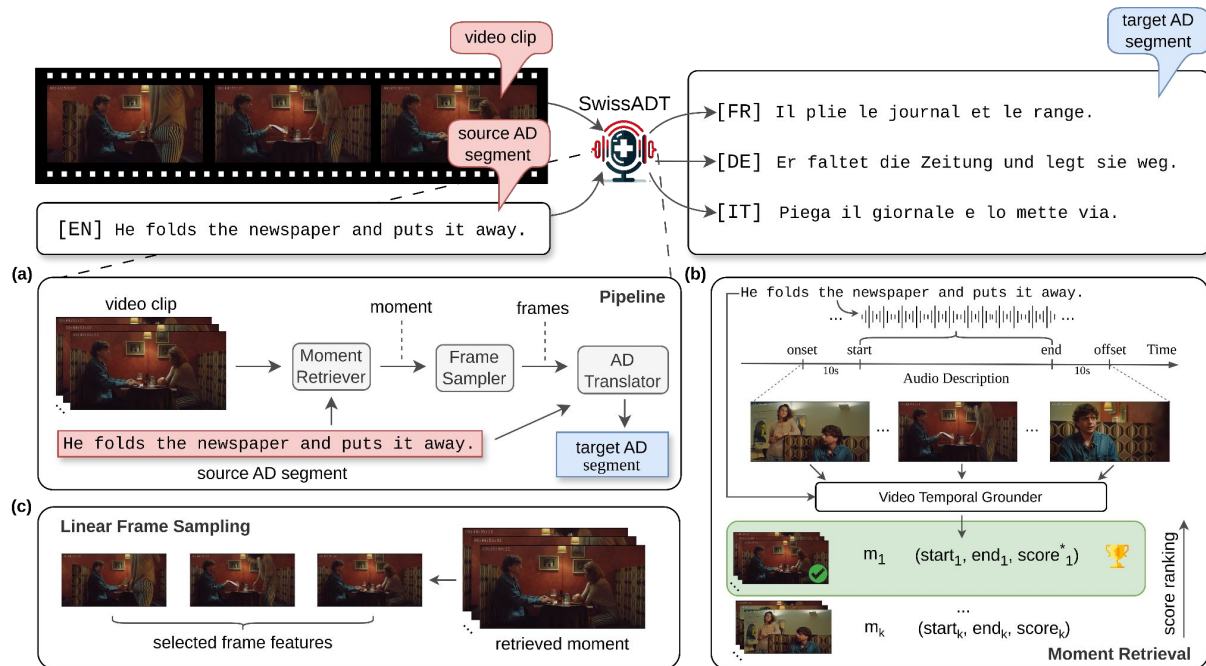
PROFESSOR PERSON++ IX WOMAN MAN
IX ARRIVE INSTITUTION HIRE START
WORK ...



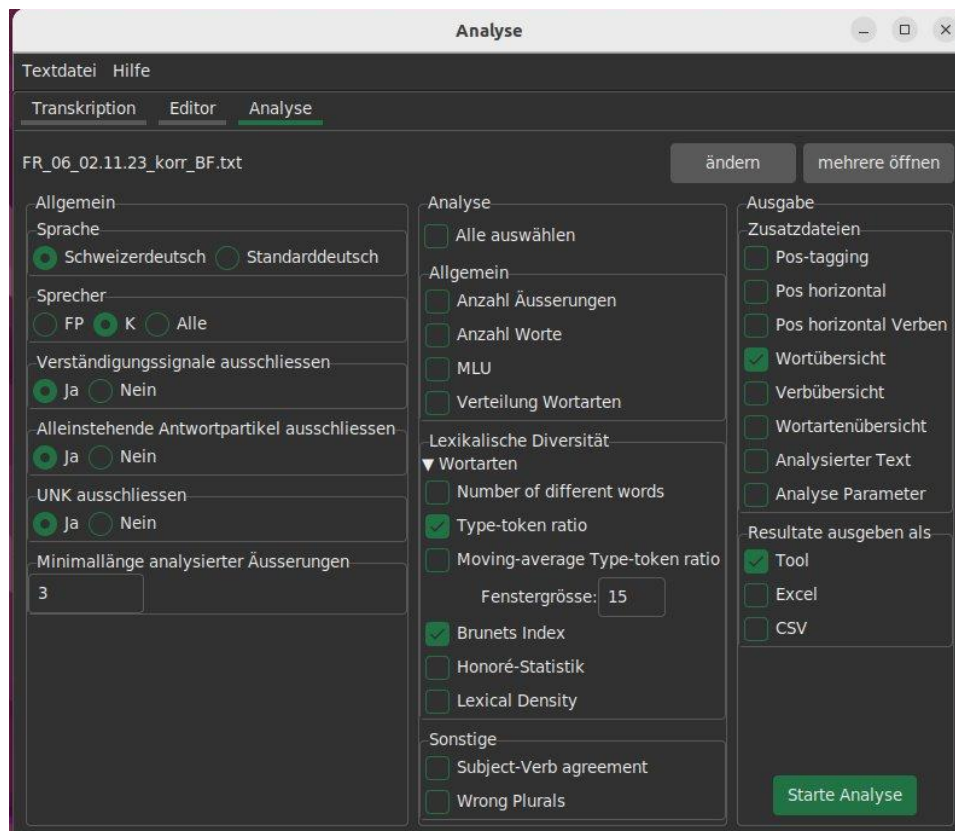
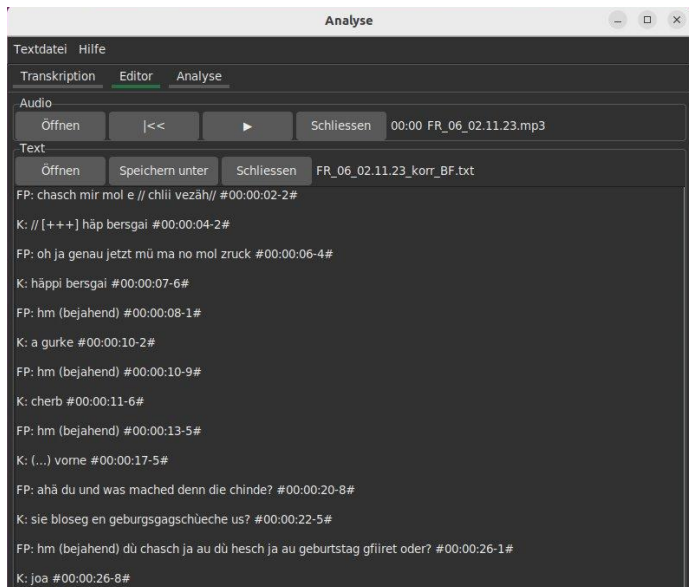
[1.7, -0.5, 2.6, 7.3, 9.0, 0.2, -3.5, ...]

Inaugural lectures often take place a long time after professors take up their posts.

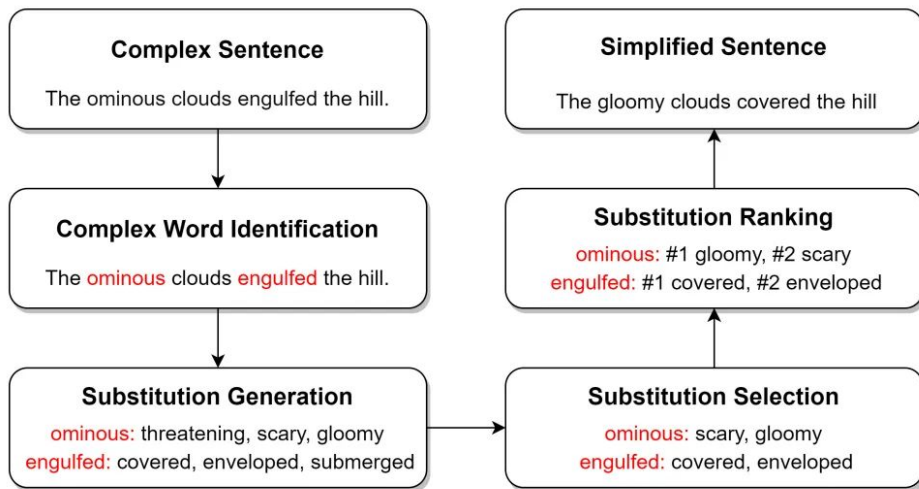
Technologies in the Audio Description Process



Computer-assisted Language Sample Analysis



Automatic Text Simplification





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Department of Computational Linguistics

contact: amit.moryossef@uzh.ch

Amit Moryossef

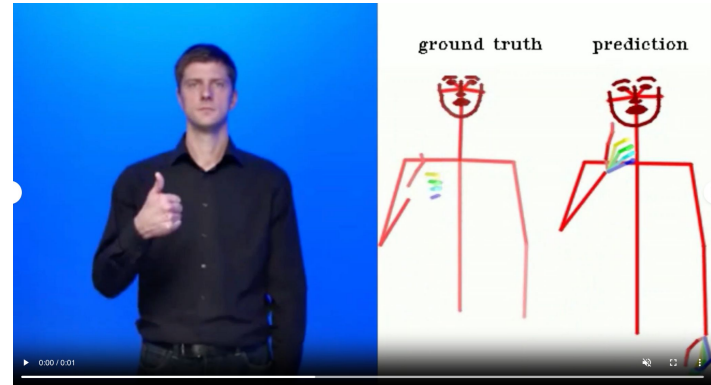
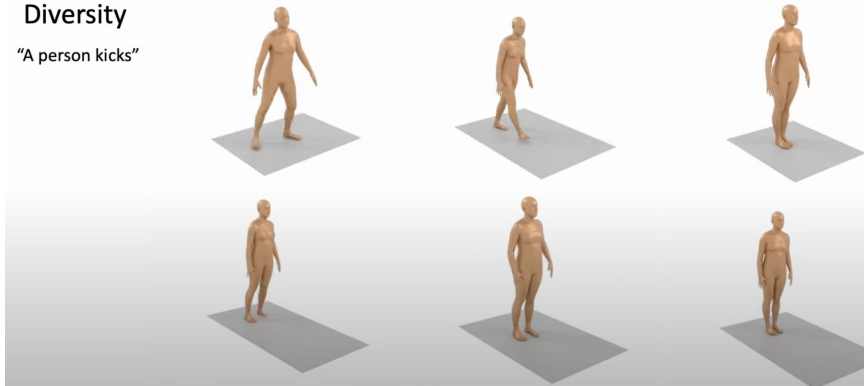
Sign Language Motion Diffusion using SignWriting & HamNoSys

Motion diffusion models have been [shown to work well](#) for sign language animation from a phonetic representation. This project requires to pre-train a diffusion model on a large, un-annotated sign language dataset, then finetune it to allow for control from SignWriting/HamNoSys (and possibly text). An extension would be to consider how to seamlessly transition between multiple signs.

Human Motion – a Many-to-many Problem

Diversity

“A person kicks”



Sign Language Synthetic Translation with SSML

When generating synthetic sign language translations using dictionaries, we use spoken language text as input. Similar to speech synthesis, this representation is often not enough, and more control is needed. This project will involve solving [several small issues](#) in a larger framework, and introducing [Speech Synthesis Markup Language \(SSML\)](#) support.

```
<speak>
```

```
Here are <say-as interpret-as="characters">SSML</say-as> samples.
```

```
I can pause <break time="3s"/>.
```

```
I can play a sound
```

```
<audio src="https://www.example.com/MY_MP3_FILE.mp3">didn't get your MP3 audio file</audio>.
```

```
I can speak in cardinals. Your number is <say-as interpret-as="cardinal">10</say-as>.
```

```
Or I can speak in ordinals. You are <say-as interpret-as="ordinal">10</say-as> in line.
```

```
Or I can even speak in digits. The digits for ten are <say-as interpret-as="characters">10</say-as>.
```

```
I can also substitute phrases, like the <sub alias="World Wide Web Consortium">W3C</sub>.
```

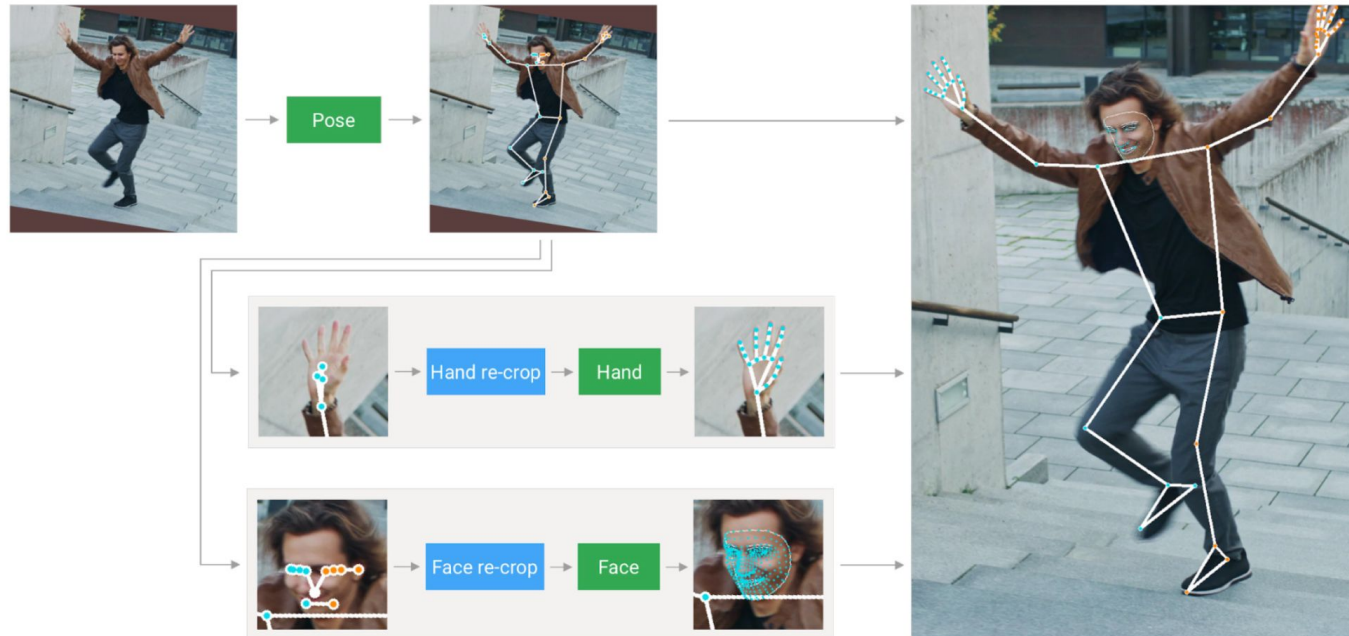
```
Finally, I can speak a paragraph with two sentences.
```

```
<p><s>This is sentence one.</s><s>This is sentence two.</s></p>
```

```
</speak>
```

Fixing Pose Estimation for Sign Language

This project aims to fix bugs and adjust the MediaPipe framework for better sign language use.

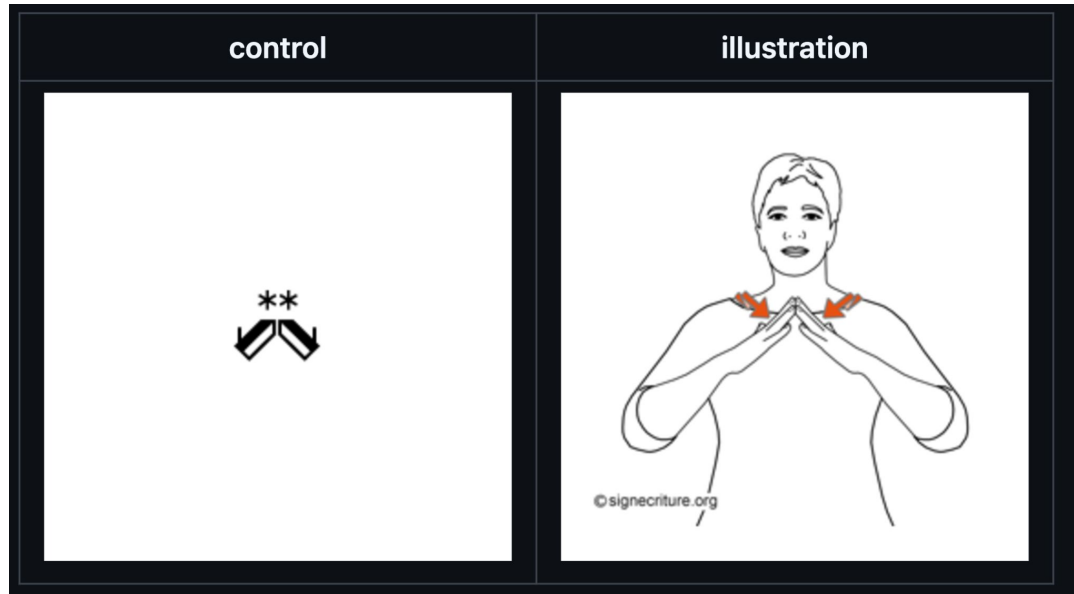


Sign Language Illustration and Description via SignWriting

This project aims to generate sign language illustrations and descriptions directly from SignWriting.

<https://github.com/sign-language-processing/signwriting-illustration>

<https://github.com/sign-language-processing/signwriting-description>



Sign Language in a Mixed-reality Setting

Only if have Swift experience.

It involves mapping sign language translation from poses to a 3D model, and placing the model in the space around the signer. It will integrate with an existing application (<https://github.com/sign/translate>) to support the Apple Vision Pro.

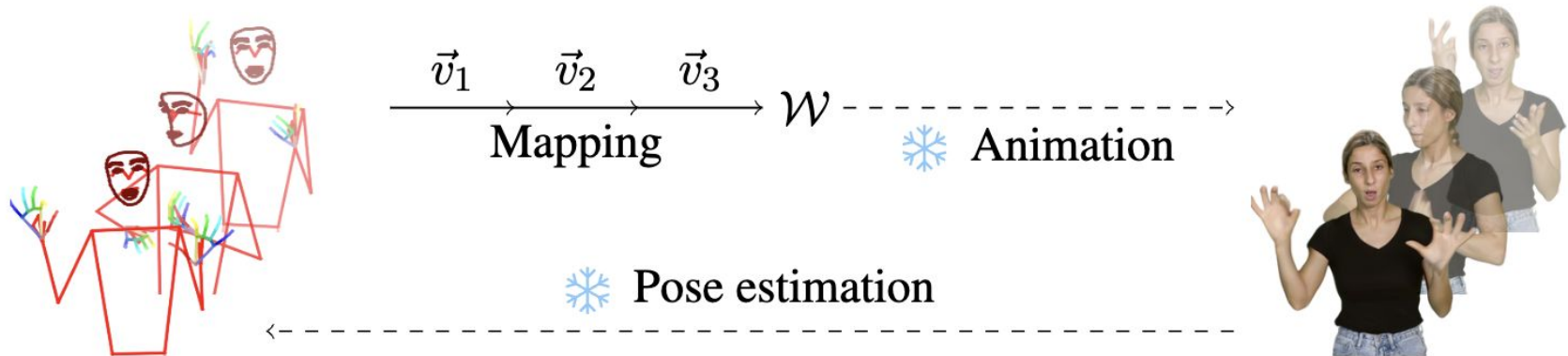


Sign Language Rendering Reinvented: Controlling Existing Avatars

The project is well defined with many parts already implemented.

You will work on operationalizing a pipeline to train control models for existing avatars.

<https://github.com/sign-language-processing/pose-to-video>



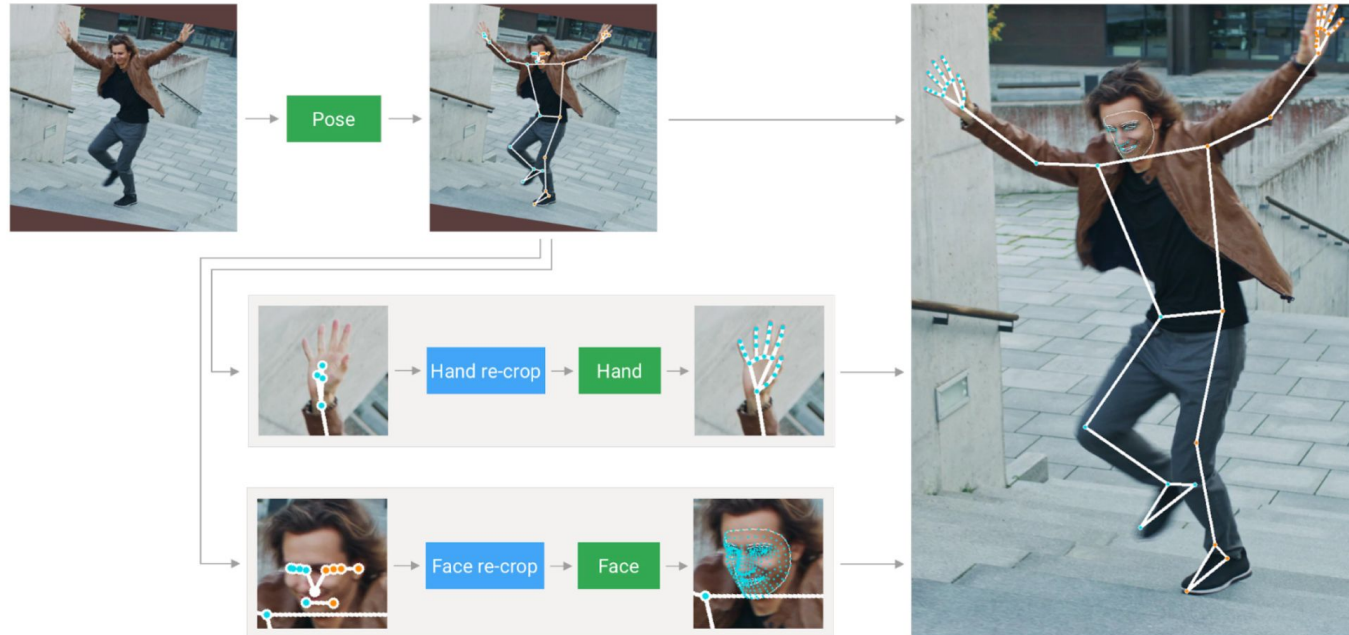
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Here are <say-as interpret-as="characters">SSML</say-as> samples.
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I can play a sound
<audio src="https://www.example.com/MY_MP3_FILE.mp3">didn't get your MP3 audio file</audio>.
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Or I can even speak in digits. The digits for ten are <say-as interpret-as="characters">10</say-as>.
I can also substitute phrases, like the <sub alias="World Wide Web Consortium">W3C</sub>.
Finally, I can speak a paragraph with two sentences.
<p><s>This is sentence one.</s><s>This is sentence two.</s></p>
</speak>
```

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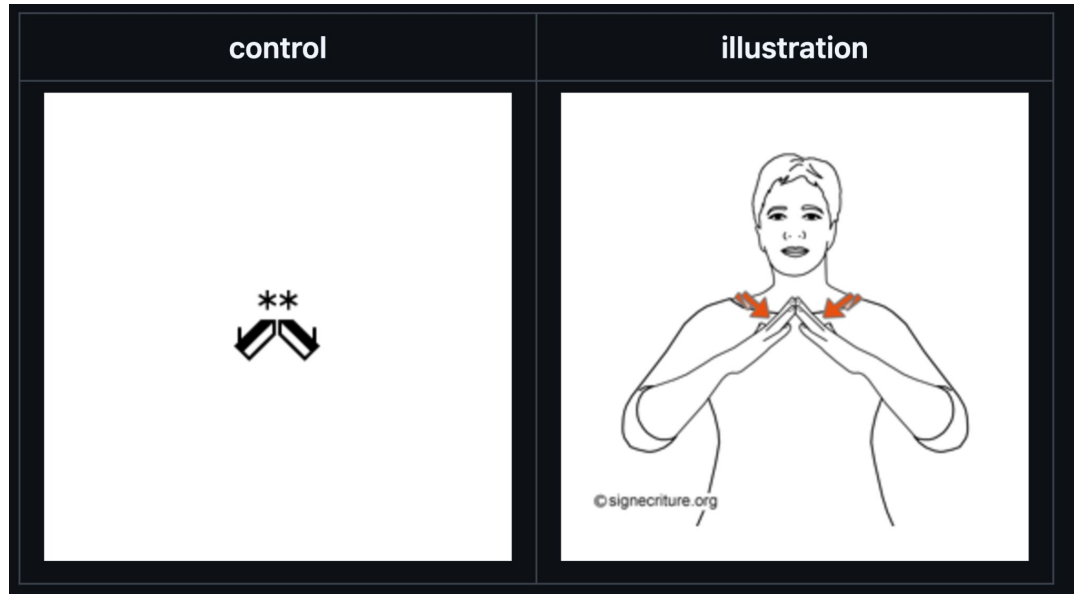


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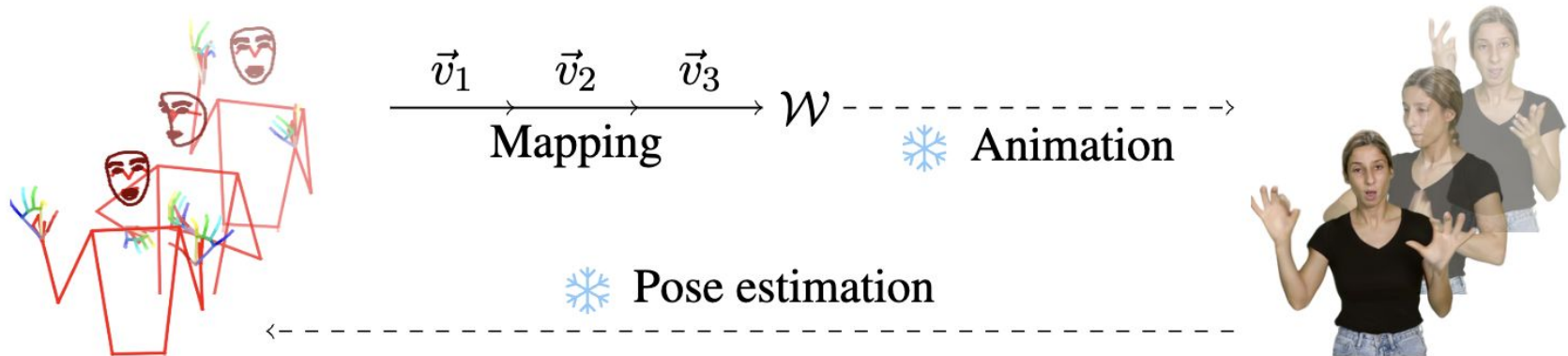


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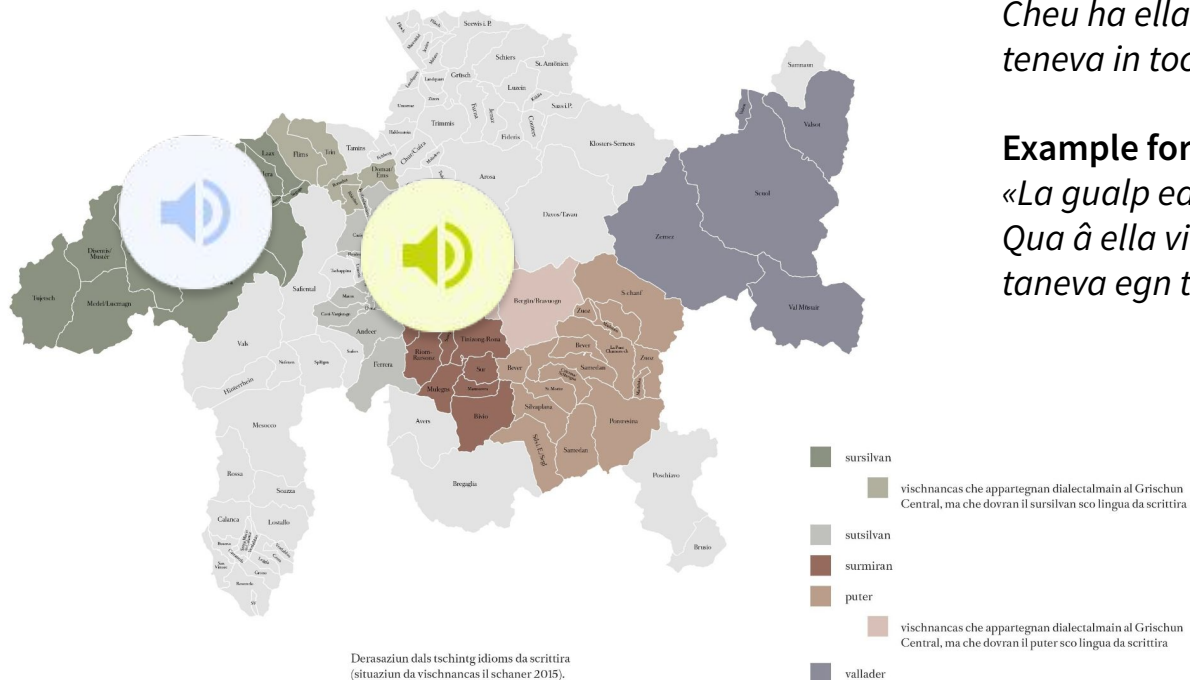


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Jannis Vamvas

Romansh Idiom Detection



Derasaziun dals tschintg idioms da scrittira
(situaziun da vischnancas il schaner 2015).

Example for Sursilvan:

«L'uoip era puspei inagada fomentada.
Cheu ha ella viu sin in pégn in tgaper che
teneva in toc caschiel en siu bec.»

Example for Sutsilvan:

«La gualp eara puspe egn'eada fumantada.
Qua â ella vieu sen egn pegn egn corv ca
taneva egn toc caschiel ainten sieus pecel.»



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Phillip B. Ströbel

Re-Experiencing History 1: Prompt Engineering for Historical Images



Original prompt



Lange, Mock



Lange, Mock



Lange, Mock



Lange, Mock



Armstrong, Claiming



Armstrong, Claiming



Armstrong, Claiming



Armstrong, Claiming



Lange, Late



Lange, Late



Wienand, Triumph



Wienand, Triumph



Lange, Mock

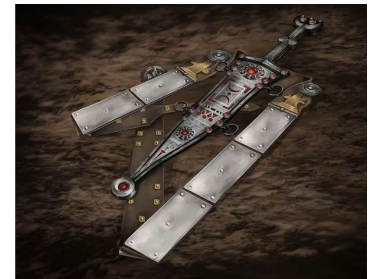
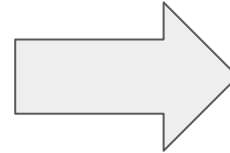


Armstrong, Claiming

Possible research questions:

- How can we ingest historical knowledge into the prompts? What about the contemporary sources? What if they contradict?
- How can we measure whether an image got better? What does better even mean?

Re-Experiencing History 2: Reconstruction of Historical Artefacts





Presenting Today

Andrianos Michail

Juri Opitz

Simon Clematide



Compare the passage on the left side with passage #2 of 3 in the same cluster

SORT BY DATE (DESC) ▾

« < 1 2 3 > »

Passage in: **NaN**
L'Impartial Fri, Jan 12, 2018 — p.1

Passage in: **NaN**
L'Express Sat, Sep 2, 2017 — p.35

Tous les membres de la Grappe Groupement d'entente communale à Milvignes ont appris avec tristesse le décès de **Madame Hugulette** LAURENT **maman** de M. Frédéric Laurent, membre fondateur et ancien conseiller communal à Milvignes Nous lui adressons, ainsi qu'à sa famille, l'expression de notre profonde sympathie.

Tous les membres de la Grappe Groupement d'entente communale à Milvignes ont appris avec tristesse le décès de **Monsieur Eric** LAURENT **papa** de M. Frédéric Laurent, membre fondateur et ancien conseiller communal à Milvignes Nous lui adressons, ainsi qu'à sa famille, l'expression de notre profonde sympathie. **028-802038**

What Do We Sacrifice Through Distilled Embedding Models?

It is suggested that cheap embedding models can be created via distillation from large embedding models, with little loss of performance. How true is this for Multilingual Models in Cross Lingual Evaluations?

In this thesis we want to:

- Examine multilingual models and their “efficient” counterparts such as [Matryoshka Embeddings](#) and [Model2Vec](#) under a cross-lingual scope.
- Understand which models synergise well for this techniques and what ends up being sacrificed with these techniques through fine-grained evaluations

Outcome: An efficient Cross Lingual Semantic Search methodology to apply on Historical News.

Keywords: Multilingual Models, Bitext Mining, Information Retrieval, Distilled Models, Deep Learning

Suitable for **BA/MA** Thesis

[Impresso II](#) CL:
Andrianos Michail
Juri Opitz
Simon Clematide



What Do Long Text Semantic Representation Capture? A Multilingual (Adversarial) Examination

We can now embed texts up to 8192 Tokens long. That's a lot of meaning to be squeezed. Are we representing the entire text fairly or is there biases in the representation based on the order of the text or other nuances?

In this thesis we want to:

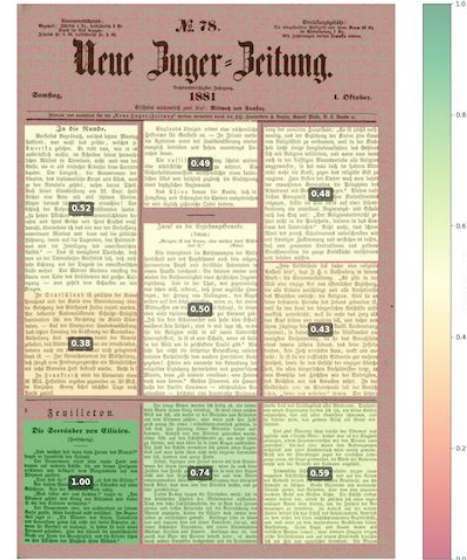
- Using existing datasets and augmentations such as reshuffling, understand different methods of achieving long context embedding.
- Quantify the contribution of smaller texts to a long text representation.
- Application of the promising techniques to Diverse Historical News Articles.

Outcome: Understanding of Multilingual Long Text Representations

Keywords: Multilingual Models, Information Retrieval, Embedding Aggregation, Deep Learning

Suitable for **MA** Thesis


[Impresso II](#) CL:
Andrianos Michail
Juri Opitz
Simon Clematide



Decompose Embeddings Into Explainable Semantic Features

The [S³BERT method](#)


- **Decomposes** an embedding such that its parts reflect different semantic aspects
- This way,
 - we can not only say, “**X and Y are similar**”,
 - but also, e.g., “X and Y are similar in that they **share the same topic**”

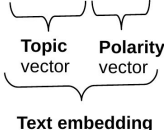
 The frog **likes** to swim
The frog **doesn't like** swimming

Transformer
(SBERT, simCSE,...)

1 1 1 **1 1**

1 1 1 **0 0**

 **Cosine Similarities**
Polarity: **0.0**
Topic: 1.0
Overall: 0.8



In this thesis we want to:

1. Contemplate which semantic features are important in a document
 - a. E.g.: Named Entities?
 - b. Topics? And more!
2. Design simple metrics that measure similarity of your features (e.g. Named Entity Overlap)
3. Apply the S³BERT method to learn your features with a SotA embedding model
4. Evaluate: Assess opportunities (e.g., explanation) and challenges

Suitable for **MA** Thesis

[Impresso II](#) CL:
Andrianos Michail
Juri Opitz
Simon Clematide



Visualizing Document Embeddings

- For visualization, n-dimensions need to be crunched down to two/three.
- Different options are available
 - Learned techniques:
 - Distill model
 - Autoencoder
 - Post-processing (classic dim reduction techniques such as PCA)
- In this thesis, we ask the following question: **Which technique is best?**
 - “Best” can be defined in different ways, one option:
 - **Quality:** How well does the small embedding preserve the characteristics of the original dimensions?
 - **Efficiency:** Which method has what compute cost?

Suitable for **BA/MA** thesis with a focus on data visualisation

[Impresso II](#) CL:
Andrianos Michail
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Simon Clematide





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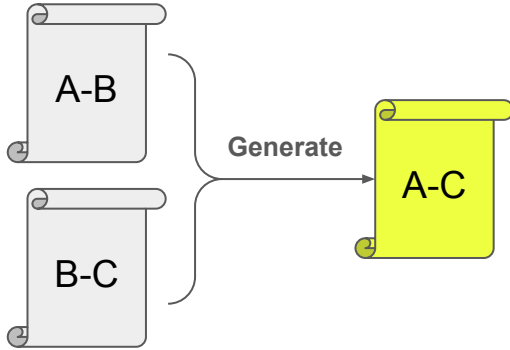
Sina Ahmadi
(sina.ahmadi@uzh.ch)

Low-resourced NLP



Create dictionaries for dialects

Translation Inference



('Aabig' > 'evening') & ('evening' > 'Abend')
>> ('Aabig' > 'Abend')

Bilingual Lexicon Induction

Wir leben im **Zeitalter** der Technik.

- AG: Mer läbe em **Zitalter** fode Technik.
- BE: Mir läbe im **Zitauter** vor Technik.
- BS: Mir läbe im **Ziitalter** vo dr Technik.
- GR: Mir lebend im **Ziitalter** vu dr Technik.
- LU: Mer läbend im **Ziitalter** vo de Technik.
- SG: Mir lebed im **Ziitalter** vo de Technik.
- VS: Wier läbe im **Zitalter** vaner Technik.
- ZH: Mir läbed im **Zitalter** vode Technik.

Zeitalter > Zitalter, Zitauter, Ziitalter, Zitalter



University of
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Department of Computational Linguistics

LiRI NLP (Linguistic Research Infrastructure)

Gerold Schneider / Tilia Ellendorff

gerold.schneider@uzh.ch / tilia.ellendorff@uzh.ch

Sustainable procurement

Sinergia Project on public procurement, joint between FH Bern and UZH: <https://data.snf.ch/grants/grant/10000100>

How does environmental and social public procurement affect the sustainability transformation in the public and private sector?

Can sustainability in the tender documents be measured with NLP methods?

Topic: develop methods to extract information, discover sustainability criteria, or map the semantic space of the Swiss public procurement landscape (exact topic can be adapted to skills and interests)

Offer: Be part of the project's NLP team for the duration of your **Master's** thesis: join project meetings, reading group sessions, discussion rounds and publications (optional)

Requirement: good programming skills in Python, knowledge in NLP and language models, and a certain interest in the legal, economic and societal dimensions of public procurement and sustainability

Co-supervision: Gerold Schneider & Tilia Ellendorff



Trade-offs between renewable energy & biodiversity

ENGAGE (*evidence-based dialogue on trade-offs in intricate societal problems*): <https://www.engage-dialogue.ch/en/>

A joint, transdisciplinary research project between ETH, eawag, WSL and UZH

Text analysis to find trade-offs between renewable energy & biodiversity

A complex situation where no single best solution exists:

The transition to renewable energy use is essential - the loss of biodiversity threatens the collapse of ecosystems

Topic: Pipeline for automated literature identification and text analysis, and identify trade-offs between renewable energy projects and biodiversity conservation

Offer: Be part of the project's NLP team for the duration of your **Master's** thesis: join project meetings, discussion rounds and publications (optional)

Requirement: good programming skills in Python and/or R, knowledge in NLP and language models, and a strong interest in trade-off analysis in intricate societal problems.

Co-supervision: Gerold Schneider & Tilia Ellendorff & Leila Schuh (WSL)





University of
Zurich ^{UZH}

Department of Computational Linguistics

LiRI NLP (Linguistic Research Infrastructure)

Gerold Schneider / Ahmet Yavuz Uluslu / Jean-Philippe Goldman

ahmetyavuz.uluslu@uzh.ch

Grammatical Error Correction of L2-English learners of Swiss German (ChaLL)


We already have:

- a corpus of 20 hours of pupil dialogues recorded and transcribed (360k words).
- an existing base model for GEC (grammatical error correction) in English.

We are offering a bachelor's/master's thesis on:

- Improve existing GEC systems by incorporating cross-linguistic influence theory and/or fine-tuning LLMs on L2 English from Swiss-German.
- Generate corrected ground truth data (data augmentation) with LLMs and validate this approach.

Grammatical Error Correction of L2-English learners of Swiss German (ChaLL)




▶ Hello there! Welcome to our English practice session. How are you doing today? If you have any questions or need help with anything, feel free to ask. Just remember, I only speak English, so if you come across any words you don't understand, you can check the language support on the right side of the screen. Let's have some fun practicing English together! 😊

[Bot] Talky Walky - before 7 minutes ⓘ

▶ User Audio (5:1)

- ▶ [O] Hello, I'm good and how is you?
- ▶ [C] Hello , I'm good and how are you ?

before 4 minutes ⓘ



▶ I'm happy you're feeling good! I'm an AI and I can't feel, but I'm here to help with your English. Is there something you want to talk about or ask me?

[Bot] Talky Walky - before 4 minutes ⓘ

▶ User Audio (5:3 s)

- ▶ [O] Yes, uh why school is so boring?
- ▶ [C] Yes , why is school so boring ?

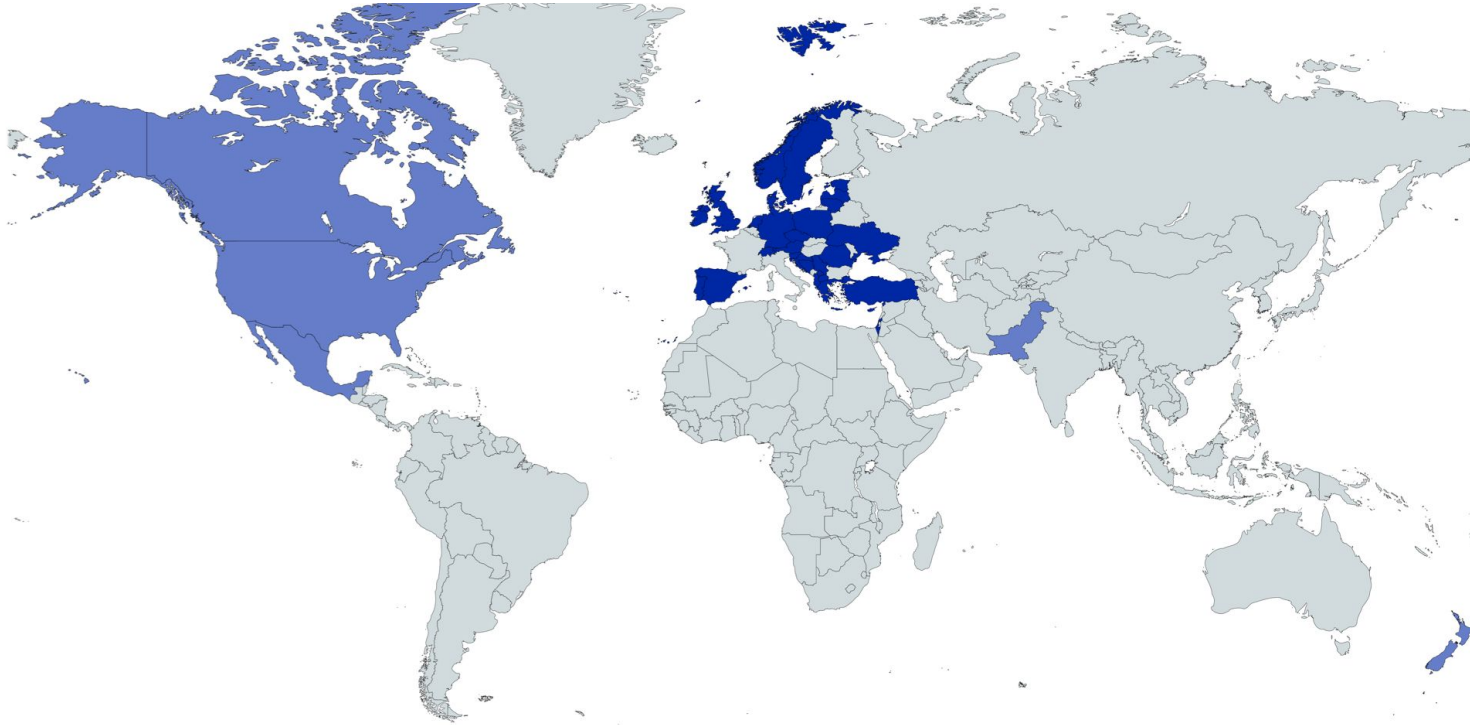


**University of
Zurich** UZH

Department of Computational Linguistics

Digital Linguistics Group
Jan Brasser

MultiEYE Enabling multilingual eye-tracking data collection for human and machine language processing research



Created with mapchart.net

MultiPLEYE Enabling multilingual eye-tracking data collection for human and machine language processing research



100 participants/language

Eye-tracking + psychometric tests data collection

Materials are prepared -> need to be translated for some languages



Project 1.1: Collecting eye-tracking data for your language



1. **Stimuli preparation: translate the stimulus from English or find translation**
2. **Data collection: 35 participants or more, depending on the languages**
3. **Statistical description and analysis of the corpus**

Choose the depth of analysis based on (1) your specific research interests in psycholinguistics or NLP, (2) the effort you've already put in step 1 and 2.



Project 1.2: Collecting eye-tracking data for your language



1. Stimuli preparation: translate the stimulus from English or find translation
2. Data collection: 35 participants or more, depending on the languages
3. Help with developing an open-source eye-tracking data preprocess pipeline (Software engineering skills are essential, particularly proficiency in Python)



Project 2: Collecting **MultiEYE** reading data with multiple psycholinguistic methods



1. Stimuli preparation: choose a subset of languages that the stimuli are ready, e.g. EN, ZH, DE, NL, HR, RU, ET...
2. Implement various psycholinguistic methods for MultiEYE, e.g. SPR, MoTR, A-maze
3. Data collection: 35 participants or more; Online or in-lab
4. Statistical description of the corpus



MultiEYE Enabling multilingual eye-tracking data collection for human and machine language processing research



Currently participating languages:

Albanian, Arabic, Basque, Catalan, Croatian, Chinese, Czech, Danish, Dutch, English, Estonian, French, German, Greek, Italian, Latvian, Lithuanian, Polish, Portuguese, Romanian, Russian, Spanish, Swedish, Turkish, Ukrainian, ...

And **your** language?



**University of
Zurich** UZH

Department of Computational Linguistics

Phonetics and Speech Sciences Group
Elisa Pellegrino
(elisa.pellegrino@uzh.ch)

THE PRODUCTION, PERCEPTION AND CLASSIFICATION OF L2 ACCENTED ENGLISH

Elisa Pellegrino with Rabeah Kiani and Alejandra Carolina Pesantez Pesantez

Previous project

Corpus Collection

600 sentences in Pakistani-accented English (20 sentences *30 speakers)

600 sentences in L1 English (30 sentences *20 speakers)

Preliminary results based on prosodic features

Evaluation Metrics

	ENG L1	ENG L2	Average / Total
Accuracy	0.825	0.825	0.825
Precision (Positive Predictive Value)	0.822	0.829	0.825
Recall (True Positive Rate)	0.848	0.800	0.825
F1 Score	0.835	0.814	0.825
Area Under Curve (AUC)	0.877	0.875	0.876

Note. All metrics are calculated for every class against all other classes.

Rate differences and the timing of consonants

Available projects

BA Thesis

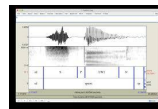
Investigate the segmental differences between Pakistani accented English and L1 English (pronunciation difference) and their weight for accuracy of classification

MA Theses

Identify the segmental features of Pakistani accented English (pronunciation difference) and test their relevance for L2 speech comprehension by humans and machines

Skills/Software

Acoustic analysis



Perception tests



Prolific

Data analysis



THE ROLE OF SPEECH ACOUSTICS TO DETECT DEEP FAKE VOICES

Elisa Pellegrino in collaboration with aurigin.ai



Previous project

Current available projects

VOICE CONVERSION DATASET

SPEECH MATERIAL

→ 685 natural utterances

- 137 utterances * 5 speakers (1 source, 4 targets)
- 44 statements (SVO; 5 words): **LONG UTTERANCE**
- 10 y/n questions (based on 5-word statement)
- 83 statements (SV; 2 words): **SHORT UTTERANCE**

→ 548 voice converted utterances

- 137 converted utterances by source speaker * 4 target speakers

SPEAKERS

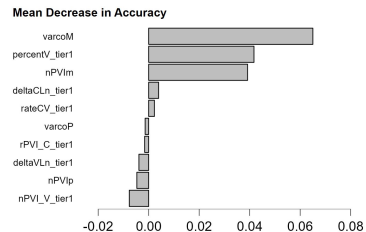
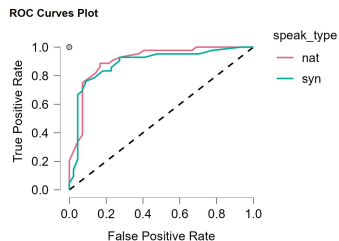
→ Target speakers

- 4 male speakers of Stand. German
- Master/Phd students
- 22-34 y. o.
- Previously screened for no audible regional accent

→ Source speaker

- Professional speaker
- Recruited at ZHDK

Preliminary results based on prosodic features



Project 1: Investigate the acoustic features (e.g. segmental, suprasegmental, idiolect, accents) that distinguish human voice from AI-generated voices (adaptable for BA theses)

Project 2: Compare the capabilities of humans and machines to rely on these features to detect natural vs AI-generated content

Dataset

– Real speech includes a combination of **publicly available datasets** for real speech (e.g., Librispeech, CoVoST2) and **proprietary recordings**

– AI: existing, proprietary **data creation pipeline**, which creates voice clones of the real speech samples from various leading voice-cloning models (e.g., Elevenlabs, Respeecher)

Skills/Software



THE ROLE OF EXPRESSIVE AUDIO-VISUAL INFORMATION ON FACE-VOICE AND VOICE-FACE IDENTITY MATCHING

Elisa Pellegrino

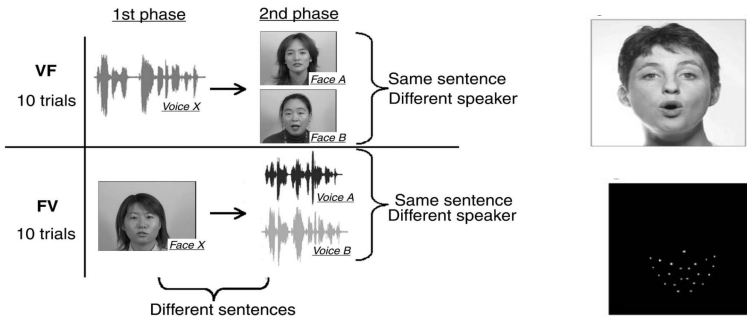
Previous MA projects (submitted in Dec 2024)

Current available projects

Corpus Collection

Less expressive (ADS)   More expressive (IDS) 

Perceptual Testing



(BA Thesis)

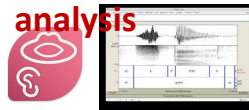
Testing the effect of language familiarity on cross-modal identity matching

(MA Theses)

Acoustic analysis/perceptual evaluations/classification of the visual and auditory expressiveness of IDS and

Skills/Software

Acoustic analysis



Perception tests



Prolific

Data analysis





**University of
Zurich** UZH

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Babies' Perception of Voices in Infant-Directed Speech (IDS) and Adult-Directed Speech (ADS)

[plan for 2024-2025] Volker Dellwo, Rushen Shi

Introduction

- ❖ Adults naturally change their speaking styles when talking to children versus to adults.
- ❖ The 2 speaking styles (IDS vs. ADS) have distinct acoustical properties.
- ❖ Our modeling work showed that the 2 speaking styles impact voice recognition performance in different ways (Dellwo, et al, under revision)

Methods

- ❖ Participants: Swiss-German-learning babies aged 7 to 8 months.
- ❖ Stimuli & design: trials of Swiss-German adult voices in IDS and ADS, with faces. 
→ Already prepared
- ❖ Perceptual exp: using Habit software; measuring babies' looking time to Swiss-German voices paired with faces. → To do in 2024-2025

The Present Study

Aims at understanding:

- ❖ the role of speech styles (IDS vs ADS) in infants' voice recognition;
- ❖ the influence of native language experience on infants' voice processing

The Exp Setup (ready)

In LiRI lab:

- ❖ baby on parent's lap facing a screen; camera on baby's eyes;
- ❖ speech from loudspeakers next to the screen;
- ❖ testing with Habit software





**University of
Zurich** UZH

Department of Computational Linguistics

Sandra Schwab & Jean-Philippe Goldman

Contactable via email

Automatic prominence detection in L2

Framework

- Computer-assisted pronunciation teaching (**CAPT**)
- Focus on L2 **stress contrasts**: e.g. import vs. import
- **Automatic prominence detection in speech signal**

Two goals

- **Train** system to develop **L1 German/Italian stress detector**
- **Assess and adapt the L1 system to L2 German/Italian** to be implemented in **Miaparle** (miaparle.unige.ch)

Requirement: Strong background in **Machine Learning**

Co-supervision: Sandra Schwab (UZH) & Jean-Philippe Goldman (UniGe, UZH)

Automatic tone detection in L2

Framework

- Computer-assisted pronunciation teaching (**CAPT**)
- Focus on L2 **tone contrasts**: e.g. shu1 'book' vs. shu4 'tree'
- **Automatic tone detection in speech signal**

Two goals

- **Assess and adapt the L1 system to L2 Mandarin Chinese** to be implemented in **Miaparle** (miaparle.unige.ch)

Requirement: Strong background in **Machine Learning**

Co-supervision: Sandra Schwab (UZH) & Jean-Philippe Goldman (UniGe, UZH)