Lingsoft and Speech recognition solutions

ELEC-E5500 - Speech Processing guest lecture
October 9, 2023

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Lingsoft®

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Today’s agenda

Introduction

Lingsoft’s solutions

Speech recognition and its uses

Human-in-the loop use case: Live subtitling

Time for questions

Lingsoft®

Lingsoft in a nutshell

The largest privately owned Finnish language management company

- Founded in 1986
- More than 100 employees
- More than 500 partners

The only Finnish company among the 100 largest language management companies in the world

- Over 1000 end customers
- Our language technology solutions have tens of millions of end users

Language services: translations, subtitling, transcription, medical transcription, term management, content production

Language solutions: accessibility and clarity, findability and text analysis, semantic compatibility

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FINLÄNDSK SERVICE
®

Lingsoft Core Technologies

Text Analysis

- Hybrid rule-based/deep learning-based
- Lemmatization, disambiguation, named entity recognition, semantic enrichment
- Spelling and grammar checker

Automatic Speech Recognition (ASR)

- Based on deep learning
- Language and domain customization
- Pre- and postprocessing

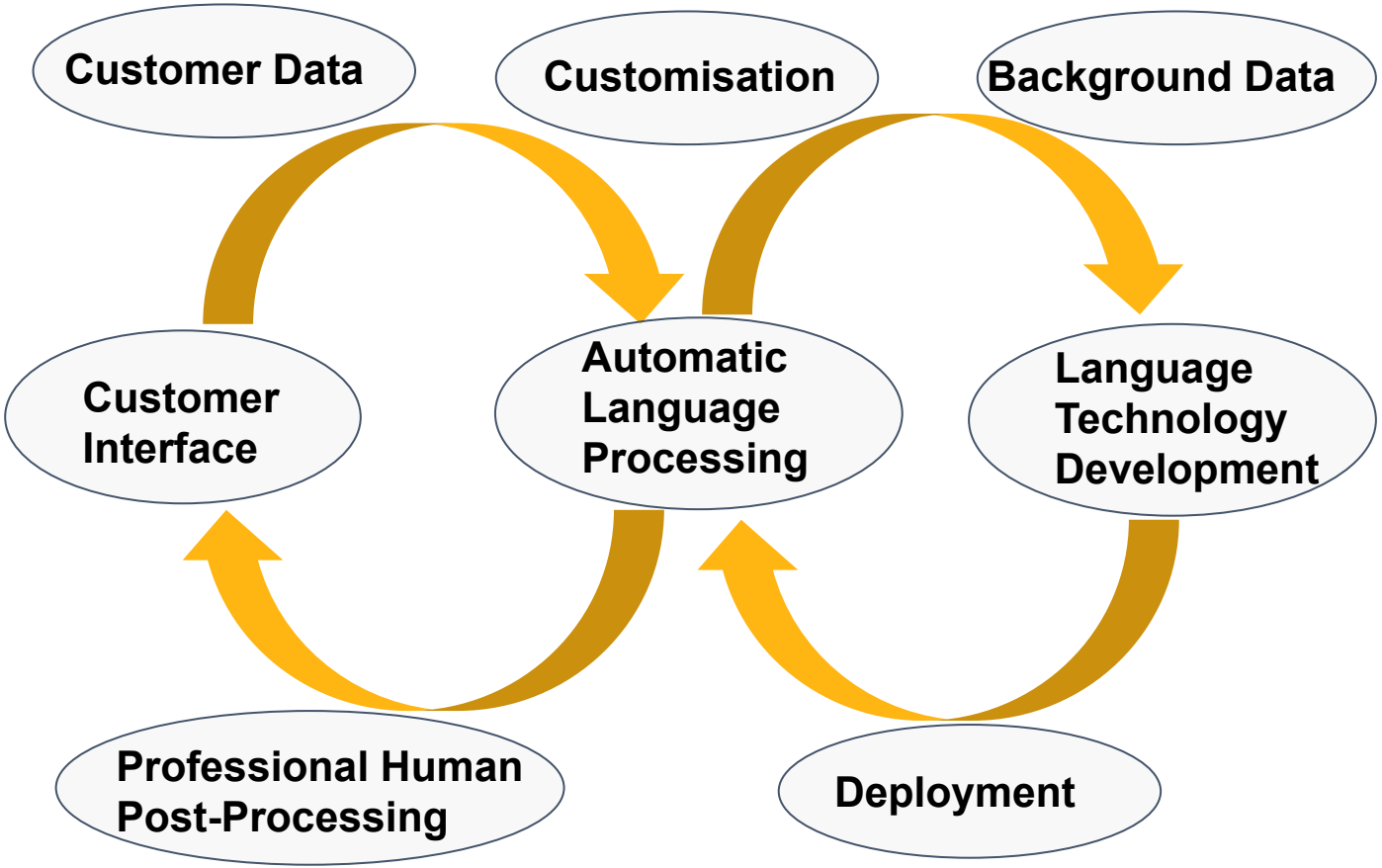
Neural Machine Translation (NMT)

- Based on deep learning
- Language and domain customization
- Pre- and postprocessing

Process Automation and Integration

- Tools available primarily as cloud services
- APIs based on industry standards

Lingsoft Process Design Model



Other Lingsoft solutions

Lingsoft Text Analysis

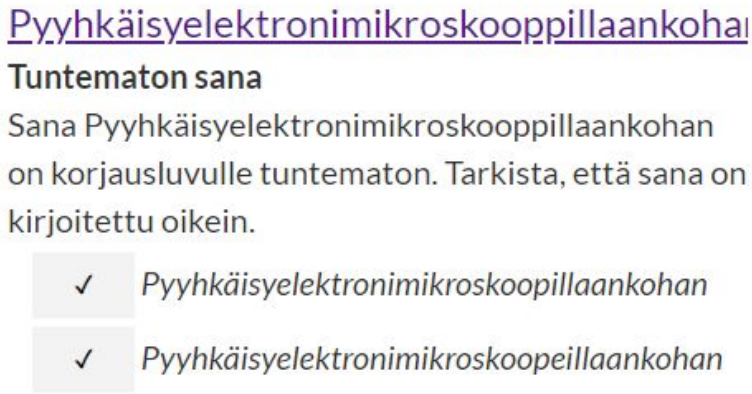
- **Morphological analysis**: fundamentals for the rest, e.g. lemma (dictionary form) identification and disambiguation
- **Proofing tools**: spelling and grammar checking
- **Terminology mark-up**: detect and mark-up terminology in running text
- **Named Entity Recognition**: detect names and related entities in text, important for e.g. **anonymization, keywords** and **metadata**
- An important part of speech recognition post processing

Proofing Tools

Pyyhkäisyelektronimikroskoopillaankohan

Pyyhkäisyelektronimikroskooppillaankohan

maybe with their scanning electron microscope



Supported languages:

- Finnish (incl. general and medical domain)
- Swedish (incl. standard and Finland Swedish)
- Norwegian (bokmål and nynorsk)
- Some support also for a number of other languages, e.g. English, Russian, German, Northern Sami, …

Terminology and Keywords

Valtiontalouden tarkastusvirasto valvoi vuoden 2022 aluevaaleissa ehdokkaan vaalirahoituksen ja vaalikampanjakulujen ilmoitusvelvollisuuden noudattamista laissa säädetyllä tavalla. Kaikki ilmoitusvelvolliset jättivät vaalirahoitusilmoituksen.

ilmoitusvelvollinen (vtv)

sv: redovisningsskyldig
en: discloser

Given a termbase or ontology, then terms/concepts can be identified and marked-up in running text

Lingsoft Machine Translation

Automatically generates translations for text

Based on **open source neural machine translation** (NMT) tools (same as behind Microsoft Translator)

Trained with **tens of millions of segments** from internal and public data sets (e.g. DGT TM)

Used by **hundreds of translators** via MTLab - our plugin for Trados Studio

Translates about **two million words every month** for Lingsoft post-editing jobs

Terminology Control in NMT

Henkilötunnus = Social security number? Personal identification number? Personal identity code? …?

source + term list + NMT engine = machine translation with the right terminology

Source	**termNMT**
<SRCTERM> henkilötunnuksen <TRANS> personal identity code </TRANS> saaminen edellyttää henkilökohtaista käyntiä <SRCTERM> palvelupaikassamme <TRANS> service location </TRANS> .	Obtaining a personal identity code requires a personal visit to our service location.

Lingsoft speech solutions

Lingsoft Speech Service

Our platform for serving speech recognition clients

Speech-to-text or automatic speech recognition (ASR)

- Automatically transcribes speech
- Based on **open source** tools
- Trained with a few **thousands of hours of** transcribed **speech plus hundreds of millions of sentences**
- Near **real-time** transcription and live subtitling
- Used by **Yle, The Finnish Institute for Health and Welfare** and **the Finnish Parliament** (Eduskunta)

Tailored post-processing capabilities available

Features

Supports file-based / real-time streams / voice commands

Industry standard APIs and two UIs

- Transcription, subtitling, speaker segmentation
- Helper APIs for data I/O, statistics

Speaker-independent, requires no individual speaker training process

General language models, as well as customer/domain-specific language models development

- Supported languages
- Finnish: general, medical, politics
- Swedish: general
- English: general (pilot use)

Secure cloud connections (based in Finland), on-premise possible

Domain and Customer Adaptation

Problem

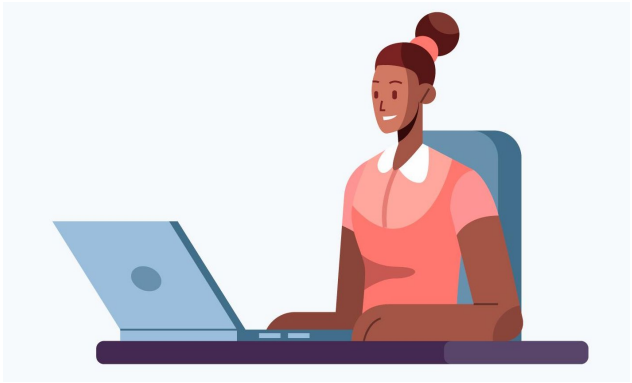
Words that were not seen in training are poorly recognised

Solution 1

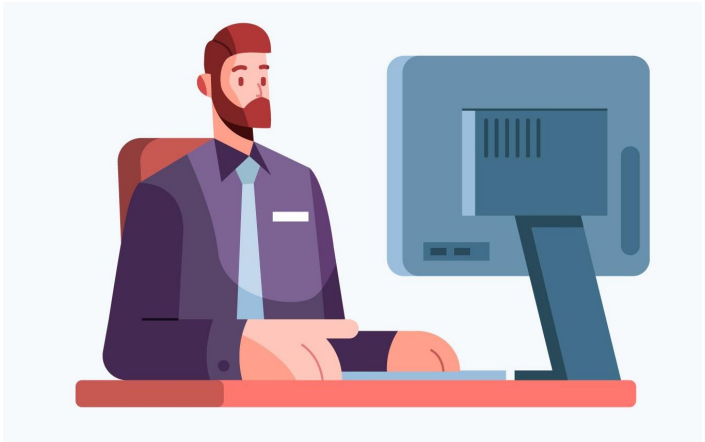
Adapt the model a bit more with text from the customer. The more text with the right content, the better the result. Works well for applications where the customer has a lot of pre-existing text with correct terminology, e.g. pathology.

Solution 2

Collect sentences with words that are poorly recognised that you believe might be useful in the future, e.g. names of (in)famous people. Then: re-train.



Who are our users?



Designed by Freepik

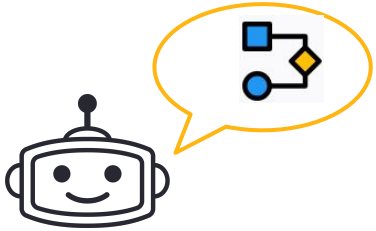
Example use case

Use case: From speech to subtitles - live

Good afternoon
and welcome!

?

~2 seconds



The broadcast and speaking begins

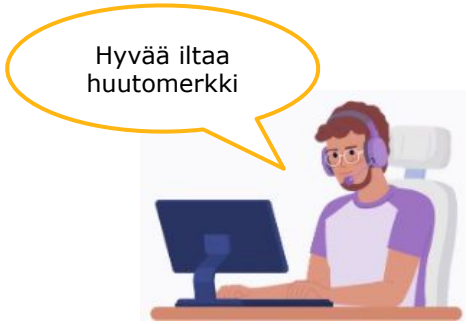
Subtitler respeaks

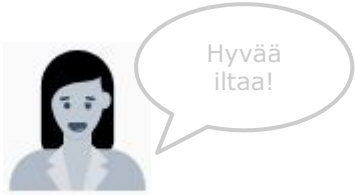
Speech recognition

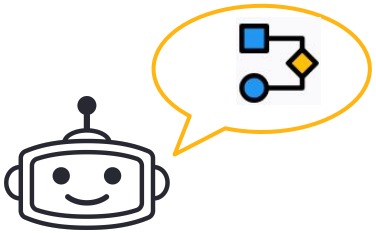
Subtitling software

Subtitles embedded to broadcast

Live subtitled TV or internet broadcast







The broadcast and speaking begins

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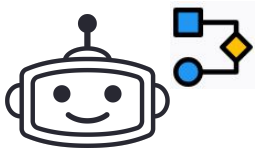
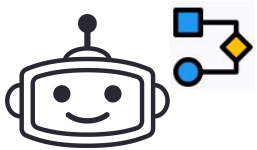
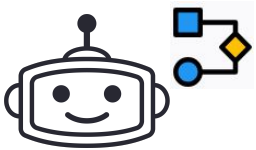
Hyvää huomenta ja tervetuloa Aalto-yliopiston puheen käsittelyn kurssille 9.10.2023!

Good morning and welcome to the Speech Processing course of Aalto University on October 9, 2023!

From speech to subtitles - live

Speech to text | Post-processing | Voice commands

Hyvää huomenta ja tervetuloa **aaltoyliopiston** puheen käsittelyn kurssille **yhdeksäs kymmenettä kaksituhattakaksikymmentä kolme** huutomerkki

Hyvää huomenta ja tervetuloa **Aalto-yliopiston** puheen käsittelyn kurssille **9.10.2023** huutomerkki

Hyvää huomenta ja tervetuloa Aalto-yliopiston puheen käsittelyn kurssille 9.10.2023**!**

Speech models

Text analysis and tailored rules

Voice commands to edit text

Speech to text

Post-processing

Voice commands

Large amounts of speech and even larger amounts of text needed for training the models

[aaltoyliopisto] > Aalto-yliopisto
[yhdeksäs kymmenettä kaksituhattakaksikymmentä kolme] > 9.10.2023

“Repla miksi kysymysmerkki”
-Miksi?

The goal: quickly readable text

*”Äsdeepee **kaksikymmentäneljä pilkku viisi** lisäystä **yksi pilkku yksi**.”*
➔ **SDP 24,5** lisäystä **1,1**.

*”**Vuonna seitsemänkymmentäkuusi** koneisto alkoi yskiä.”*
➔ Vuonna **1976** koneisto alkoi yskiä.

*”**Hoohetki** oli **kello seitsemän kolmekymmentä**.”*
➔ **H-hetki** oli **kello 7.30**.

Examples of acronym, number and unit shrinking

But preferred format depends on the use case

Subtitling

1500 kilometrin laajuisessa Rheassa näkyy muinainen pinta.
OR?
1 500 km:n laajuisessa Rheassa näkyy muinainen pinta

Medical transcription

RR 145/84 **mmHg**
OR?
Verenpaine 145/84 **elohopeamillimetriä**

Even more helpful tools for video files

Legibility can be automatically improved when not working in a live broadcast:

Automated recognition for **sentence borders** and **speaker changes**

Automatic recognition of **subclauses** as cut points for **splitting longer sentences**

Automatic recognition for **multi-word terms and collocations** that should not be split: the White House, president Niinistö

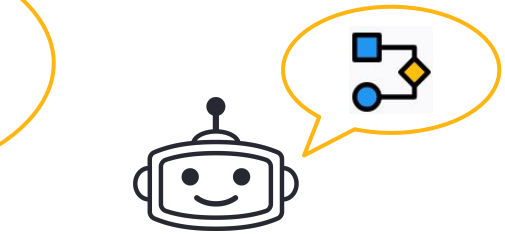
Automatic punctuation

Adaptable and developing system

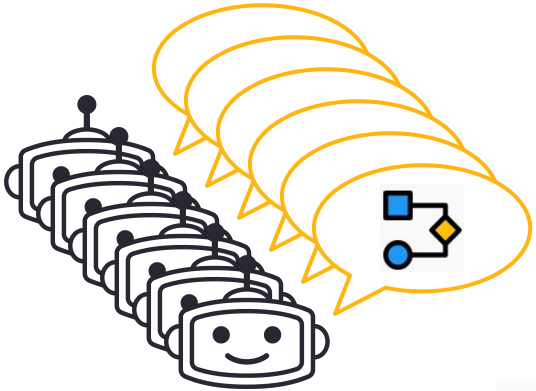
- Regularly trained for customer use with relevant and quality material
  - Vocabulary changes over time
- Models can be adapted for each organization if required
  - Customers can add material to the system and adapt their own model
- Customer can add individual words
  - pronunciation guidelines
  - examples of sentence context
  - Proper noun or not?
- Human in the loop - also in training

Future of live accessibility solutions?

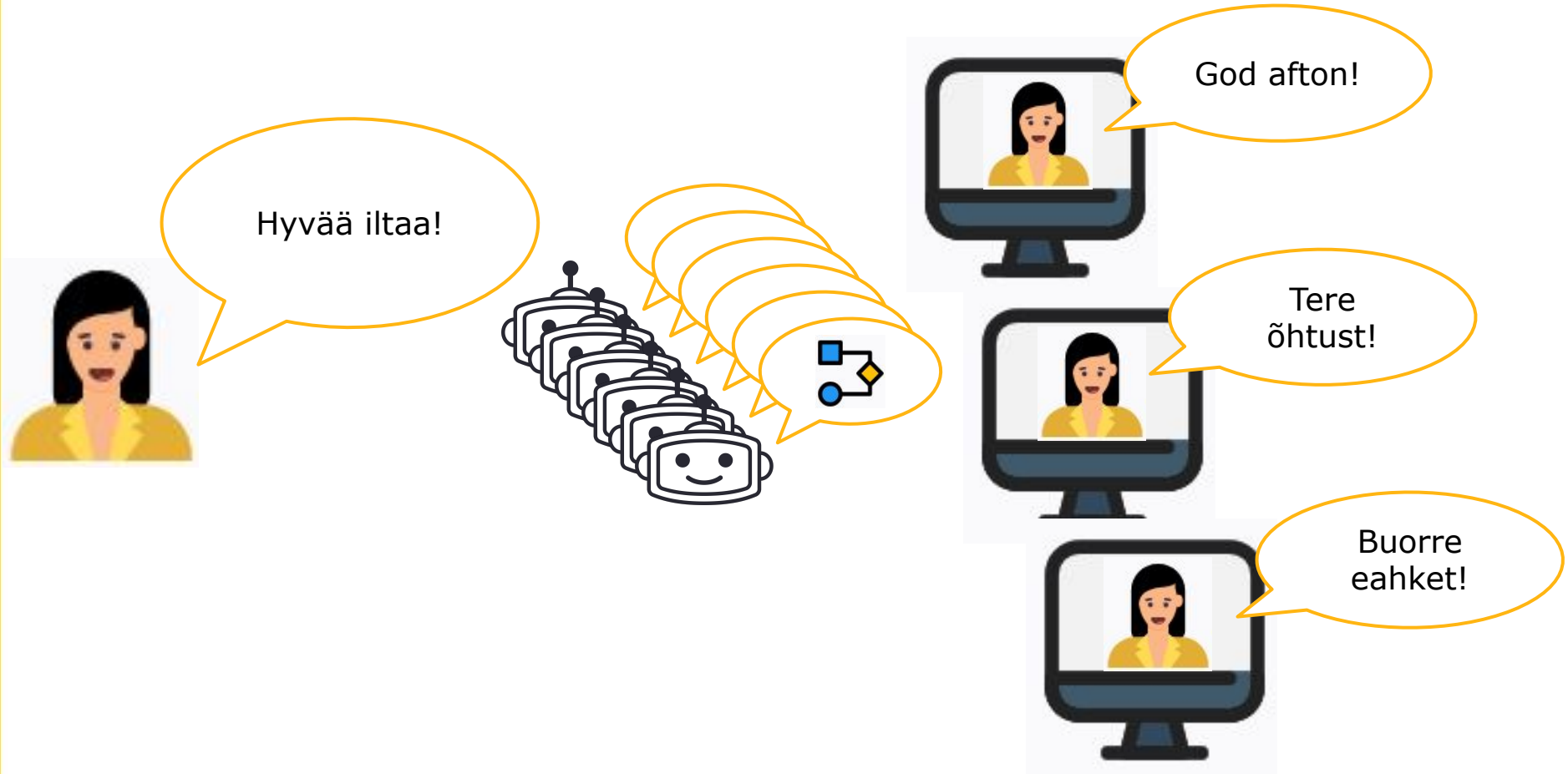
Live subtitling on all platforms



Multilingual subtitling



Multilingual speech to speech



Thank you!

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