

AI Speech Translation for Education: Challenges, Tools, and Future Directions

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Kyuhong Shim @ SKKU
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Classroom Reality: A Multilingual World

- Students from diverse countries now share the same classroom.
 - English is the “bridge” language, but not everyone is fluent.
 - This challenge is especially common for Asian students & teachers.
- Translation technology is no longer **optional**. It has become **essential**.

Who Benefits in Current System?

- **Professors** repeat the same content twice (English & Korean).
 - Slows down the class and causes disengagement & boredom.
 - International students often find bilingual lectures confusing.
- **Korean** students struggle to follow English-only lectures.
 - During class: rely on **live translation apps**
 - After class: rely on **offline translation** of the recorded lecture.
- **International** students lose motivation to learn through lectures.
 - They lack local communities for support.
 - Many stop attending and only watch recordings.
 - Some switch to easier or fully online courses.

Emotional and Pedagogical Impact

- Linguistic issues are related to not just **comprehension**, but also, **motivation** and **participation**.
 - Students hesitate to ask questions.
 - Nuances and tones are lost in translation (either teaches or AI).
 - Emotional frustration affects everyone (teachers and students).

What is AI Speech Translation?

- Converts spoken language to another language.
 - Speech-to-Text-Translation (S2TT) vs. Speech-to-Speech-Translation (S2ST)
 - Online (simultaneous) vs. Offline translation.
 - Cascaded vs. End-to-end approach.

Current AI Speech Translators

Tool	Use Cases	Notes
ChatGPT Voice Mode	Real-time multilingual chat	Not a dedicated translation tool.
Google Live Translate	Real-time translation of speech & text	On-device execution depends on the device.
MS Teams Live Captioning Zoom Automated Captions	Near real-time text subtitles during online meetings.	One language pair supported per session.
MS Teams Interpreter Agent	Near real-time S2ST	Experimental.

Simultaneous Translation: Challenges (1)

- **Linguistic challenges**

- Structural differences between languages
 - Korean/Japanese SOV vs. English/Chinese SVO
- Frequent code-switching conversations
- Poor recognition of rare or domain-specific terms
 - Especially in technical classes (math, science, engineering, etc.)
- Many low-resource languages remain unsupported.

Simultaneous Translation: Challenges (2)

- **Technical challenges**

- On-device translation is still far behind cloud-based services.
- Even a 1-2 second delay disrupts learning flow.
- Unlike online meetings, offline sessions first need clear speaker separation.
- Spoken translation is often less accurate than written translation.

Simultaneous Translation: Challenges (3)

- **Cognitive challenges**

- Human listening rely heavily on context, not just sound.
- Students must manage listening, reading, and comprehension simultaneously.
 - Processing speech, visuals, and captions at once causes heavy cognitive overload.
 - Moreover, these multi-stream information is often unsynchronized.

Tips & Concerns

- Provide **multilingual materials** before class and summaries afterward.
 - Offer recordings after class but consider privacy issues.
 - (not yet) AI tools will benefit from predefined list of domain-specific terms.
 - This is also true for students.
- Translation reflects **choices** about what is “essential” and what can be simplified or omitted.
 - Accents, prosody, and paralinguistic information are often lost first.
 - Technical terms and concepts may be simplified or mistranslated.

Discussions

- Should we slow down our lectures for better understanding?
- Should we move fully from offline to online?
- To what extent can we rely on AI for translation?
 - Translation requires choices.
 - AI models have inherent bias.
- How do we **handle mistranslations** that affect student trust?
- How can we ensure fairness when some can afford AI tools and others cannot?

Thank you!

Kyuhong Shim @ SKKU

khshim@skku.edu

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