With the rise of the gig economy, temporary and flexible jobs are prevalent toward efficient resource allocation. As instances of the gig economy, online language tutoring services (e.g., Cambly, Preply, and italki) that provide part-time jobs for native speakers to work as tutors and enable language learners to have one-on-one lessons with tutors on demand are becoming increasingly popular. In contrast to the fixed instructors in the conventional language learning classroom, learners can select different tutors every learning session. The learning experience in such kind of online language tutoring services was newly identified as “distributed tutorship”, in which learners distribute their learning time with different tutors, implying learning discontinuously in time with different tutors. For example, in Ringle4 , a popular online English tutoring platform, 40% of 15,959 learners change to new tutors every session; 44% of learners change to new tutors while reverting to previous tutors sometimes; and only 16% of learners change to new tutors and then fix on one tutor.

Distributed tutorship brings learners convenience in scheduling tutoring sessions and benefits in receiving diverse feedback. However, higher distributedness is suggestively correlated with lower learning gains and poses challenges for learners to reflect on their learning progress. Feedback discontinuity is one of the issues in distributed tutorship. In traditional learning, fixed instructors can provide continuous feedback to learners by pointing out their recurring bad habits or suggesting incremental improvements based on observing longitudinal learning practices. In distributed tutorship, it is hard for learners to receive such feedback since tutors have limited access and motivation to check a learner’s session history with other tutors. In particular, language learning is a long process, where learners need to reflect on their learning practices over time to correct their common problems (e.g., tense errors, redundant filler words). However, little research has investigated learners’ challenges in reflecting on cumulative language learning practices under distributed tutorship and how computer techniques can assist the reflection process.

Previous studies proposed to improve the feedback quality by asking tutors to check the samples of other tutors’ feedback before grading assignments. However, this process is tedious and involves privacy issues for a tutor to listen to the learner’s previous audio recordings or check other tutors’ feedback in online language tutoring platforms. To reduce tutors’ workload and avoid privacy concerns, we propose a computer-aided visualization system, RLens, which utilizes natural language processing (NLP) and data visualization techniques to automatically analyze different tutors’ feedback and learners’ speaking transcripts for assisting learners’ reflection under distributed tutorship.

First, by interviewing 16 English learners who experienced distributed tutorship, we identified four major challenges (i.e., grading inconsistency, feedback discontinuity, unorganized feedback, lacking context for feedback understanding) that learners face in reflecting on their learning progress. We then implemented RLens to address these challenges. Specifically, to mitigate the challenge of different tutors having different grading standards, RLens calculates learners’ speaking performance (Algo1) based on transcripts throughout the sessions and shows the computed scores in Overview (Figure 1A). To solve the feedback discontinuity, Correction View (Figure 1B) helps learners identify common language issues by ranking the language issues pointed out by different tutors based on their frequency and recency. It further detects learners’ feedback uptake behaviors (i.e., learners’ corrective actions to the feedback) across sessions (Algo2) and demonstrates them using a heat map. In particular, we propose an algorithm to extract atomic corrections (e.g., suggested words) from tutors’ feedback and track feedback uptake behaviors in each learning session using masked language modeling. Suggestion View (Figure 1C) groups different tutors’ suggestions using natural language inference techniques (Algo3) and uses a heat map to show where to focus on. Transcript View (Figure 4) helps the learner to understand the context of the feedback by mapping tutors’ feedback to the transcripts based on the sentence similarity (Algo4). A Filter Panel (Figure 1D) is integrated into RLens to filter tutoring sessions. We evaluated RLens in a between-subjects study with 40 realworld learners by asking them to reflect on their actual learning data. Results show that learners can successfully analyze their progress and common language issues under distributed tutorship with RLens, while most learners using the baseline interface had difficulty achieving reflection tasks. Our contributions are:

• A computer-aided visualization system facilitating learners’ reflection on the learning process under distributed tutorship.

• A user study showing the effectiveness of reflecting learning progress with RLens, and a set of design considerations for computer-aided learning systems under distributed tutorship.