

Title: RecurTutor: An Interactive Tutorial for Learning Recursion

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Abstract:

The paper presents RecurTutor, an interactive tutorial for learning recursion. It combines examples, visualizations, and automatically assessed programming exercises. Analysis shows it improves exam performance and confidence.

Introduction:

- Recursion is an important and difficult concept in lower division CS courses.
- Best way to learn programming skills like recursion is through targeted practice exercises.
- Manual assessment limits number of recursion problems students can practice.
- RecurTutor provides a large number of auto-assessed small exercises.
- Exercises target sub-skills and address common misconceptions.

Prior Work:

- Prior work looks at teaching recursion through examples, visualizations, games, and in-class experiments.
- Two studies showed improved learning but did not compare against typical instruction.
- No prior work combined a full tutorial with extensive practice exercises.

Requirements Gathering:

- Instructor surveys indicated students need more practice than they currently get.
- Analysis of student exam responses revealed common misconceptions.
- Writing and tracing recursion require different skills.

RecurTutor Design:

- Implemented in OpenDSA eTextbook system.
- Contains examples, visualizations, 20 programming exercises, 20 tracing exercises.
- Programming exercises involve writing base cases, recursive calls, etc.
- Tracing exercises involve spotting errors, predicting output, etc.
- Examples address specific misconceptions.
- Exercises are auto-assessed with feedback.

Evaluation:

- Compared control group without RecurTutor to intervention group with RecurTutor.
- Intervention group performed significantly better on exam recursion questions.

- Intervention group reported higher confidence levels.
- More time spent on RecurTutor exercises predicted exam performance.

Conclusion:

- RecurTutor's extensive practice and misconception targeting improves learning of recursion.
- Future work is needed to analyze the specific benefits of examples versus exercises.