Enhancing Learning in CS courses using ChatGPT-enabled Learning Tools

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Abstract:

Since its introduction in November 2022, ChatGPT has demonstrated the viability of using large language models to create chatbots with extensive knowledge of many subjects. On the other hand, ChatGPT's knowledge and reasoning ability is limited and sometimes it makes mistakes in its answers, which could be an obstacle in its adoption for education. In this project, we will develop new learning tools based on ChatGPT to enhance education in Computer Science (CS) courses. We first assess the current capabilities and limitations of ChatGPT in CS knowledge, programming skill, and problem solving. This assessment can help inform the design of the learning tools so that correct information can be provided to students. Next, we will develop 4 learning tools: 1) CS Tutor will use ChatGPT to answer students' questions on which it is typically correct; 2) on questions that it typically incorrect, CS Tutee will act as a ChatGPT-based virtual student, and the CS student will point out its mistakes and guide it to the correct answer; 3) CS Quizzer will ask questions to test students' knowledge, while students also consider whether the Quizzer is correct; 4) CS Pair Programmer will use a ChatGPT-based AI to guide students during their programming exercises, through high-level discussion and pointing out possible errors during coding.

Finally, to maintain academic honesty, we will integrate ChatGPT into plagiarism detection systems for checking that students' submitted source codes are not copied from ChatGPT.

The proposed tools can enhance students' learning in CS subjects, through both providing answers to their questions and also encouraging students to think critically when those answers are incorrect. The Pair Programming tool can help students who are weak in programming to develop their coding skills and logical thinking skills during programming exercises. Since students must think critically about ChatGPT's answers, students can understand the limitations of ChatGPT in CS topics, and learn when to not rely on such technologies.

These tools will have a wide impact on both CS students and non-CS students, since computer programming and related courses are taught in many engineering and science disciplines.