CMPSC 442 GEA Worksheet

Goals

What might be the goals of the *intelligent* system?

- Assist students in learning how to do math problems
  - Using this assistance to then walkthrough where exactly they went wrong within the problem
  - Also will allow the student tho then practice the types of problems that they get wrong
- Provide adaptive feedback
  - Adapt to the student's style of learning and level of knowledge
  - Award the student when they are correct
  - Explain and walkthrough with the student when they are wrong
  - Track student progress, provide problems, and assessments
- Increase student engagement and motivation
  - Ensure the student is comfortable with the section of math they are working on
  - With some students that struggle with mathematics, it can involve them feeling very stressed. We want to make sure the student feels as if they are in a stress-free environment so we strive for the student to not feel stressed.
  - Increased accessibility for students to help them in developing their math skills.

Environment

What is the environment that the system will be adapting within? What are the important characteristics of that environment?

- Learning/Classroom Environment
  - Characteristics to consider: system should mirror aspects of physical classroom(i.e. Lesson structure, topic division/categories). Kids have short attention spans so needs to draw their focus

- Mathematical problem sets
    - Characteristics to consider: large number of students with different levels of understanding and struggle with different tasks
        - Possible solution could be a standard intro test to gauge where the students' math skills are at.
- Multiple choice questions and fill in the blanks
    - Characteristics to consider: wide variety of answer possibilities with fill in the blank questions

The stakeholders for this project who would be most impacted are students and staff. These students and staff are of education institutions for primary school education. Primary school education is defined to us as students and teachers that are involved within the grades kindergarten to sixth grade. There are many potential benefits with our system that could help students learn the process for solving problems and help them where they go wrong. With the younger generation being more engaged in technology, this tutor will draw more attention and engagement to students who feel this way. Potential drawbacks of this technology could be that some education jobs would be replaced by an AI system. For example, there are teacher aides and tutors within school systems that are there to support students who may not be doing well in their classes. These roles may be decreased as this system would replace that role. Even though this would benefit the students it would not benefit the teachers who dedicated their careers to teaching.

Our proposed system is for a simple math tutor, therefore grade school students are the most impacted since they will lean the heaviest on our system to teach them something that the higher grade levels have already mastered. The potential benefits of this system would be additional help for students who need it when learning basic math skills. This would also relieve pressure on teachers who have large classes and can’t spend 1-on-1 time with each student. Another benefit is that this could speed up the learning process and save time that would have been spent waiting on time to meet with a teacher. The drawbacks of this system could be that it doesn’t have the ability to provide emotional support. It is frustrating not understanding a problem and an AI math tutor might not be able to give the reassurances a student needs to keep trying. For some students, having a physical person helping them is reassuring for a student and using an online tool could bore or potentially harm the desire to learn.

Adaptation

> **How might the system adapt to the environment given the goals? How might its inner environment change?**

As the user practices more problems, the system will begin to pick up on what the user is struggling with. For example, if the user is practicing their multiplication tables and they commonly get multiples of 12 wrong, the system will begin to show more problems involving 12 * x. Similarly, if the student has a good grasp of multiples of 5, it may begin to show fewer easier problems involving that 5 * x, and more difficult problems to keep challenging them. The system would also be able to provide better tips and explanations for the student/user based on the types of problems they are getting wrong and the frequency.

Teachers use a variety of tools to teach students and better explain concepts, why shouldn't this proposed system? A future version of this system might be able to provide explanations of the steps for solving that specific problem as well as a more general ChatGPT explanation for the subject or specific type of problem

- Example:
    - Our system output:
        - 2*2=4 -> "add the first number to itself the second number times"
    - ChatGPT:
        - "Multiplication is a mathematical operation that involves combining two or more quantities to produce a third quantity that represents the total value of the combined quantities…"

For a more in-depth look into the tools our system would be in the inner environment of the simple math tutor system:

- Decision Tree Model
    - Breaking down given problems into subproblems
- Neural Network
    - Understand the student's inputs and provide personalized feedback
    - Using a dataset of math problems could train the model
- Reinforced Learning (RL)
    - Allow the model to adapt and improve its response using feedback