**Machine Learning: What Is It Good For?**

Machine learning has played a pivotal role in many of the new technologies society has adopted. It will continue to play a pivotal role as society continues to integrate technology into other facets of life. Furthermore, machine learning can help solve modern complex problems. Such problems can be discovering new elements on the periodic table or automating quality control during manufacturing of goods. The three problems I believe could benefit from machine learning reside in the fields of language learning, 3D animation, and video game balancing.

One of the most important variables when learning a language is the input and output feedback loop between the student and a source utilizing the target language. This source can be a teacher, another student, or some sort of media. Additionally, the input the student is given must be of the best quality possible to avoid the learning, and fossilization of bad language habits. Machine learning can be used to develop an AI that can supply quality input to a student along with analyzing the output of a student. The analysis results can then be used to assign the student assignments and resources to work through tailored to that student’s specific weaknesses. As the student progresses and advances in their proficiency the AI developed through machine learning can adapt to the student’s progress. When this occurs, using machine learning, the AI can then start to use more advanced grammar, syntax, and vocabulary. Lastly, one of the greatest benefits would be for the AI to use topics relatable to the student to nurture and maintain the motivation of the student throughout the learning process.

In the field of 3D animation, machine learning could be used for rigging 3D models and creating animations tailored to the 3D rigged models. The greatest benefit of this is the elimination of the monetary barrier of entry for high quality 3D animations. The best way to create 3D animations today is to utilize a technique called MOCAP. The problem with this is that all the technology needed for MOCAP is incredibly costly. Furthermore, rigging 3D models manually can take an incredible amount of time depending on how many models you have.

Lastly, in the field of video game development, the balancing of abilities and characters can benefit greatly with machine learning. The importance of proper balancing in a video game is even more important in the competitive scene where real money is won. It also aids in the enjoyment of the game by allowing players to play their favorite character since it would be viable due to proper balancing. This can lead to greater player retention resulting in greater profits for the developer. The problem is that balancing video game abilities and characters can take an exuberant amount of time and money. This is even more true with games like League of Legends with a character roster over one hundred and each character having at least 5 abilities.

Regarding the input and output feedback loop for language learning, the tasks to be performed would be daily conversations with the student. These conversations would be simple to facilitate consistent and measurable development. For example, the student likes fantasy novels, by using machine learning, the AI could formulate questions for the student to answer revolving around who, what, and why. Who is your favorite character? Why are they your favorite character? What part is your favorite? Why is it your favorite? Etc. The experience would be the student’s output retained as data to be analyzed. The performance would be measured by the development of the student. Tests would be administered like in a classroom setting, but also tests tailored to analyze the ability of the student to process input and provide adequate output with a margin of error to be defined in the grading criteria.

For 3D animation, the task would be two-fold. First the supplied 3D models must be rigged. Once the rigging of the 3D model is complete, all animations applicable will need to be applied to the rigged model. The performance measure will be multi-faceted. The first aspect of performance will be the accuracy of the rigging. Essentially, does the rigged model adhere to anatomical structure. The second aspect is the fluidity of the animations. The final and third aspect is how well do the animations themselves adhere to the limitations of the rigged model. It can be argued that a final aspect can be the realism of the final product.

In the balancing of a video game the task would be to balance the abilities and characters so that they all perform within a determined set of boundaries. The area within the set of boundaries would be the viability of a character. Having perfect balance may not be possible or even wanted depending on the vision of the game director. The experience would be the data gathered by having an AI use the different characters. The performance would be measured by how close the characters are to the middle within the set of boundaries after each change. A margin of error can be placed so that if a character is five units above the line of viability it is acceptable, likewise five units below would be accepted.

The approach to be used for the input out feedback loop would be semi-supervised. This is because language itself can be very tricky even to native human speakers. The reason for this is that language is always evolving and depending on the region and culture of a speaker, a word may not mean what it is defined to mean. Context is incredibly important, and this would need to be considered and supervised. However, it is important to not limit the system in a generalized manner to avoid constraining the creativity and natural flow of the generated sentences. Additionally, it will need be capable of learning incrementally to advance and adapt to the progression of the student on the fly.

Regarding 3D animation, the model would also be semi-supervised. This is because once a quality animation is done, models of similar constraints can have the same process done to them. Additionally, due to anatomical and physical constraints animations would not need to be completely redone every time. A biped model will more than likely run in the same way another biped model will. Batch learning would be suitable approach since the system would only need to be retrained if a completely new kind of model is introduced.

Lastly, for video game balancing a reinforcement model would work best since balancing would involve hundreds if not thousands of game sessions depending on the total amount of characters and abilities that need to be balanced. The system could be either be online or offline based. This will depend on how often items, characters, rules, or other constraints are introduced. For a single player game where nothing new is introduced, offline learning would be best. For an everchanging online competitive game, online learning would be best.

In summary, machine learning can help solve the problem of having access to a quality input output feedback loop for language learners that can advance and adapt with their progression. Automate the rigging and animating of 3D models and the balancing of video game characters and abilities. If a suitable solution is found using machine learning in these fields it would greatly reduce the cost and time of any previous and current method and by extension, the barrier of entry for access to such resources and capabilities.