

1. **Why must the course be taken as an independent study?**

**Intratumoral heterogeneity has consistently affected the metastasis, progression, and resistance to different cancer therapy in various cancer cells. Many researchers found that the evolution of these persistent heterogeneity follows the structure proposed in Evolutionary Game Theory. Recently, adaptive treatments based on this mathematical model successfully cure breast cancer and metastatic castrate-resistant prostate cancer. However, these studies do not have diverse states and test cases of these cancer models. Within this course, I aim to develop an AI algorithm to study and configure various initial setups of this cancer game. Therefore, future researchers can deploy our computational model as test cases to enhance the robustness of their proposed adaptive treatment methods.**

1. **Learning Goals**

**This proposed study primarily focuses on deploying an artificial neural network through TensorFlow or PyTorch, which are the two most popular Python libraries used to create AI. Aside from neural networks, I aim to apply more machine learning techniques, such as stochastic local search and Monte Carlo Tree Search, to minimize the chances of having unplayable games. Our final goal is to write our findings in the paper and submit it to the Artificial Intelligence and Interactive Digital Entertainment (AIIDE) conference and Educational Advances in AI (EAAI) workshop.**

1. **Activities and Assignments (include deadlines)**

* **Throughout the semester, I will write up my findings and report them back to my professor weekly. Furthermore, we will regularly meet once every week to discuss my current progress and future directions of the projects.**
* **Below I include deadlines and assignments throughout the semester:**
  + **Resume with the project - Wednesday, August 25**
  + **Using Monte Carlo simulations to gather sample player’s movement data - Wednesday, September 8**
  + **Finishing tutorial in Monte Carlo Tree Search - Wednesday, September 15**
  + **Finishing tutorial in Stochastic Local Search - Wednesday, September 22**
  + **Finishing the first rough draft - Wednesday, September 29**
  + **Enhance the visualization for the cancer game - Wednesday, October 6**
  + **Finishing tutorial in implementing simple neural network architecture - Wednesday, October 13**
  + **Finishing tutorial in Deep Generative neural network - Wednesday, October 27**
  + **Deploying and Fine-tuning AI models - Wednesday, November 10**
  + **Finishing the second draft - Wednesday, November 17**
  + **Finishing the final paper - Wednesday, December 8**

**(over)**

1. **Expectations (e.g. grading criteria, frequency of contact, quality and quantity of output)**

* **Grading Criteria:**
* **Class participation - 5%**
* **Weekly reports - 20%**
* **First draft of research paper - 10%**
* **Game visualization - 5%**
* **Second draft of research paper - 10%**
* **Final draft of research paper - 50%**
* **Frequency of contact: As mentioned above, we will meet once every week and I will write the weekly report to keep track of our progress.**
* **Quantity of output: Final research paper, weekly reports, visualization and playable cancer game.**

**Student Signature Date**

**Faculty Signature Date**

**Department Chair Signature Date**