

Project 1 Proposal: The game of fighting cancer-Curtis Lin

Overview of Program:

Cancer is a complex group of diseases with many possible causes. Many extrinsic and intrinsic effectors have been found to lead tumorigenesis of different subtypes of cancers. For example, cigarette smoking and air pollution not only show high incidences with lung cancer but also has possibilities to cause other cancers. Signs and Symptoms are usually the early indicators of cancers. In the initial phase of game, a subtype of cancer and how severe the cancer is will be assigned based on the effectors and signs and symptoms which player selects. Next, the game will provide various treatment options to player. The player can monitor their tumor size changes upon the period of treatment. Finally, the game will be ended when the player become cancer-free or is killed by cancer.

The game includes eight classes: **Player_info**, **Effectors**, **Symptoms**, **Cancer_types**, **Tumor_stages_sizes**, **Treatment_options**, **Responses**, and **Treatment_periods**. The winning (cancer-free) or losing (killed by cancer) of game depends on tumor size. The game will start with tumor size = 0 (cancer-free condition). The classes of **Player_info**, **Effectors**, and **Symptoms** collect the basic information. The class of **Cancer_types**, **Tumor_stages_sizes** next calculate the probabilities based on the basic information and further assign the cancer subtypes and tumor size. The classes of **Treatment_options**, **Responses**, and **Treatment_periods** are the key parameters to change the tumor sizes. The entire game is based on the probabilities just like the real-world situation. Therefore, there is no guarantee that you will win or lose the fight even though you use the same inputs.

The overview of Classes is listed below.

1. **Player_info**: The attributes in this class includes “name”, “gender”, and “age”. Gender and age are highly associated with certain subtype of cancer and chance of getting cancer, respectively. For example, breast cancer favors females. For sure, males have a chance to get breast cancer with very low possibility.
2. **Effectors**: The attributes include a dictionary of extrinsic and intrinsic effectors, such as cigarette smoking, air pollution, diabetes etc., with their probabilities of causing cancers.
3. **Symptoms**: The attributes include a dictionary of symptoms of cancer, such as coughing, fatigue, weight loss etc., with their probabilities to associate with different stage of cancers.

4. **Cancer_types:** This class includes a *rank()* method to calculate the probabilities of getting different type of cancers based on the Player_info and Effectors. In addition, the attributes in this class include a list cancer subtypes, such as lung cancer, liver cancer, breast cancer etc.
5. **Tumor_stages_sizes:** This class is similar to Cancer_types class. The method will use *rank()* method in Cancer_types class calculated in Cancer_types and assign the tumor stage and size to play. This class includes three attributes; 1) tumor stages, 2) tumor sizes, 3) metastasis. The method *Tumor_size()* is included in this class to calculate the size of tumor and metastasis for game initiation. The tumor size is mutable by the classes of Treatment_options, Treatment_periods, and Responses. In addition, metastasis is Booleans and is associated with stage IV tumor stage
6. **Treatment_options:** In this class, three functions of therapeutic options are included and listed below.
 - a. *Surgical()*: the tumor size will return to 0. Meanwhile, it will also run the *Recurrence()* in the Response class.
 - b. *Chemotherapy()*: the tumor size will be a linear decrease upon treatment period. This method interact with the *Recurrence()* in the Treatment_period class.
 - c. *Target_therapy()*: the tumor size only changes when certain conditions are chosen in the Effector class and is an exponential decrease upon treatment period This method interact with the *Recurrence()* in the Treatment_period class.
7. **Responses:** The attribute in this class is treatment response and is Booleans. When response is “False”, other treatment options can be chosen. The Responses class has function call *Recurrence()*. The *Recurrence()* function applies autoregression model. If outcome of *Recurrence()* function < 0 , it will turn Response attribute into “False”; furthermore, increasing the tumor size.
8. **Treatment_periods:** In this class, player can choose how long they would like to treat the cancer if the response is “True”. The class will run *Recurrence()* during each iteration. The class also includes a *treatment_monitor()* method to plot the changes of tumor sizes upon tumor treatment. If the tumor size is not equal to zero after treatment period or tumor recurrence, the play can choose other treatment options.

Indeed, player can choose not to keep treating the cancer after a set of treatment (quit). The game will encourage the player to stay until the player confirm to quit again.

Layout of Program:

