CSI 701 – Assignment 5 – Cellular Automata

Introduction:

The project requires simulating skin cancer growth using simple rules for the cell transition from living to cancerous condition and finally to a dead cell. The simulation is done on a triangulated mesh surface.

The growth rules of cancer in cells is regulated by a ratio of cell area to the affected area surrounding the cell. The aggressiveness of the cell growth can be tested by changing the probability limit together with the growth area.

Implementation Details:

The simulation of cellular cancer growth requires initialization of the mesh information which includes:

1. Read in the mesh information.

2. Find neighbors that share boundaries with a given cell for all cells.

We start each of the scenario by selecting 3 cancerous cells and determine the proliferation of cell status as follows:

1. If the ratio of cell area to the surrounding affected area is greater than the set limit, the cell undergoes a change corresponding to its status and the status of the surrounding cells.

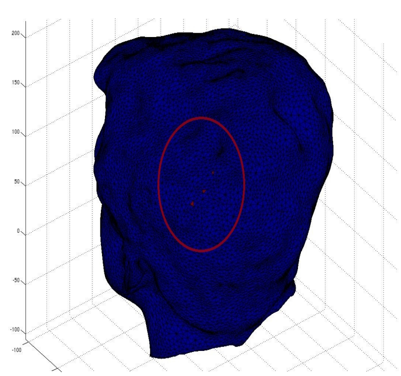
2. If all the surrounding cells are cancerous or have advanced in their condition, the present cell undergoes a corresponding change even though the ratio is within the set limit.

Simulation Results:

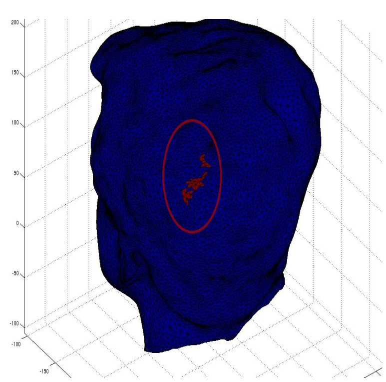
The simulation was run for 40 iterations, for two levels of aggression of cancer growth to compare the results.

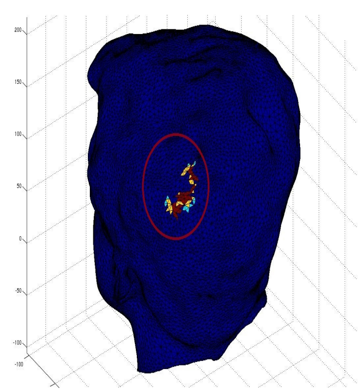
1. Low Aggressive growth:

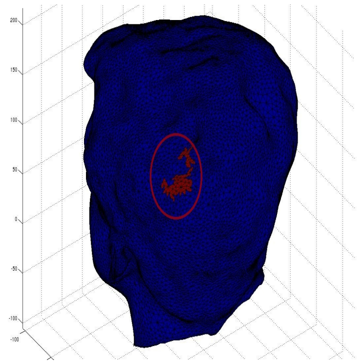
The probability limit set for the cell to convert was 0.05. The growth reaches a constant area after 10 iterations. The results were as follows:



Initial State



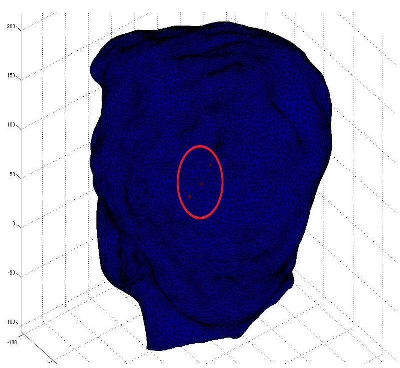




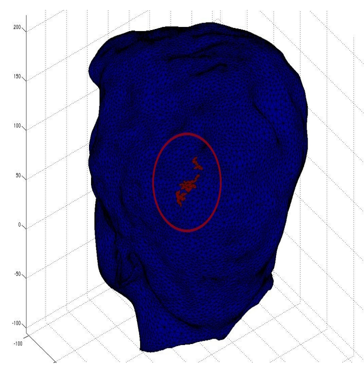
Final State

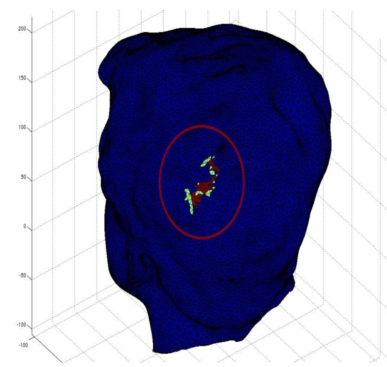
2. High Aggression Growth Simulation:

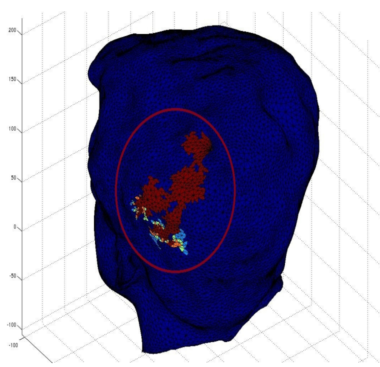
The probability limit set for the cell to convert was 0.04. The growth is visibly more aggressive and the results are as follows:

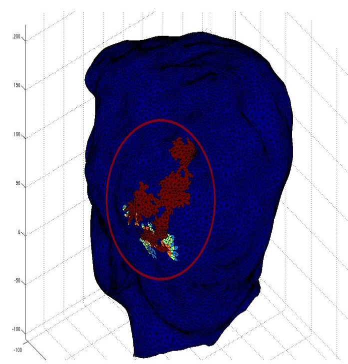


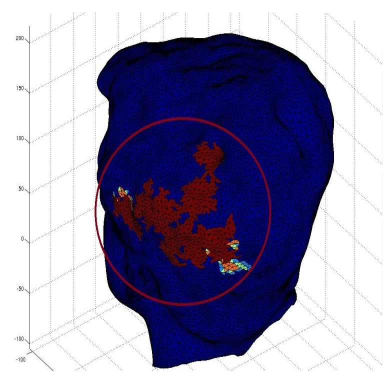
Initial











Final State

Conclusion:

The simulation follows the set rules of growth and shows clear variation of aggression depending on the set condition.