CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

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Project Number

S1217

Project Title

Fractals and the Chaos Theory in Oncology and the Analyzation of Tumors

Abstract

Objectives

Comparison of the fractal dimensions healthy tissue to cancerous tissue to find a trend or pattern and be used for earlier diagnosis or a different method of diagnosis.

Methods

ImageJ, a public domain Java-based program developed my the NIH for Computational Instrumentation and a computer capable of running ImageJ. TCIA (The Cancer Imaging Archive), a public domain with an archive of medical images of cancer available for download. Plugin for ImageJ (FracLac) which is used for fractal analysis. Scanned images from TCIA using ImageJ and FracLac to recieve the fractal dimension of said images for analysis. 3 images of cancerous imagery and 3 images of healthy images for 5 cancers and 8 images of cancerous and healthy images for brain cancer.

Results

ImageJ produced the fractal dimensions of the cancerous images to have a larger deviation and range compared to the healthy images which displayed more consistent and linear dimensions. A pattern of higher values of fractal dimensions and irregular dimensions show a link between fractals and the growth of cancer.

Conclusions

Using the data from the experiment, more testing can be done with different methods of fractal analysis to obtain a clearer differences between fractal dimensions in healthy tissue and cancerous tissue as well as strengthen the correlation between cancer and the concept of fractals. Using machine learning to recognize these patterns inside of tissue can lead to development in cancer diagnosis to even the smallest levels of biology as fractals are infinitely conplex. Difficulties could be that cancer baries from patient to patient and many factors go into diagnosis. Another obstacale may be the difficulty of obtaining the amount images for a machine to learn from.

Summary Statement

Using fractal analysis on cancer scans such as ct and mri and the healthy counterparts, there was a pattern in the cancerous images which was more irregular and on average fractal dimensions within those images.

Help Received

Dr. Rachel Auld, Dr. Kim Lawe