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Assistant Professor Dorin Drignei Studies How Brain Tumors Grow

How do brain tumors form and grow? This question is crucial for treating cancer. Assistant Professor **Dorin Drignei**, of the Department of Mathematics and Statistics, addressed this issue in an article in the December, 2008 issue of the **Journal of Computational and Graphical Statistics** titled **Fast Statistical Surrogates for Dynamical 3D Computer Models of Brain Tumors** (Volume 17, Pages 844-859). Below is excerpts from the introduction of his paper.

"Despite recent advances in computerized tomography (CT) and magnetic resonance imaging (MRI), the chances for early detection and subsequent successful treatment of malignant brain tumors are still low. In general, the cancerous tumors develop from one or several mutating cells which sustain rapid uncontrolled growth and invade the normal tissue. This paper is concerned with the most common type of primary brain tumors, called gliomas, which begin in glial cells (the supportive tissue of the brain)....

Mathematical models of brain tumors are helpful in understanding some aspects of the mechanism responsible for brain tumors, with implications for prognosis and treatment. The dynamical three dimensional (3D) mathematical model considered here includes growth and diffusion parameters. These mathematical models are typically implemented in computer models, or codes. Different combinations of parameters (or inputs) lead to appropriate simulations of virtual brain tumors with different degrees of malignancy (the outputs). Experimentation with these computer models, in which the inputs are systematically changed, represents a useful method for understanding their effects on the outputs. For each input, these computer models are solved numerically over time and three spatial dimensions, and they are very computationally intensive, with a single run taking hours of computational time. Therefore, only small size experiments (corresponding to a small number of sampled inputs) can be conducted and analyzed.

The main goal of this paper is to illustrate a computationally efficient method for predicting virtual brain tumors at any input in an input space, conditioned on the virtual brain tumor data available from the small number of computer model runs..."

SUMMARY

How do brain tumors form and grow? Assistant Professor Dorin Drignei, of the Department of Mathematics and Statistics, addressed this question in an article in the December, 2008 issue of the Journal of Computational and Graphical Statistics.

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